



United States  
Department of  
Agriculture

Forest Service

Eastern  
Region



# Appendices - Final Environmental Impact Statement

January 2006

## 2006 Land and Resource Management Plan



*Caring for the Land and Serving People*

**This document is available in large print.  
Contact the Wayne National Forest  
Supervisor's Office  
1-740-753-0101  
TTY 1-800-877-8339**

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

# Appendices to Environmental Impact Statement

---

## Table of Contents

Appendix A.....	A-1
Public Involvement.....	A-1
Introduction.....	A-1
Public Participation Prior to Notice of Intent .....	A-1
Public Participation after NOI .....	A-3
Public Participation in Development of Alternatives .....	A-6
Public Participation after Development of Alternatives .....	A-9
Appendix B.....	B-1
The Analysis Process.....	B-1
Introduction.....	B-1
Public Involvement and Identification of Issues.....	B-2
Analyses Prior to Development of Alternatives .....	B-2
Development of Alternatives .....	B-19
Effects Analyses.....	B-33
Content Analysis of Response to Release of the DEIS and Draft Forest Plan .....	B-55
Appendix C.....	C-1
Potential Roadless and Wilderness Areas Inventory .....	C-1
Introduction.....	C-1
Inventory Process.....	C-1
Conclusion .....	C-7
Appendix D.....	D-1
Range of Natural Variability, Old Growth, and Silvicultural Systems .....	D-1
Range of Natural Variability.....	D-1
Silvicultural Systems .....	D-14
Gypsy Moth .....	D-25
Oak Management in the Historic Forest Management Area.....	D-27
Appendix E.....	E-1

Plant and Animal Diversity and Management Indicators ..... E-1

    Plant and Animal Diversity ..... E-1

Appendix F1 ..... F1-i

    Biological Assessment ..... F1-1

        Organization of the Biological Assessment ..... F1-3

        Introduction ..... F1-3

        Description of of the Selected Alternative ..... F1-9

        Consultation History ..... F1-14

        Species Evaluated ..... F1-16

        Overview of the Effects Analysis ..... F1-17

        Federally Listed Terrestrial Animal Species ..... F1-19

            Indiana Bat ..... F1-19

            Bald Eagle ..... F1-79

            American Burying Beetle ..... F1-93

        Federally Listed Aquatic Species ..... F1-111

            Fanshell ..... F1-111

            Pink Mucket Pearly Mussel ..... F1-126

        Federally Listed Terrestrial Plant Species ..... F1-131

            Northern Monkshood ..... F1-131

            Small Whorled Pagonia ..... F1-148

            Virginia Spiraea ..... F1-166

            Running Buffalo Clover ..... F1-180

        List of Preparers ..... F1-200

        List of Reviewers ..... F1-200

        Literature Cited ..... F1-200

        References ..... F1-211

        Personal Communications ..... F1-211

        Appendix 1. Conservation Plan for the Federally Listed Species ..... F1-213

Appendix F2 ..... F2-i

    Final Biological Opinion ..... 1

        Introduction ..... 3

Consultation History .....	3
Biological Opinion.....	10
I. Description of the Proposed Action.....	10
Action Areas .....	22
II. Status of the Species.....	23
Indiana bat.....	23
Running buffalo clover .....	31
III. Environmental Baseline .....	34
IV. Effects of the Action.....	46
V. Cumulative Effects.....	75
VI. Conclusion .....	75
Incidental Take Statement.....	77
Amount or Extent of Take Anticipated.....	77
Effect of the Take.....	78
Monitoring .....	79
Reinitiation Notice .....	79
Literature Cited .....	80
Appendix A. Revised Forest Plan Conservation for Federally Listed Species.....	87
Conservation Direction and Guidance for all Federally Listed Species .....	87
Species-specific Conservation Direction and Guidance .....	88
A. Indiana Bat .....	88
B. Bald Eagle .....	91
C. American Burying Beetle.....	92
D. Running Buffalo Clover.....	93
Appendix B. Documentation of Indiana bat on the WNF .....	95
Appendix F3.....	F3-i
Final Biological Evaluation .....	F3-1
Organization of the Biological Evaluation.....	F3-1
Introduction.....	F3-1
Description of Alternatives .....	F3-5
Species Evaluated .....	F3-11

Overview of the Effects Analysis ..... F3-13

Effects Analysis ..... F3-14

    Regional Forester Sensitive Species ..... F3-14

    Species Proposed for Regional Forester Sensitive Species Designation ..... F3-79

List of Preparers ..... F3-109

List of Reviewers ..... F3-109

Literature Cited ..... F3-109

References ..... F3-118

    Personal Communications ..... F3-118

Appendix G ..... G-1

    Oil and Gas Management ..... G-1

        Reasonably Foreseeable Development Scenario for Oil and Gas ..... G-1

Appendix H ..... H-1

    Management Area Numbers/Names Crosswalk ..... H-1

Appendix I ..... I-1

    Literature Cited ..... I-1

    References ..... I-18

    Personal Communications ..... I-18

Appendix J ..... J-1

    Glossary, Acronyms, and Scientific Names ..... J-1

        Glossary ..... J-1

        Acronyms ..... J-45

        Scientific Names for Common Names Used ..... J-53

Appendix K ..... K-1

    US Highway 33 – Nelsonville Bypass ..... K-1

        Introduction ..... K-1

        Effects Analysis ..... K-1

        Incorporation by Reference ..... K-2

# Appendices to Environmental Impact Statement

---

## Table of Contents

Appendix A.....	A-1
Public Involvement.....	A-1
Introduction.....	A-1
Public Participation Prior to Notice of Intent .....	A-1
Public Participation after NOI .....	A-3
Public Participation in Development of Alternatives .....	A-6
Public Participation after Development of Alternatives .....	A-9
Appendix B.....	B-1
The Analysis Process.....	B-1
Introduction.....	B-1
Public Involvement and Identification of Issues.....	B-2
Analyses Prior to Development of Alternatives .....	B-2
Development of Alternatives .....	B-19
Effects Analyses.....	B-33
Content Analysis of Response to Release of the DEIS and Draft Forest Plan .....	B-55
Appendix C.....	C-1
Potential Roadless and Wilderness Areas Inventory .....	C-1
Introduction.....	C-1
Inventory Process.....	C-1
Conclusion .....	C-7
Appendix D.....	D-1
Range of Natural Variability, Old Growth, and Silvicultural Systems .....	D-1
Range of Natural Variability.....	D-1
Silvicultural Systems .....	D-14
Gypsy Moth .....	D-25
Oak Management in the Historic Forest Management Area.....	D-27
Appendix E.....	E-1

Plant and Animal Diversity and Management Indicators ..... E-1

    Plant and Animal Diversity ..... E-1

Appendix F1 ..... F1-i

    Biological Assessment ..... F1-1

        Organization of the Biological Assessment ..... F1-3

        Introduction ..... F1-3

        Description of of the Selected Alternative ..... F1-9

        Consultation History ..... F1-14

        Species Evaluated ..... F1-16

        Overview of the Effects Analysis ..... F1-17

        Federally Listed Terrestrial Animal Species ..... F1-19

            Indiana Bat ..... F1-19

            Bald Eagle ..... F1-79

            American Burying Beetle ..... F1-93

        Federally Listed Aquatic Species ..... F1-111

            Fanshell ..... F1-111

            Pink Mucket Pearly Mussel ..... F1-126

        Federally Listed Terrestrial Plant Species ..... F1-131

            Northern Monkshood ..... F1-131

            Small Whorled Pagonia ..... F1-148

            Virginia Spiraea ..... F1-166

            Running Buffalo Clover ..... F1-180

        List of Preparers ..... F1-200

        List of Reviewers ..... F1-200

        Literature Cited ..... F1-200

        References ..... F1-211

        Personal Communications ..... F1-211

        Appendix 1. Conservation Plan for the Federally Listed Species ..... F1-213

Appendix F2 ..... F2-i

    Final Biological Opinion ..... 1

        Introduction ..... 3

Consultation History .....	3
Biological Opinion.....	10
I. Description of the Proposed Action.....	10
Action Areas .....	22
II. Status of the Species.....	23
Indiana bat.....	23
Running buffalo clover .....	31
III. Environmental Baseline .....	34
IV. Effects of the Action.....	46
V. Cumulative Effects.....	75
VI. Conclusion .....	75
Incidental Take Statement.....	77
Amount or Extent of Take Anticipated.....	77
Effect of the Take.....	78
Monitoring .....	79
Reinitiation Notice .....	79
Literature Cited .....	80
Appendix A. Revised Forest Plan Conservation for Federally Listed Species.....	87
Conservation Direction and Guidance for all Federally Listed Species .....	87
Species-specific Conservation Direction and Guidance .....	88
A. Indiana Bat .....	88
B. Bald Eagle .....	91
C. American Burying Beetle.....	92
D. Running Buffalo Clover.....	93
Appendix B. Documentation of Indiana bat on the WNF .....	95
Appendix F3.....	F3-i
Final Biological Evaluation .....	F3-1
Organization of the Biological Evaluation.....	F3-1
Introduction.....	F3-1
Description of Alternatives .....	F3-5
Species Evaluated .....	F3-11

Overview of the Effects Analysis ..... F3-13

Effects Analysis ..... F3-14

    Regional Forester Sensitive Species ..... F3-14

    Species Proposed for Regional Forester Sensitive Species Designation ..... F3-79

List of Preparers ..... F3-109

List of Reviewers ..... F3-109

Literature Cited ..... F3-109

References ..... F3-118

    Personal Communications ..... F3-118

Appendix G ..... G-1

    Oil and Gas Management ..... G-1

        Reasonably Foreseeable Development Scenario for Oil and Gas ..... G-1

Appendix H ..... H-1

    Management Area Numbers/Names Crosswalk ..... H-1

Appendix I ..... I-1

    Literature Cited ..... I-1

    References ..... I-18

    Personal Communications ..... I-18

Appendix J ..... J-1

    Glossary, Acronyms, and Scientific Names ..... J-1

        Glossary ..... J-1

        Acronyms ..... J-45

        Scientific Names for Common Names Used ..... J-53

Appendix K ..... K-1

    US Highway 33 – Nelsonville Bypass ..... K-1

        Introduction ..... K-1

        Effects Analysis ..... K-1

        Incorporation by Reference ..... K-2

## Appendix A

# Public Involvement

---

## Introduction

---

As a Federal agency, the Forest Service is required to solicit public comment on draft plans involving significant actions under the National Environmental Policy Act (NEPA). Further, the agency is directed to “assess and consider (the resulting) comments both individually and collectively.” In addition, comments are viewed as critical in shaping a responsible plan for management of the Wayne National Forest that best meets the Forest Service’s mission, legal mandates, the goals of NEPA and the National Forest Management Act (NFMA), and the interests of the American public.

This appendix includes a summary of public involvement and efforts made to engage the public in the creation of the Proposed Revised Forest Plan. Also included is a list of the Federal, State, local agencies, and elected officials who submitted comments. Copies of all documents received are available to the public at the Supervisor’s Office in Nelsonville, Ohio.

---

## Public Participation Prior to Notice of Intent

---

### External Participation

In January 2002, the Wayne National Forest invited public comment as part of the Need for Change analysis in preparation for drafting a Notice of Intent (NOI) to revise the Forest Plan. To engage the public, a variety of strategies were employed.

A letter was mailed Jan. 14, 2002, to 1,400 addressees drawn from all WNF mailing lists. Letters were also sent to American Indian Tribes with possible interest in management of the WNF. On that same day, a news release was sent to more than 40 media outlets in Ohio. Three days later, a Plan Revision section was added to the WNF website.

The WNF began publishing quarterly issues of its Forest Plan Revision Newsletter in February 2003. This publication, sent to the Forest’s mailing list, summarizes progress made in the revision effort.

A series of public listening sessions was then held at three principal towns within the Forest. The first session was held Jan. 22 in Nelsonville, Ohio, followed by sessions in Marietta, Ohio, on Jan. 23 and in Ironton, Ohio, on Jan. 24.

More than 150 individuals attended these three sessions, and more than 70 took the opportunity to speak for three minutes. Their statements were recorded by a stenographer for later review by the Planning. In addition, letters, oral comments, and other replies were received in response to the press releases and individual mailings. A total of 264 comments were received and recorded.

Comments at the January 2002 public meetings covered nearly every resource and program on the Forest. Almost all individuals made a comment related to some form of recreation, most often expressing a preference for the Forest to provide for more or less of specific forms of recreation, such as OHV trail riding. Fewer comments were received on a wide variety of other management issues. Frequently mentioned topics other than recreation included:

- Vegetation management (primarily centered around timber harvest)
- Land acquisition
- Plant and animal species diversity
- Minerals management
- Wilderness / Roadless areas

A number of comments related to how the Forest had implemented direction in the current Forest Plan and whether the Forest was providing the quantity of a specific output as called for in the Plan, e.g., the amounts of OHV trails or timber harvest as forecast.

## Internal Participation

A review by Forest employees had generated a list of over 100 recommendations for change. These fell into three general classifications. First, many recommendations were simply edits to the wording of standards and guidelines but did not change the substance of any standard or guideline. Second, other recommendations related to the implementation of various standards and guidelines for specific resources. The final grouping contained general recommendations not tied to any specific resource program.

The Planning Team then reviewed the comments gathered in the January 2002 public meetings and along with those previously collected from Forest employees to determine potential Forest Plan revision topics.

## Criteria for Evaluation of Revision Topics

Comments from nearly 300 external and internal sources were considered. They were screened to identify subjects with the significance and relevance necessary to become potential Forest Plan revision topics using the following criteria:

- Proposed topics must be consistent with Federal laws and policies and relate to the Forest Service’s mission.
- Proposed topics must be within the responsible official’s decision-making authority
- The proposed topic is not adequately addressed in the current Forest Plan
- The topic is proposed because is new information warrants a reevaluation of one of the six decisions made in the Plan cited above in the first criterion.

---

## Public Participation after NOI

---

Based on the analysis of the Need for Change, the Forest Service published in the Federal Register on April 4, 2002 a Notice of Intent to Revise the Wayne National Forest’s Land and Resource Management Plan. The NOI contained the potential revision topics gleaned from the public meetings, submitted comments, and internal discussions.

The public was invited to submit comments on the Notice of Intent for 90 days following its publication, and 626 responses were logged.

### Public Meetings

Ten public meetings were held during the 90-day public comment period. All 10 took place in June 2002. Nine meetings were held in Ohio, and one was held in Huntington, W.Va. The Huntington location was selected because it is a large population center on the south side of the Ironton Ranger District. Comments resulting from these meetings were included in the content analysis.

Public meetings were held in the following locations:

- June 3, Wright State University, Dayton, Ohio
- June 4, Clarion Hotel, Cincinnati, Ohio
- June 5, Radisson Hotel, Huntington, W.Va.
- June 10, Embassy Suites Hotel, Dublin, Ohio
- June 13, Logan-Hocking Middle School, Logan, Ohio
- June 22, Graysville Community Center, Graysville, Ohio
- June 24, Holiday Inn, Independence, Ohio
- June 25, Four Points Sheraton, Canton, Ohio
- June 26, Holiday Inn, Zanesville, Ohio

- June 29, University of Rio Grande, Rio Grande, Ohio

## Form Letters

The Forest Service received four unique form letters in response to the NOI. A form letter is one in which content is exactly the same from letter to letter. Some form letters include more than one signature. Since content analysis is not a voting process, the unique letters were coded. Because they are interested in the Forest Planning process and care about decisions made in the Forest Plan, however, the names and addresses of signatories of form letters were entered into the database of commentors. They have been kept informed as the revision has progressed. Their geographic distribution was also noted.

## Petitions

Three petitions regarding the Need for Change were received. The names of signatories were entered into the log of persons commenting, and the text of the petitions was coded. Petitions submitted in response to the Notice of Intent were submitted by:

- Friends of the Wayne National Forest
- Rivers to Trails, Inc.
- Southwest Ohio Green Party.

## Record of Public Comments

The original submission of all comments, including tapes of the verbal comments provided at the public meetings, are on file in the Forest Supervisor's Office, Wayne National Forest, 13700 US 33, Nelsonville, OH 45764.

In order to best understand and use information provided during this phase of the Forest Plan revision, a process known as content analysis was used. The purpose of content analysis is to help focus those issues that will guide the revision of the Forest Plan.

## Overview of Post NOI Content Analysis

All letters received were reviewed and are retained in the planning files. A summary of the review process and the comments received is documented in a Content Analysis document, which is posted on the Wayne WNF website. The original comments are available for inspection at the Forest Supervisor's Office.

## Summary of Response Statistics

It is important to note that content analysis is not a vote counting process. It is a tool for decision makers that displays collected information. In other words, it provides information on public input to the decision makers, so they understand the issues and concerns of the public. Content analysis provides a summary of the extent, content, and nature of public input, without any attempt to pass judgment

on comments received. This approach attempts to process every comment in an objective fashion to ensure equal consideration.

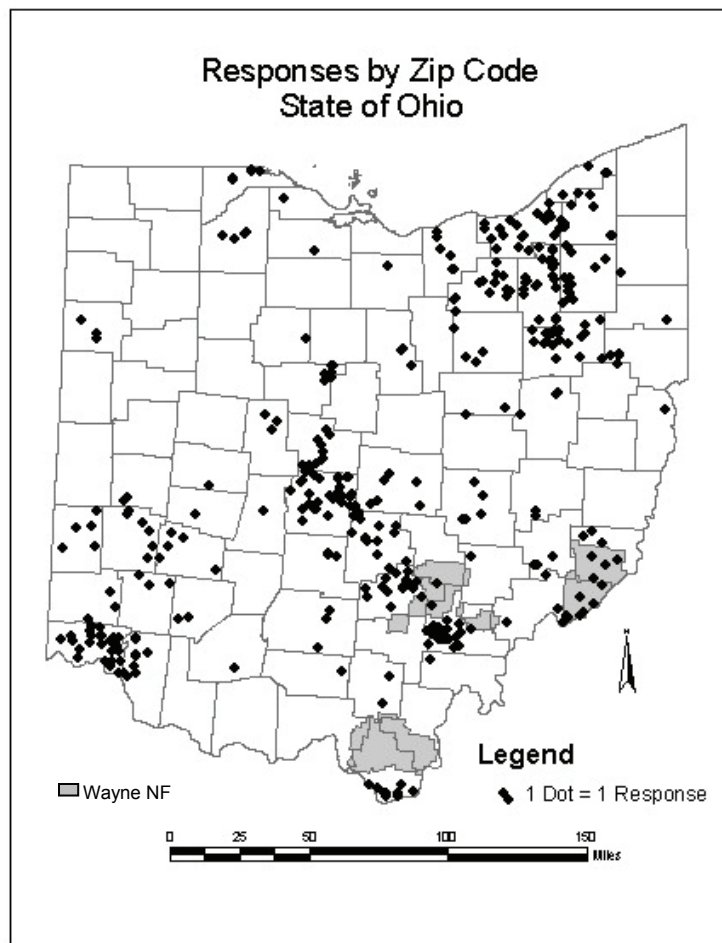
- Of the 626 responses to the Notice of Intent, 57 were duplicate submissions, leaving 566 responses to be coded. Responses were considered duplicate if they contained identical content and were submitted by the same individual. Form letters that contained the same content but were submitted by different persons were not considered duplicates.
- Of the 566 responses coded, 218 were form letters. There were four unique form letters. Responses that modified or added information to the content of the form letter were not considered form letters.
- In addition, 151 persons commenting were signatories to one of three petitions received.
- At the 10 public meetings held in June, 237 verbal comments were received, transcribed, and coded.

### Geographic Analysis of Responses

The geographic information is based on self-reporting by the respondents. No independent effort was made to verify identity, addresses, or state of residence. In some cases, respondents who used e-mail and did not provide demographic or geographic information.

- 21 respondents, or 3.7 percent of the responses coded, identified themselves as from outside Ohio.
- Approximately four percent of the responses came from states other than Ohio: Arizona, Georgia, Indiana, Kentucky, Michigan, Minnesota, Nebraska, Pennsylvania, Puerto Rico, West Virginia.
- Two respondents with return addresses in Australia indicated that they were Ohio residents working overseas.
- Ninety-two respondents, approximately 16 percent of all those coded, provided an address with a zip code found in a county in which Wayne National Forest land is located.

The scattergraph on the map below shows the location of addresses provided by respondents. Concentrations of responses coincide with Ohio population centers and the locations of the public meetings.



## Response Types

Respondents used several methods to submit comments; written letters, comment forms, form letters, electronic mail, telephone, and verbal comments at public meetings.

Electronic versions of all coded comments were made. E-mails were converted to word-processing documents. Transcripts were provided by a legal stenographer. Commenters who submitted lengthy documents were asked to provide their comments electronically.

---

## Public Participation in Development of Alternatives

---

### Alternative Development Workshops

Three workshops were held in October and November 2003, one each in Akron, Brookville and Athens, Ohio, to provide people with an opportunity to generate and discuss ideas that should be considered in USDA-Forest Service decisions about the future management of the Wayne National Forest. The meetings were held in different locations around the state in an effort to make attendance easier

for those who want to participate. Those unable to participate in the workshops were encouraged to provide input on alternatives to the Wayne National Forest office in Nelsonville.

The workshops were designed using ideas from a collaborative learning approach (Daniels & Walker, 2001). Collaborative Learning is an approach appropriate for natural resource, environmental, and community decision-making situations with the following features: multiple parties, deeply held values, cultural differences, multiple issues, scientific and technical uncertainty, and legal and jurisdictional constraints. It emphasizes activities that encourage systems thinking, joint learning, open communication, constructive conflict management, and a focus on appropriate change.

The workshops were divided into three main parts. The first part of the workshop was a series of presentations by the Forest Service to provide information on the issues that had been identified for the revision. The second main part of the workshops was to provide an overview of the collaborative learning process and to involve everyone at the workshop in developing a situation map identifying components related to revising the Forest Plan and the interrelationships of those components. This was a way of starting the systems thinking part of the collaborative learning approach.

During the third main part of the workshops, participants worked with other members of the public to develop different general management approaches, called themes, as ways to improve on the current plan. The groups then presented their theme(s) to the entire workshop and explained their rationale and thinking related to the theme. The themes developed by each group were posted on the Forest's Forest Plan Revision web site shortly after the workshops were completed.

All of the themes developed at the workshops were carried forward and considered by the Forest Service as alternatives were developed. Recommendations included in some of the themes were integrated into the alternatives developed by the Forest Service.

### **Additional Briefings and Updates**

Discussions of the proposed Forest Plan revision alternatives were held with the following government agencies and public groups beginning in January 2004.

- Forest biologists met with officials of U.S. Fish and Wildlife Service on January 6, 2004.
- A partnership meeting was held with Ohio Department of Natural Resources-Division of Wildlife on April 14, 2004.
- Two planning team members met with the Ruffed Grouse Society's biologist Bill Hunyadi on April 23, 2004.
- On April 21, 2004 discussions were held with representatives of the North Country Trail Association and the National Park Service (via telephone)

regarding their recommendations for changes in Forest Plan goals, objectives, standards, and guidelines.

- Two planning team members met with representatives of the Southeast Ohio Oil and Gas Association on May 4, 2004.
- Two planning team members met with Frontier Local School District representatives on May 17, 2004.
- Two planning team members met with Richard Cooper of “Friends of the Wayne” to discuss the alternatives on July 8, 2004.
- Forest Planner briefed officials of the U.S. Environmental Protection Agency in Chicago on August 2, 2004 on the plan revision. Three representatives of the Forest Service’s Region 9 office attended.
- A program on the Forest plan Revision was presented to the Ohio Dept. of Natural Resources-Division of Wildlife’s annual agreements areas conference on August 28, 2004 at Shawnee State Park. Approximately 75 people attended representing the Ohio Division of Wildlife, Mead-Westvaco, American Electric Power (AEP), The Ohio State University, and U.S. Fish and Wildlife Service Law Enforcement
- The director and staff of TNC were given a briefing in Columbus on the Forest Plan revision on August 12, 2004.
- The Forest Supervisor and the Forest Planner gave a briefing on the Forest Plan revision to the Ohio Department of Natural Resources, Assistant Director; Deputy Director for Recreation and Resource Management; and the Chief for the Division of Forestry on August 19, 2004. The Executive Director for Ohio Forestry Association also attended part of this briefing.
- Briefing for State and county representatives of the Ohio Farm Bureau was held for September 17, 2004.

---

## Public Participation after Publication of the Draft Environmental Impact Statement

---

The Forest Service published in the Federal Register on April 1, 2005 a Notice of Availability for the Draft Environmental Impact Statement and the Wayne National Forest's Proposed Revised Land and Resource Management Plan.

Publication of the Notice of Availability started the 90 day comment period which ran from April 1, 2005 through July 1, 2005.

### Public Open Houses

Six public open-houses were held during the 90-day public comment period. All 6 took place in Ohio during May 2005. These open house sessions were informal sessions, offering the public a chance to talk with Forest Service representatives. The goal was to provide information about the documents that were out for review, and to help the public understand how to participate in the public comment process.

Public meetings were held in the following locations:

- May 2, Wayne National Forest Supervisor's Office, Nelsonville, Ohio
- May 3, Frontier Local High School, New Matamoras, Ohio
- May 5, Ironton Ranger District Office, Pedro, Ohio
- May 10, Columbus area, Holiday Inn – I-70 East, Columbus, Ohio
- May 11, Cincinnati area, Holiday Inn – I-275 North, Cincinnati, Ohio
- May 16, Cleveland area, Holiday Inn, Independence, Ohio

### Responses Received

The Wayne National Forest received 678 letters and 2 petitions in response to the Draft EIS and Proposed Revised Forest Plan during the 90 day comment period.

### Record of Public Comments

The original copies of all responses are on file and available for inspection at the Forest Supervisor's Office, Wayne National Forest, 13700 US 33, Nelsonville, OH 45764.

## Overview of Content Analysis

A content analysis process was used to understand and use information received during this phase of the Forest Plan revision. The purpose of content analysis is to help focus those issues that will guide the revision of the Forest Plan.

All letters received were reviewed and are retained in the planning files. The Content Analysis process used at this stage is described in Appendix B to this Final Environmental Impact Statement.

Of the 678 responses received on the Draft EIS and Proposed Revised Forest Plan, 190 of these were unique original letters, and 488 were form letters. Responses were received from 34 different states. No responses were received from outside of the United States.

## Form Letters

The Forest Service received five form letters in response to the Draft EIS and Proposed Revised Forest Plan. Form letters are letters that are received from different individuals but are identical in content. In cases when letter text paraphrases the content of a form letter with no change in meaning, the letter is still treated as a form. For our content analysis process, we had to receive five or more letters with identical or very closely paraphrased text for the letters to be considered a form letter.

One of the form letters was produced and sent to the Wayne using a letter generator on the World Wide Web. Two different web sites (Heartwood and the Buckeye Forest Council web sites) generated essentially the same letter. All someone had to do was insert their name and address and then click submit to send the letter to the Wayne NF. We received 285 copies of this form letter.

One form letter was a postcard which the Buckeye Forest Council sent to their mailing list asking that the postcard be clipped out and mailed to the Wayne NF. We received 35 of these postcards.

We received a package of form letters from the Buckeye Forest Council, mailed to us from a single source that had a form letter with different persons each signing an individual copy. In some cases the signatures were legible and some were not. Some persons signing these gave their address, some did not. We received 154 copies of this form letter.

The two other form letters were letters written that included exactly the same relevant comments. We received 8 copies of one from grouse hunters and 6 copies of one from OHV riders.

The names and addresses of signatories of form letters were entered into the database of commenters. Some form letters include more than one signature. If an address was included, the geographic distribution was also

noted. Many of the form letters included a statement that said basically to include their comments in the record but do not put them on a mailing list. For those persons who requested not to be on our mailing list, they were not added to our Forest Plan Revision mailing list.

## Petitions

Two petitions regarding the Draft EIS and Proposed Revised Forest Plan were received. The names of signatories were entered into the log of persons commenting, and the text of the petitions was coded. Petitions submitted in response to the Drafts were submitted by:

- Heartwood – 3007 signatures \*
- Buckeye Forest Council – 14 signatures

\* Heartwood stated that these petitions included 3097 signatures. A Forest Service count of the signatures found duplicate pages and duplicate signatures. The Forest Service count showed 3007 unique signatures.

The Heartwood petition names 23 national forests that the petition states it refers to; one of these forests is the Wayne National Forest.

## Geographic Analysis of Responses

### Unique Responses

The forest received 190 unique responses. The geographic information below is based on self-reporting by the respondents who provided an address and who prepared a unique response. No independent effort was made to verify identity, addresses, or state of residence. In some cases, respondents did not provide an address that could be used for demographic or geographic information. See Table A-1 on the following page for a breakdown of percentage of responses received from geographical areas.

### Form Letter Responses

The forest received 488 form letter responses. The geographic information below is based on self-reporting by the respondents who provided an address and who sent in a form letter response. No independent effort was made to verify identity, addresses, or state of residence. In some cases, respondents did not provide an address that could be used for demographic or geographic information. See Table A-1 on the following page for a breakdown of percentage of responses received from geographical areas.

**Table A-1: Demographic Breakdown of Where Responses to the DEIS and Draft Revised Forest Plan Came From**

Response Type	Percent of Responses			Percent of Responses From within the 12 Counties where Wayne NF is located (Subset of Column (A))
	(A) From within Ohio	(B) From outside OH	(C) No Zip Code Info	
Unique Letters	72%	8%	20%	30%
Form Ltr 1 – Buckeye Forest Council and Heartwood	18%	80%	2%	6%
Form Ltr 2 – Grouse hunters	50%	13%	37%	13%
Form Ltr 3 – Buckeye Forest Council	70%	6%	24%	12%
Form Ltr 4 – OHV Riders	83%	17%	0	0
Form Ltr 5 – Buckeye Forest Council	95%	3%	2%	1%

**Response Types**

Several methods were used to submit responses; hand written letters, comment forms, form letters, post cards, and electronic mail (email).

Electronic versions of all response letters were made. E-mails were converted to word-processing documents.

## Appendix B

# The Analysis Process

---

## Introduction

This appendix provides additional detail on the processes used in revising the Wayne National Forest's Land and Resource Management Plan (Forest Plan). This information supplements the affected environment and effects analyses found in Chapter 3 of this Final EIS. Detailed information on the process available in other Appendices is referenced but not repeated.

Analyses covered in this appendix include the following major topic areas:

- Public Involvement and Issues Identification (See Appendix A)
- Analyses Prior to the Development of Alternatives
- Development of Alternatives
- Effects Analyses
- Content Analysis of Responses to the Draft EIS and Proposed Revised Forest Plan

These analyses were performed to fulfill the requirements of the Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 as amended by the National Forest Management Act (NFMA) of 1976. These Acts require that renewable resource programs be based on a comprehensive assessment of present and anticipated uses. The demand for and supply of renewable resources must be determined through an analysis of environmental and economic impacts. The implementing regulations developed for these acts are in Code of Federal Regulations (CFR), Title 36, Part 219 (36 CFR 219). The Wayne National Forest (WNF) is revising its 1988 Plan under the 1982 version of 36 CFR 219.

---

## Public Involvement and Identification of Issues

The public involvement process and the process used in the identification of issues are fully discussed in Appendix A to this Final EIS. In the interest of saving printing costs and paper, it is not repeated here.

---

## Analyses Prior to Development of Alternatives

### Analyses of the Management Situation

The analysis of the management situation is a determination of the ability of the planning area covered by the Forest Plan to supply goods and services in response to society's needs. The primary purpose of this analysis is to provide a basis for formulating a broad range of reasonable alternatives. The analysis may examine the capability of the unit to supply outputs both with and without legal and other requirements.

“Analysis of the Management Situation” reports (AMS) were developed under the 1982 Planning Rules for all Forest resources (36 CFR 219.12(e) and FSH 1909.12 Section 3.4). The AMS reports were prepared using the format shown in Figure B - 1.

Resource
<p><b>Appendix A</b>    <u>Introduction</u></p> <p>State why this resource is important and tie the importance to our Forest Service Mission.</p> <p><b><u>Existing Management Situation</u></b></p> <ol style="list-style-type: none"> <li>1. <u>Summarize the existing management plans and the direction included those plans.</u> (Refer to Forest Plan goals and objectives, standards and guidelines, land classifications, forest policies, and forest supplements to manuals or handbooks.)</li> <li>2. <u>Summarize actual current outputs and activities.</u></li> <li>3. <u>Describe projected outputs and activities, if current management direction were to continue into the future.</u> (If different than projections shown in the forest plan, display and explain the differences.)</li> <li>4. <u>Describe the expected future conditions of the forest, if current management direction were to continue into the future.</u></li> <li>5. <u>Describe any known problems with the existing direction or situation.</u></li> <li>6. <u>Assess the Forest's capability to supply this resource.</u></li> <li>7. <u>Assess the demand for this resource from the Forest.</u></li> </ol> <p><b><u>Conclusions</u></b></p> <ol style="list-style-type: none"> <li>8. <u>Describe the need and opportunities for the Forest to establish or change management direction.</u></li> <li>9. <u>Assess the Forest's ability to resolve the issues and concerns through the planning process.</u></li> <li>10. <u>Assess and display the range within which it is possible to formulate alternatives.</u></li> </ol> <p><b>REFERENCES:</b></p> <p><b>APPENDICES:</b></p>

**Figure B - 1. Analysis of the Management Situation Format.**

Benchmark analyses were prepared as part of the AMS and are described in the next section of this appendix.

Forest specialists prepared the AMS for their area of expertise with input and advice from both Ranger District personnel and Regional Office specialists. As the AMS reports were completed they were posted on the Forest's public web site. The public was informed of the availability of the AMS reports via the Forest's planning newsletter. As is the case of all information that has been placed on the Forest's public web site, the Forest offered to send a printed copy to anyone who requested it.

Descriptions of the processes used by the individual specialists in preparation of their AMS are disclosed in the AMS reports.

The AMS reports located on the Forest’s public web site and in the Plan revision hard copy files are hereby incorporated by reference.

## Benchmark Analyses

The purpose of benchmark analysis is to define the range within which alternatives can be constructed. There are five benchmark analyses required to meet the minimum management requirements (36 CFR 219.12).

- Minimum level of management
- Maximum Present Net Value (PNV) for both market (timber) and non-market (personal use) commodities
- Maximum PNV for only market commodities
- Current level of management – the selected alternative for the current plan.
- Maximum level of production of selected goods and services.

The current plan looks at timber production (unconstrained, single tree selection, and uneven-aged), maximum late successional, maximum early succession, maximum non-motorized recreation, and maximum ORV use. Many other Forest’s plans only do Maximum timber.

The starting point for conducting the benchmark analyses was to examine and consider the work done for benchmark analyses during development of the 1988 Forest Plan. The benchmark analysis for the original Forest Plan is discussed and explained in the 1986 Draft EIS in Chapter 2, Table 2 - 1 through Table 2 - 7 and in Appendix B to that document, Part 6 (USDA Forest Service, 1987). The analysis done at that time met the requirements of the 1982 planning regulations.

The Forest Operations Research Analyst – with input and advice from the Forest Silviculturist, Regional ORA, and Forest Service Research Scientists – reviewed the 1986 information. The review found that the benchmark modeling and yield table assumptions done in 1986 still portrayed the outside limits for the required benchmarks with the exception of taking into account the new lands that had been added to the WNF since the analysis was completed.

Based on the review, the 1986 Benchmark projections were updated to account for the new acreage acquired by the Forest. Since the 1988 Forest Plan was developed, the Forest has added over 50,000 acres to its land base (the original analysis was based on the 1982 total of 176,787 acres). This change was addressed by assuming that the relationship between the original and acquired acres is such that, on average, the newly acquired acres look like the acres used for the original analysis. The benchmarks were then adjusted proportionally to account for the added acres.

Table B - 1a and 1b present the results of this analysis.

Table B - 1a. Updated Benchmark Analysis

Benefit	Measure	Units	Decade	Benchmarks			
				Min Level Mgmt.	Max. PNW Market/Assigned Values	Max. PNW Market Values Only	Max. Timber for 5 Decades
<b>Vegetative Management</b>							
<b>Veg. Comp.</b>	Oak-Hickory	M-Acres	1	150.26	147.49	149.87	146.30
	Mix. Decid. Hardwoods	M-Acres	1	42.82	45.20	42.82	47.97
	Pine & Pine-Oak	M-Acres	1	35.15	45.73	32.51	31.06
	Oak-Hickory	M-Acres	5	152.11	141.01	148.94	138.37
	Mix. Decid. Hardwoods	M-Acres	5	44.01	54.98	44.93	67.93
	Pine & Pine-Oak	M-Acres	5	32.51	29.34	31.45	19.03
<b>Tbr. Quan.</b>	Uneven_age Harvest	MMBF/Yr	1				
	Even-age Harvest	MMBF/Yr	1		3.30	0.79	11.76
	Uneven_age Harvest	MMBF/Yr	5				
	Even-age Harvest	MMBF/Yr	5		8.85	3.30	14.54
	Even-aged Harvest						
	Clearcut	M-Acres/Yr	1		0.79	0.13	3.44
	Shelterwood	M-Acres/Yr	1		0.13		0.53
	Uven-aged Harvest						
	Selection	M-Acres/Yr	1				
	Even-aged Harvest						
	Clearcut	M-Acres/Yr	5		1.85	0.13	2.91
	Shelterwood	M-Acres/Yr	5		0.13	0.40	0.26
	Uven-aged Harvest						
	Selection	M-Acres/Yr	5				
	Even-aged Harvest	MMBF/Yr	1		9.65	2.11	33.57
	Uven-aged Harvest	MMBF/Yr	1				
	Total Harvest Volume	MMBF/Yr	1		9.65	2.11	33.57
	Total Harvest Volume	MMBF/Yr	5		25.24	9.52	41.50
	Long Term Sustained Yield	MMBF/Yr	N/A		33.30	10.44	44.01
	Suitable Timber Land	M-Acres	1		205.37	22.60	218.46
<b>Wdif. Hab.</b>	Openings	M-Acres	5	1.06	8.46	4.36	4.36
	Small Lakes/Ponds	Acres	5	178.41	178.41	178.41	178.41
	Marshes	Acres	5	22.47	22.47	22.47	22.47
<b>Veg. Div.</b>	Open/Shrubland	M-Acres	1	6.48	6.74	6.74	6.74
	Early Successional	M-Acres	1	7.14	15.59	8.72	29.21
	Intermediate Hardwoods	M-Acres	1	30.79	30.79	30.79	30.79
	Mast Producing Hardwoods (40-99yrs)	M-Acres	1	114.32	111.54	114.32	101.63
	Mast Producing Hardwoods (100+ yrs)	M-Acres	1	40.70	34.76	38.85	32.38
	Open/Shrubland	M-Acres	5	3.44	6.74	6.74	6.74
	Early Successional	M-Acres	5	0.93	19.43	4.36	27.09
	Intermediate Hardwoods	M-Acres	5	2.11	42.42	5.81	74.01
	Mast Producing Hardwoods (40-99yrs)	M-Acres	5	67.14	74.54	68.33	77.71
	Mast Producing Hardwoods (100+ yrs)	M-Acres	5	125.95	61.19	118.55	27.62

Table B - 1b. Updated Benchmark Analysis.

Benefit	Measure	Units	Decade	Benchmarks				
				Max. Single Tree.	Max. Uneven-aged Mgmt.	Max. Late Succ	Max. Non-motorized	Max Early Succ
<b>Vegetative Management</b>								
<b>Veg. Comp.</b>	Oak-Hickory	M-Acres	1	149.87	148.02	147.62	147.49	149.47
	Mix. Decid. Hardwoods	M-Acres	1	42.82	45.33	45.20	45.20	45.86
	Pine & Pine-Oak	M-Acres	1	32.51	31.85	32.38	32.51	30.00
	Oak-Hickory	M-Acres	5	130.57	138.90	141.01	140.35	139.43
	Mix. Decid. Hardwoods	M-Acres	5	64.10	57.49	54.98	54.71	64.76
	Pine & Pine-Oak	M-Acres	5	30.53	28.81	29.21	30.13	21.01
<b>Tbr. Quan.</b>	Uneven_age Harvest	MMBF/Yr	1	2.70	2.83			
	Even-age Harvest	MMBF/Yr	1			4.23	3.70	8.46
	Uneven_age Harvest	MMBF/Yr	5	5.68	5.51			
	Even-age Harvest	MMBF/Yr	5			8.72	7.14	12.29
	Even-aged Harvest							
	Clearcut	M-Acres/Yr	1			0.93	0.79	1.98
	Shelterwood	M-Acres/Yr	1			0.13		0.26
	Uven-aged Harvest							
	Selection	M-Acres/Yr	1	1.98	1.32			
	Even-aged Harvest							
	Clearcut	M-Acres/Yr	5			1.85	1.45	2.51
	Shelterwood	M-Acres/Yr	5			0.13	0.13	0.26
	Uven-aged Harvest							
	Selection	M-Acres/Yr	5	6.61	3.44			
	Even-aged Harvest	MMBF/Yr	1			12.29	10.57	24.32
	Uven-aged Harvest	MMBF/Yr	1	9.65	10.04			
	Total Harvest Volume	MMBF/Yr	1	9.65	10.04	12.29	10.57	24.32
	Total Harvest Volume	MMBF/Yr	5	20.48	19.69	24.85	20.62	35.02
	Long Term Sustained Yield	MMBF/Yr	N/A	20.48	19.69	30.40	25.90	46.65
	Suitable Timber Land	M-Acres	1	222.42	218.32	210.79	169.69	218.85
<b>Wdlf. Hab.</b>	Openings	M-Acres	5	4.36	4.36	4.36	4.36	4.36
	Small Lakes/Ponds	Acres	5	178.41	178.41	178.41	178.41	178.41
	Marshes	Acres	5	22.47	22.47	22.47	22.47	22.47
<b>Veg. Div.</b>	Open/Shrubland	M-Acres	1	6.74	6.74	6.74	6.74	6.74
	Early Successional	M-Acres	1	N/A	N/A	17.97	16.39	29.74
	Intermediate Hardwoods	M-Acres	1	N/A	N/A	30.79	30.79	30.79
	Mast Producing Hardwoods (40-99yrs)	M-Acres	1	N/A	N/A	110.35	111.14	102.29
	Mast Producing Hardwoods (100+ yrs)	M-Acres	1	N/A	N/A	33.57	34.36	32.38
	Open/Shrubland	M-Acres	5	6.74	6.74	6.74	6.74	6.74
	Early Successional	M-Acres	5	N/A	N/A	19.30	15.86	28.15
	Intermediate Hardwoods	M-Acres	5	N/A	N/A	37.67	31.85	75.73
	Mast Producing Hardwoods (40-99yrs)	M-Acres	5	N/A	N/A	77.18	75.20	78.11
	Mast Producing Hardwoods (100+ yrs)	M-Acres	5	N/A	N/A	63.44	73.61	25.11

## Species Viability Analysis

The process used to analyze species viability on the WNF is fully discussed in Appendix E to this Final EIS titled “Plant and Animal Diversity”. To save printing costs and paper, it is not repeated here.

## Reasonably Foreseeable Development Scenario for Oil and Gas

To help evaluate the oil and gas resources on the WNF, the Division of Mineral Resources of the Bureau of Land Management prepared a Reasonably Foreseeable Development Scenario for Forest. Completed it in January, 2004, this report is included in its entirety in Appendix G to this Final EIS. To save printing costs and paper, it is not repeated here.

A summary of that report follows:

Increased national demand for energy has increased the price producers receive at the wellhead. Consequently, interest in drilling wells on federally owned surface of the WNF has increased. The Forest’s Federally owned surface overlies a mix of mineral estate that is classified as either Federal, Reserved, Outstanding, or a combination thereof. Based upon a survey of local oil and gas producers, a forecast of the total number of new wells and associated surface disturbance that will likely occur on Federal surface over the next 10 years, regardless of mineral classification, is shown in Table B - 2 for each of the three organizational units of the Forest:

**Table B - 2. Projected Oil and Gas Development over the Next 10 Years.**

	Athens Unit	Marietta Unit	Ironton Unit
Number of new wells drilled over next 10 years	24	110	100
Miles of new access road needed	5	21	19
Total acres of surface disturbed by oil & gas drilling activity before reclamation	27	135	110
Total acres of surface needed to support drilled wells that are completed for production (excess disturbance reclaimed)	11	59	51
Number of depleted wells plugged over next 10 years	82	26	0
Total acres reclaimed by plugging depleted wells	45.1	14.3	0

Federally owned minerals make up about 40 percent of the mineral ownership on the WNF. Federal minerals are the only class of mineral estate for which the Forest Service may determine whether land will be made available for oil or gas development. The above projection assumes that:

- All Federal minerals in the Forest are available for lease unless precluded by law.
- All Federal minerals are timely leased upon request with only standard lease stipulations.
- Drilling permits for Federal minerals are timely processed.
- Oil and gas prices remain at or above current levels.

## Social Assessment

During 2002 and 2003, the Wayne conducted a social assessment which was completed and published in January 2004.

The purpose of the Social Assessment was to characterize the social and economic environment of the Wayne National Forest by showing the relationship and linkages between National Forest System land and communities.<sup>1</sup> The goal of this assessment was to help the Forest Service and the public to:

- Better understand the relationship between public lands and communities
- Identify specific elements of the current forest plans that may need to be changed
- Assemble the information needed to evaluate trade-offs between options for future forest management.

The information from this assessment points out the WNF's unique position and helps clarify the Forest's role in, and key contributions to, the local community, the State, and the nation. The assessment can be broadly useful to the Forest and the public, as a basis for well-informed consideration of future alternatives within and beyond the planning process.

The assessment is intentionally broad in scope and multi-faceted to provide a context for Forest Plan revision. It builds a contextually-rich foundation that reveals the parts, amounts, patterns, and dynamics of the area in and around the WNF. It also aids in understanding the history behind the current situation. Findings from the social and economic

---

<sup>1</sup> 36 CFR 219.1 (b)(14) (1982)

assessment will be used in concert with other resource information and assessments, the analysis of the management situation, need for change and the Notice of Intent. The social assessment will be further used in describing the affected environment; helping to set a reasonable range of alternatives, and providing a baseline for effects analysis of the Forest Plan revision.

The assessment is divided into three primary sections. The first section provides the background to the social landscape of the Forest. This section discusses pre-history, frontier and early industry, and the Federal acquisition of lands that led to the creation of the WNF. It also describes forest planning. The second section focuses on the regional socio-economic conditions in the study area, Southeastern Ohio, including the 12 counties in which the Forest lies. The demographic and economic characteristics of the region are described, including the impacts of National Forest land ownership on local governments. The third section assesses the role of Forest-specific resource industries, both commodity (timber, other wood products, and subsurface commodities such as coal, oil, and gas) and non-commodity (recreation).

The Social Assessment utilized data from a number of publications, Federal agencies not related to the Forest Service, and from a contract to analyze economic and social statistics for Ohio and for the 12 counties in which the WNF owns land (Woods and Poole, 2002). A complete listing of the references used is included in the assessment.

The processes used in preparing the Social Assessment are disclosed in the assessment document. They are incorporated here by reference.

## Recreation Feasibility Study

During 2002 and 2003, the WNF prepared a Recreation Feasibility Study. The purpose of this Recreation Feasibility Study was to assist the Forest in developing its current recreation program into one that offers the most appropriate opportunities from a standpoint that considers natural resources, demographics, and local economies. The specific objectives of this study were:

- To determine potential recreational opportunities by taking into account:
  - User demands and trends
  - An outdoor recreation user profile
  - Recreational opportunities currently available in southeast Ohio and nearby states
  - Gaps between demand and offerings

- The impact of recreational opportunities on surrounding communities.
- To determine how the WNF can position itself to work with local communities to:
  - Better meet public desires and community political agendas
  - Meet the capital investment and maintenance projects needed to implement and sustain the proposed objective.

The study resulted in two documents, an Executive Summary and the detailed Technical Report.

The Technical Report provides the detailed findings of the feasibility study. Findings are reported textually, and graphs and tables are included whenever appropriate. The Technical Report is meant only to provide the reader with a report of these findings, not a report of their implications. The Executive Summary provides the implications of the results, recommendations, and suggestions for further research and monitoring of the recommendations. Both of these documents are available at the WNF supervisor's office.

## Methodology

Any recreation feasibility study conducted for the Forest Service must follow the guiding principles of its mission statement. The outcome strategy for the recreation program must balance the diverse interests of citizens while protecting the public lands under Forest Service jurisdiction. In addition, the strategy must take into account the economic impact on the surrounding areas and promote economic development on State, regional, and local levels. Thus, including the opinions of policy makers, business owners, and local recreation users is not only instrumental in insuring a viable recreation program that represents the needs of the local areas, it also allows the Forest Service to meet its mission goals of “listening to people and responding to their diverse needs in making decisions” and “forming partnerships to achieve shared goals” (USDA Forest Service, 2002a).

Data collection for the Recreation Feasibility Study followed these guidelines. Input was obtained from a wide variety of WNF stakeholders, potential users, and existing data sources. Table B - 3 provides an overview of the methods use and the objective for each.

**Table B - 3. Overview of Methodologies Utilized in Recreation Feasibility Study.**

Methodology	Objective
Secondary Data Review	<ul style="list-style-type: none"> <li>• Understand national and regional recreation trends.</li> <li>• Identify public attitudes toward uses of the National Forest.</li> <li>• Identify county population and economic indicators.</li> <li>• Identify recreational opportunities and shortfalls.</li> </ul>
Stakeholder Interviews	<ul style="list-style-type: none"> <li>• Determine the knowledge, attitudes, and opinions regarding local recreational activities and opportunities and WNF multiple use programs.</li> <li>• Understand the role of recreation in the area.</li> <li>• Identify issues relevant for developing a working relationships with WNF.</li> </ul>
Area Outdoor Recreation Users: Telephone Interviews in 4 urban areas in proximity to WNF	<ul style="list-style-type: none"> <li>• Identify Recreation Use of Potential Users.</li> <li>• Identify Needs of Recreation Users.</li> <li>• Identify ways to improve recreation enjoyment.</li> <li>• Find the level of awareness and knowledge of WNF.</li> <li>• Develop an area recreation user profile.</li> <li>• Determine the general indicators of regional public use of WNF.</li> </ul>
Town Meetings	<ul style="list-style-type: none"> <li>• Identify recreational opportunities.</li> <li>• Identify entrepreneurial opportunities.</li> <li>• Determine ways for WNF and communities to work together.</li> <li>• Develop criteria to prioritize recreation expansion opportunities.</li> </ul>

### Secondary Data Review

Two primary sources provided data on national and regional outdoor recreation trends and attitudes toward public lands – the National Survey on Recreation and the Environment (NSRE) (USDA Forest Service, 2002b) and the Recreation Roundtable Survey (RSW, 2000). National public land attitudes and user information was obtained from publications by H. Ken Cordell et al. (Cordell et al., 1999; 2001). In addition, other data presented were obtained from the Ohio Department of Development (ODOD) and the Ohio Department of Natural Resources (ODNR). Finally, map data were gathered from a variety of sources, including Wayne National Forest (WNF), ODNR, American Electric Power Land Management Department, and Mead/Westvaco Paper Company.

### Stakeholder Interviews

The first phase of this project was to identify and interview stakeholders from the counties surrounding each of the three WNF Units in addition to relevant state officials. Area stakeholders included local government officials, environmental activists, recreation users, WNF employees, related service or business people, and other community activists. The final number of personal interviews totaled 107. Stakeholders were identified through a three-stage process:

- Potential stakeholders were identified by collecting names of all government (local, county, regional, and state level) officials,

business owners, recreation associations, environmental groups, and other related individuals in the area

- WNF officials provided lists of relevant parties
- During the personal interview, each individual was asked to provide names and telephone numbers of other appropriate individuals.

Interview questions focused on existing and potential recreational opportunities, the role of recreation in the area, perceptions of the WNF, and potential recreation-oriented partnerships. Appendix A to the Recreation Feasibility Study provides the questions asked of stakeholders and a list of the entities represented.

For the purpose of analysis, interviewees were divided into groups across two criteria: stakeholder status or organization and county or area represented. For stakeholder status, such as the type of self-identified organization to which a respondent belonged, seven groups were created. They are:

- Local officials (county commissioner, mayor, OSU extension county agent, chamber of commerce, community action organization, regional planning commission, county engineer)
- Service or business people (economic development, business, private animal reserve)
- Environmental organization officials (environmental association/organization, Resource Conservation and Development [RC&D])
- Public recreation officials (recreation-oriented association, city or county public recreation, citizen, Governor’s Office of Appalachia)
- Tourism officials (visitor bureau, Ohio Historical Society, higher education/college or university, Ohio Division of Travel or Tourism, Ohio Travel Association, county historical society, tourism association, college)
- WNF officials
- Park, forest, and reserve officials (ODNR/wildlife/State parks/forestry/natural areas and preserves, park district or county or metro).

As for the counties or regional areas represented among the interviewees, eight groups were created. They are:

- Athens region counties (Perry, Morgan, Athens, Hocking, and Vinton Counties)

- Ironton region counties (Washington, Noble, and Monroe Counties)
- Marietta region counties (Jackson, Gallia, Scioto, and Lawrence Counties)
- WNF
- State agency
- County/metro park district
- Franklin County
- Muskingum County.

Initial content analyses of the interview responses revealed that most responses could be categorized into mutually exclusive and exhaustive themes. Therefore, responses could then be coded into a database and statistically analyzed. Analysis consisted of identifying patterns and comparisons across stakeholder groups and regional units. Statistical analyses (chi-square tests) were conducted to determine significant differences among groups (by stakeholder groups and by WNF Unit). Only statistically significant differences at the  $p \leq .10$  level are presented in this report.

### Area Outdoor Recreation Users

The second phase of this study was a telephone survey of outdoor recreation users from four urban communities surrounding the WNF: Cincinnati, Cleveland, and Columbus, Ohio, and Charleston, West Virginia. These four areas were identified by WNF staff as primary sources of users of WNF recreation resources. A total of 400 telephone interviews were conducted, with 100 interviews in each of the four urban areas. A random sampling procedure was used, where all potential households with telephones in the target area were eligible to be chosen. Once a household was identified, a second random procedure was used to choose from the adults (18 years or older only) living in the household. Only people who had participated in an outdoor recreational activity within the past year were interviewed.

Area outdoor recreation users were asked a series of questions regarding their recreational activities, satisfaction with activity locations, awareness and perceptions of WNF, and attitudes toward recreation and the natural environment. Appendix B to the Recreation Feasibility Study is a version of the telephone interview questionnaire that has been modified to eliminate the programming used by the computer-assisted software in administering the survey.

A wide range of statistical techniques was used to analyze the telephone survey data. The margin of error for the total sample is  $p \leq .05$ . However,

when data are presented for the four urban areas, specific outdoor recreation activities, or WNF visitors, the margin of error increases, depending on the number of respondents fitting the criteria. The smaller the group the less reliable the data. Therefore, caution must be taken when viewing these data.

A user profile was created using discriminant analysis and is described in detail in Appendix D of the Technical Report on the Recreation Feasibility Study. Statistically significant differences among groups at the  $p \leq .05$  level are presented throughout the report.

### Town Meetings

The final phase of this study was to conduct public town meetings. Six town meetings were held in “gateway communities” surrounding WNF. Communities were chosen by WNF staff and represented travel pathways into WNF Units. Notification of the town meetings was sent to area newspapers for publication. In addition, all stakeholders who were interviewed were sent information regarding the town meeting locations and were invited to attend personally and/or to pass on the information to other interested parties. Information on the town meetings was also given to tourism and visitor organizations in the areas surrounding the town meeting locations.

Participants in the town meetings were assigned to groups to discuss one of three questions on recreation, entrepreneurial opportunities, or ways to enhance WNF/community working relationships. The fourth group was asked to provide feedback on how to prioritize these opportunities. Once individuals were assigned to a group, they were asked to write down their ideas individually and then to discuss them as a group to identify their top ranked responses. These responses were then presented to all town meeting participants for discussion. Appendix C provides the town meeting agenda and a listing of the number of participants and the organizations they represented. All individual and group responses were listed for each question and patterns were identified. These patterns are given throughout the Technical Report.

### Roadless Area Analysis

The process used in analyzing the potential for roadless areas on the Forest is fully discussed in Appendix C to this Final EIS. To save printing costs and paper, it is not repeated here.

### Wild and Scenic Rivers Analysis

The Wild and Scenic Rivers Act of 1968 was passed to provide a process by which a river that is “free flowing” and possesses “outstandingly remarkable” characteristics may be evaluated for Wild and Scenic River designation (USDA Forest Service, 1990)

The Little Muskingum River was identified in the Nationwide Rivers Inventory prepared by the Heritage Conservation and Recreation Service, U.S.D.I., in 1982 for potential inclusion in the Wild and Scenic River System.

The Little Muskingum is a 57-mile long stream that winds across Washington and Monroe Counties in southeastern Ohio. The river runs south from Ethel, Ohio, through the WNF, eventually completing its 57-mile journey to the Ohio River near Cornerville, Ohio. The river corridor ranges from one-half to one mile wide, which includes some of the river's flood zone. Of the 16,700 total acres in the river area corridor, approximately 4,000 acres (24 %) are under National Forest System administration. The Little Muskingum is a slow, relatively shallow river with an average fall of 3 feet per mile. The river is canoeable in the spring and fall, except during periods of high, turbulent water or periods of extreme drought. The river flows through forested, pasture, and farm land. Four historic wooden covered bridges cross the river along its 57-mile course. There is also evidence of roads, mineral activities, utility lines, and timber harvest throughout the corridor. (Final EIS, Appendix D, 1987)

Two additional rivers traverse Southeastern Ohio counties, the Salt Creek and Hocking River, are also listed on the National Rivers Inventory (NRI). However, the eligible segments of these rivers do not fall within WNF boundaries, and therefore are not evaluated by the Forest Service for Wild, Scenic, or Recreation River consideration.

In 2002, the WNF completed the Watershed Integrity Analysis. This analysis provided an assessment of the health or integrity for watersheds containing National Forest System (NFS) lands within the Wayne's proclamation boundaries. The watershed analysis concluded that, with the exception of the Little Muskingum River, rivers/streams within the 15 major watersheds located on the Forest were not considered "outstanding resource waters". In other words, these aquatic systems were not considered exceptional warm water habitats for aquatic species.

## Historical Background

The Little Muskingum River was one of 1,524 rivers listed in the U.S. Department of Interior's 1982 Nationwide Rivers Inventory to have potential for inclusion in the Wild and Scenic River System.

When the 1988 Forest Plan was being revised, the Forest Service decided to postpone the eligibility study for the Little Muskingum River until the next Forest planning cycle. The Forest Service's rationale for postponing the eligibility study was based on two key factors:

- Standards and guidelines in the Forest Plan (for Management Area 2.1) would adequately protect the river's values until an eligibility study could be completed.

- The WNF then had an active land acquisition program in the Marietta Unit (location of Little Muskingum River and it would be more appropriate to complete a study at a later date when additional NFS land along the river had been acquired.

American Rivers, Inc. appealed the Forest Service's decision to defer the eligibility study on the premise that Forest Service national direction mandates all potentially eligible rivers within a National Forest's proclamation boundaries be studied during Forest Plan revision or immediately after in a separate study. The Forest Service settled with American Rivers, Inc. by agreeing to begin an eligibility determination study for the Little Muskingum River soon after the Forest Plan was revised. (USDA Forest Service, 1990)

An evaluation team involving Forest Service specialists and an advisory committee that included key local stakeholders was formed to study the Little Muskingum River's eligibility potential. Many other Federal, State, and private organizations specialists contributed to this study. The Little Muskingum River Eligibility Determination for Wild and Scenic River System study was completed in January 1990, and a copy of this study is filed at the Forest supervisor's office in Nelsonville, Ohio, and its Marietta ranger district office.

An evaluation team involving Forest Service specialists and an advisory committee that included key local stakeholders were formed to study the Little Muskingum River's eligibility potential. Many other federal, state, private organizations specialists also contributed to this study. The Little Muskingum River Eligibility Determination for Wild and Scenic River System study was completed in January 1990. A copy of this study is filed at the Wayne's headquarters in Nelsonville, OH and its Marietta office.

The Little Muskingum River's natural characteristics were examined against the criteria set forth in the Forest Service Handbook (FSH 1902.12, Chapter 8) for wild, scenic, and recreation Rivers. The 1990 study found the Little Muskingum River to contain no values that were considered "outstandingly remarkable" and therefore was determined to be ineligible for Wild, Scenic, or Recreation (WSR) River nomination. One of the primary reasons for the river's ineligibility determination was its close proximity to roads, bridges, utility corridors, oil and gas wells, farms, residences, and small towns. This was confirmed during visits and discussion with American Rivers, Inc. Public Lands Specialist (Jamie Fosburgh) and the Forest Service's national Wild and Scenic Rivers' Coordinator (Dean Lundeen). Furthermore, there was consensus among the interested public that the river did not qualify under the national WSR system (USDA Forest Service, 1990).

However, the Evaluation Team felt the river's characteristics could improve over time and that it should be re-evaluated for Wild, Scenic, or

Recreation River consideration in the next 10 to 20 years. This conclusion was based on two assumptions:

- The land within the river corridor would continue to revert from farm and pasture land to forest at a somewhat rapid pace.
- The Forest Service land acquisition program would continue to acquire more land along the river corridor at a rapid rate. (USDA Forest Service, 1990)

A March 2003 review of the Forest's land status atlas found less than 200 acres of additional river frontage had been acquired by the Forest Service since 1990. GIS was used to view 1996 digital ortho quads (latest quads) to get an overall picture of how the landscape surrounding the river corridor appeared since the 1990 study. Numerous farms, pastures, and other developments clearly remained. New information on watershed conditions was collected and analyzed through a detailed ecological analysis of the Little Muskingum watershed in May 2002. Results from this analysis provided no new information about the river that could be considered "outstandingly remarkable". Additionally, the Forest Service conducted a Forest-wide watershed integrity analysis for all fifth level watersheds on the WNF in 2002. This study not only supports the conclusion of previous studies that the Little Muskingum River did not meet the criteria for WSR, but also confirmed that all other streams and rivers on the Forest lacked the unique character to qualify for WSR consideration.

The State of Ohio Wild and Scenic River's Coordinator (Bob Gable) was also consulted to determine if any WNF rivers/streams qualify for State wild and scenic river nomination. According to him, of all the WNF rivers and streams inventoried and analyzed in the State's 1991 river study, only the Little Muskingum River qualified for State Wild and Scenic River designation. However, for a river to be nominated for State Wild and Scenic River status, it must also have local support to proceed with a study for subsequent designation, which the Little Muskingum River lacked. The State readdressed potential designation in 2002 and again found strong local opposition to considering a designation. The State has no plans to pursue designation for the Little Muskingum River.

Therefore, based on the findings listed above and the WSR criteria in Forest Service Handbook (FSH 1902.12, Chapter 8), the Forest Service concluded that no rivers or streams on the WNF were eligible for national Wild, Scenic, or Recreation River nomination.

## Management

When the 1988 Forest Plan was developed, no Wild and Scenic Rivers were designated on the WNF, and therefore, no guidelines or other direction is included in the current Forest Plan to manage this resource.

Nevertheless, the Forest Service made a conscious decision to manage the Little Muskingum River for recreational purposes under the standards and guidelines for Management Area 2.1. It is managed primarily for and promoted as a canoeing and fishing river.

In discussions of allocating lands to various management areas during the Forest Plan revision process, it was recommended that the Little Muskingum River continue to be managed in a “River Corridor” allocation under all alternatives.

---

## Development of Alternatives

This section describes the process used by the Forest Service to develop and formulate the alternatives being considered for implementation for the Wayne National Forest. These alternatives provide a framework for meeting the purpose and need for Plan revision as discussed in Chapter 1. All alternatives are considered viable; yet provide varying amounts of goods and services that can be offered to the public.

### General Process of Developing the Alternatives

The first step was to listen to the public. Since the Notice of Intent (NOI) to revise the Plan was published in February 2002, the Forest Service received over 600 pages of input from interested citizens and organizations in the form of letters and verbal contacts. Content analysis derived from three public meetings prior to the NOI and 10 post-NOI public meetings provided a good understanding of what our citizens wanted to see from the Forest. This gave the planning staff a clear understanding of what key issues should drive the alternatives, what were minor issues that would not drive alternatives, and issues that were beyond Forest Service jurisdiction.

Our second step was for our own Forest specialists to do an Analysis of the Management Situation (AMS) within their own disciplines, giving detailed accounting of current Plan direction and where there was room for improvement. The AMS parameters asked specialists to elaborate on current Plan strategies, how well the Forest had progressed and to suggest where changes needed to be made. (See Analysis of the Management Situation section of this Appendix.)

Assemblage of several studies were undertaken to help with the AMS and further development of alternatives. They included:

- Recreation Feasibility Study
- Assessment of Roadless Areas and Wild and Scenic River Eligibility
- Subsurface (Minerals) Ownership Database and Geographic Information System Mapping
- Species Viability Evaluations
- Social Assessment
- Roads Assessment
- Silvicultural Systems Workshop
- Issues and Alternative Development Papers

Additionally advice was sought from professional societies and other government agencies:

- Reasonably Foreseeable Development Scenario for Oil and Gas Resources (Bureau of Land Management)
- Broad-scale Ecological Assessment/Western Allegheny Plateau Assessment (The Nature Conservancy)
- Threatened and Endangered Species Plan Amendment (based upon the USDI Fish and Wildlife Service Biological Opinion)

Our third main step was to once again go to the public, present an overview of the issues identified and asked them to participate in three workshops around the State to collaborate on developing the themes to help shape alternatives. Prior to these collaborative workshops, the interdisciplinary team had not met to develop alternatives. This delay was deliberate, to allow the team to gain insight and ideas from the public before the Forest Service undertook its part in developing the alternatives.

At these workshops, the three issues that would drive the alternatives were identified. Three other issues of concern to the public that could be addressed in similar fashion across all alternatives were also identified.

Issues that vary by alternative include:

- Vegetation
- Recreation
- Minerals

Issues addressed the same way in all alternatives:

- Watershed Health
- Land Ownership
- Roadless Areas, Wilderness, and Wild and Scenic River Recommendations.

## Range of Alternatives

The National Environmental Policy Act requires that a “no-action alternative” be considered. A no-action alternative in this case would mean the continued implementation of the current Forest Plan, including its 13 Amendments.

The Forest Plan interdisciplinary team discussed all public input received from the collaborative workshops, grouping together similar ideas and themes. Based on the groupings of ideas and input received during the public workshops and the information developed during the analyses of the management situation, the Forest Service developed alternatives to the no-action alternative. During this process, several new management area

prescriptions were developed to respond to issues and ideas raised by the public and by Forest Service employees.

Some alternatives were considered and eliminated from future study for specific reasons outlined in Chapter 2 of the Final EIS associated with this Appendix. Alternatives that were eliminated from detailed study are still part of the range of alternatives considered (40 CFR 1502.14(a)).

This stage of the development of alternatives resulted in four alternatives to the no-action Alternative (Alternatives B through E). As the alternatives were being developed, it became obvious that some of the proposed changes that made sense for Alternatives B through E would also make sense even if the Forest were managed under the no-action alternative. After discussion on-Forest and with the NEPA and Planning Specialists in the Forest Service Regional Office, the no-action alternative was modified (treating the revision as a multi-faceted Forest Plan Amendment).

After Alternatives A through E were developed conceptually, reviewed, and, in some cases, modified, they were approved by the Forest Leadership Team. After this approval, the interdisciplinary team discussed the concepts and how the Forest's land base might be allocated to put the concepts to work. Discussions included physical and ecological conditions as well as social and economic concerns/desires. These discussions resulted in a draft mapping of land allocations (management areas).

The draft mapping of management areas was reviewed and critiqued by Forest Service field personnel who were intimately familiar with the actual ground conditions. Based on this input, adjustments were made to the management areas, including location of boundaries on readily identifiable ground features wherever possible. These changes then went to the Forest Leadership Team for approval.

The Eastern Regional Forester verbally approved the range of alternatives, A through E, on February 5, 2004. The 5 alternatives were posted on the Forest's public Web site and presented to the public in a newsletter.

During the spring and early summer of 2004, as Forest resource specialists analyzed effects of the alternatives, it became apparent that the range of alternatives could be expanded to better address the initial issues related to roadless and wilderness conditions. As a result of public involvement, a new alternative, Alternative F, was developed. The primary focus of this alternative was to increase land allocated to a management prescription that did not allow commercial timber harvesting and where non-motorized dispersed recreation would be emphasized.

After discussions on the Forest, this additional alternative was presented to, and verbally approved by, the Regional Forester for inclusion in the analysis.

## Overview of the Alternatives

**Alternative A** – Current direction (no action). Emphasis on mature forest habitat with limited active management.

**Alternative B** – Emphasis on even-aged successional mosaic. A mix of age-classes is created, including early successional habitat.

**Alternative C** – Emphasis on mature forest habitat, more semi-primitive non-motorized recreation opportunities and constraints on oil and gas development.

**Alternative D** – Emphasis on a combination of mature forest habitat and active ecological restoration.

**Alternative E** – Emphasis on active ecological restoration.

**Alternative F** – Emphasis on non-motorized dispersed recreation and ecological restoration.

### How the Alternatives Would Address Vegetation Management

This chart shows how the alternatives vary in addressing the vegetation management/wildlife habitat issue.

**Table B - 4. Habitat Conditions Produced by Alternative.**

Habitat Conditions Produced	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Mod	Alt. F
Grassland Mosaic	0	0	5,334	5,334	5,334	5,334	5,334
Successional Mosaic	0	160,488	22,946	42,536	57,562	54,580	35,779
Mature Forest	200,421	39,944	142,194	112,251	77,367	78,220	68,249
Old Forest	18,470	18,470	23,649	18,947	23,650	26,632	54,551
Approaching Historical Range of Variability	0	0	17,869	21,923	48,078	47,225	48,078
Veg Mgt Only for Maintaining or Enhancing Other Values	19,162	19,151	26,061	37,062	26,062	26,062	26,062

Note: Numbers are total acres.

**Alternative A** is current Plan direction. Most of the Forest would be allocated to management areas with an objective of mature forest habitat; no early successional habitat would be created.

**Alternative B** would emphasize creation of early successional habitat. Most of the Forest would be allocated to management areas with an objective of a mosaic of age classes, produced mainly through even-aged timber harvest.

**Alternatives C, D, E, and E Modified** would provide varying combinations of mature forest, mature forest with repeated prescribed fire

for ecological restoration (historic forest prescription), and mosaic of varying age classes.

**Alternative F** would provide much of the same as Alternatives C, D, E, and E Modified, but places greater emphasis, by acreage, to increasing future old forest.

## How the Alternatives Would Address Recreation

**Table B - 5. Recreation Opportunity Spectrum Objectives by Alternative.**

ROS Classification	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E <sub>mod</sub>	Alt. F
<b>Rural</b>	1,839	1,839	4,078	4,078	4,078	4,078	4,078
<b>Roaded Natural</b>	217,744	226,611	209,530	224,386	219,683	216,701	206,853
<b>Semi-primitive Non-motorized</b>	18,470	9,603	24,445	9,589	14,292	17,274	27,122

Note: Numbers are total acres.

Table B - 5 shows how the alternatives would vary in addressing recreation. The alternatives vary within a small range in terms of the amount of area allocated to developed recreation and to semi-primitive non-motorized recreation.

**Rural** – The Forest’s campgrounds, picnic areas, and other developed recreation sites with significant recreation facilities. Minor developments, such as trailhead parking lots, are generally not included, unless located near larger sites.

**Roaded Natural** – Recreation experience in a natural setting (forested landscape without major facilities such as campgrounds) with roads and motorized travel. This includes areas allocated to off-highway vehicle (OHV) trails and to areas of the Forest without OHV trails.

**Semi-Primitive Non-Motorized (SPNM)** – Back-country recreation experience without roads or motorized travel and relatively little interaction with other visitors. Areas that provide this kind of experience are very limited on the Wayne because of the Forest’s extensive road network. Most of the Forest’s road mileage is comprised of State, county and township roads over which the Forest Service has no jurisdiction. Therefore, SPNM is more an objective to move toward, than an existing condition, over most of the management area.

## How the Alternatives Address Oil and Gas Development

**Table B - 6. Surface Occupancy Conditions by Alternative.**

Surface Occupancy Conditions	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E <sub>mod</sub>	Alt. F
<b>Surface Occupancy Allowed</b>	209,113	217,981	200,887	215,742	211,039	208,057	198,209
<b>No Surface Occupancy</b>	28,953	20,086	37,166	22,311	27,014	29,996	39,844

Note: Numbers are total acres.

This chart shows how the alternatives would vary in the amount of area designated as no surface occupancy (NSO) for oil and gas development. The current Plan designates some management areas (about 11% of the Forest) as NSO.

The alternatives vary little because law and regulation direct the Forest Service to make oil and gas available for development unless there is a compelling surface resource protection reason to apply NSO.

Note that NSO applies only to areas when both the surface and subsurface Federal are in ownership. Access and surface occupancy must be provided for privately owned minerals (reserved and outstanding rights) under Federal surface ownership, even within management areas with NSO.

### Management Area Acreage by Alternative

Table B-7 lists the acreages of the different management areas for each alternative. Maps of the six alternatives, showing how the management areas are distributed, are available in electronic or hard copy versions.

**Table B - 7. Acres in Management Areas by Alternative**

Mgt Area	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F <sub>mod</sub>	Alt. F
Candidate Areas	981	981	981	981	981	981	981
Developed Recreation	1,839	1,839	4,078	4,078	4,078	4,078	4,078
Diverse Continuous Forest	155,408	12,079	98,292	83,405	55,089	55,267	45,971
Diverse Continuous Forest with OHVs	45,010	27,851	43,901	29,846	22,278	22,953	22,278
Forest and Shrubland Mosaic	0	143,329	22,946	42,536	57,562	54,580	35,779
Forest and Shrubland Mosaic with OHVs	0	17,159	0	0	0	0	0
Future Old Forests	18,470	9,603	23,649	8,793	13,496	16,478	26,326
Future Old Forests With Mineral Activity	0	8,867	0	10,154	10,154	10,154	28,225
Grassland and Forest Mosaic	0	0	5,334	5,334	5,334	5,334	5,334
Historic Forest Restoration	0	0	17,869	17,869	26,456	26,278	26,456
Historic Forest Restoration with OHVs	0	0	0	14,054	21,622	20,947	21,622
Research Natural Areas	117	117	117	117	117	117	117
River Corridors	8,682	8,682	12,544	12,544	12,544	12,544	12,544
Special Areas	7,546	7,546	7,546	7,546	7,546	7,546	7,546
Timbre Ridge Lake	0	0	796	796	796	796	796
<b>Total Acreage</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>

## Recreation Opportunity Spectrum Inventory/Assignment Process

### Introduction

The Recreation Opportunity Spectrum (ROS) system was used to delineate, define, and integrate outdoor recreation opportunities in the forest planning process in accordance with the ROS Users Guide and Forest Service Manual 2300.

The ROS system defines six recreation opportunity classes that provide different settings and opportunities for recreation use: primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural, and urban. Each ROS class may be divided into subclasses to better reflect local conditions.

ROS maps will assist the public in understanding and identifying with:

- The type of settings (landscapes) provided
- The types of transportation permitted
- The social setting to expect
- The level of management and infrastructure.

Planning steps in which ROS can be utilized include:

- Defining Existing Conditions
- Assessments of current management direction
- Defining Desired Conditions
- Developing Alternatives
- Analyzing Effects of Alternatives
- Defining the Preferred Alternative
- Determining actions necessary to move from existing to desired (Implementation)
- Measuring effects of actions / implementation (Monitoring)

Five mapping criteria are used in defining the physical, social and managerial setting of each landscape.

Physical Setting	Social Setting	Managerial Setting
Remoteness	User Density	Managerial regimentation
Size	--	--
Evidence of humans	--	--

Highly developed sites, high visitor use, and low scenic integrity may exhibit rural or even urban ROS class characteristics. In contrast,

dispersed and/or primitive recreation sites, low to moderate visitor use, and moderate to high scenic integrity may exhibit roaded natural to semi-primitive ROS class characteristics.

### Existing ROS Inventory Process

The following narrative describes the ROS inventory process on the WNF. Using the geographic information system's (GIS) geophysical analytical capabilities and interdisciplinary team input, the following steps were used to implement ROS and integrate it into the planning process.

#### STEP 1 – Determining the Physical Setting

A physical setting inventory considering remoteness, size of area, and evidence of humans was completed for all Forest lands to determine their ROS class eligibility. Using GIS technology, all roads and motorized trails on the Forest were mapped. This includes improved and unimproved Forest Service roads, non-Forest Service roads, and motorized trails within the Forest's proclamation boundary. For this analysis, maintenance level (ML) 2 (open, natural surfaced, high clearance vehicle roads) through 5 roads (open, paved roads) are considered "better than primitive" roads, and ML 1 roads (closed roads) and motorized trails are identified as "primitive" roads.

The following lists the physical setting criteria were used to determine ROS class eligibility and the results from the inventory:

##### Primitive

**Criteria:** Areas of at least 5,000 acres and at least 3 miles from any road would be eligible for the primitive ROS class.

**Results:** No lands on the WNF met the remoteness or size criteria for the Primitive ROS class.

##### Semi-primitive Non-motorized

**Criteria:** Areas of at least 2,500 acres and at least one-half mile but not more than 3 miles from any roads or motorized trails would be eligible for the semi-primitive non-motorized ROS class. It may include the existence of primitive roads and non-motorized trails.

**Results:** No lands on the WNF met the remoteness or size criteria for the semi-primitive non-motorized ROS class.

##### Semi-primitive Motorized

**Criteria:** Areas of at least 2,500 acres in size and within one-half mile from any "primitive" (maintenance level 1) road or motorized trail, but not closer than one-half mile from "better than primitive" road would be eligible for the semi-primitive motorized ROS class. Motorized trails are included in the "primitive" road category.

**Results:** No lands on the WNF met the remoteness or size criteria for the semi-primitive motorized ROS class.

### **Roaded Natural**

**Criteria:** Areas within one-half mile from any “better than primitive” or “classified” (maintenance level 3 or above) road and a structure density of 5 or fewer structures per square mile would be eligible for the Roaded Natural ROS class. No land size criteria apply to this ROS class.

**Results:** 144,449 acres on the WNF met the criteria for the Roaded Natural ROS class.

### **Rural**

**Criteria:** No distance criteria and no land size criteria apply to this ROS class. However, an area should have a structure density of greater than 5 structures per square mile to be eligible for the Rural ROS class.

**Results:** 91,900 acres on the WNF met the criteria for the Rural ROS class.

### **Urban**

**Criteria:** No distance criteria and no land size criteria apply to this ROS class. Areas that are within incorporated towns/villages would be eligible for the urban ROS class.

**Results:** 1,703 acres on the WNF met the criteria for the Urban ROS class.

## **STEP 2 – Determining the Social Setting**

In addition to using the physical setting criteria, some social criteria were used to determine ROS class eligibility. Using GIS, the Forest mapped the existing carrying capacity of each developed recreation sites in terms of recreation visitor days (RVDs).

Visitor use numbers were also used where use numbers were reliable, such as for trail activity. Actual campground and day use visits were sketchy, therefore, the Forest relied more on employees’ knowledge of those sites’ historical use. Results from the National Visitor Use Monitoring (NVUM) were not available when the inventory was completed.

Knowing where the highest concentration of recreation sites, site capacities, and use helps the Forest to better assign the appropriate ROS class to an area. Generally, areas with high concentration of recreation sites or with high recreation facilities development and capacities would best align with the Rural or Urban ROS classes. Conversely, areas of lower concentration of recreation sites, recreation facilities development, and capacities would better align with the primitive or semi-primitive ROS classes.

### STEP 3 – Determining the Managerial Setting

The amount and kinds of management restrictions placed on certain areas of the Forest determines its managerial settings. Higher management restrictions or controls (i.e. rules/regulations, signing, fees, etc.) are generally associated with ROS classes at the more developed setting end of the ROS spectrum, such as Rural or Urban.

The managerial setting criterion was not mapped for the Forest during the inventory process, however, it was considered to help the Forest complete its ROS inventory. A general assumption was made that the more developed a recreation site was or the more use it receives, the more restrictions were placed on visitors' actions. Therefore, areas on the Forest with the highest concentration of developed recreation sites were given a Roaded Natural, Rural, or Urban ROS setting depending on the degree of development. The reverse is true for lesser developed recreation site. They would be aligned with the Semi-primitive Non-motorized ROS setting.

### Tabular Results of Existing ROS Inventory

**Table B - 8. Existing Roaded Natural ROS Acres by Alternative and Management Area.**

Management Areas	Inventoried (Existing) ROS Acres by Alternative and Mgmt. Area (Roaded Natural)						
	A	B	C	D	E	E <sub>mod</sub>	F
Developed Recreation	133	133	1,612	1,612	1,612	1,612	1,612
River Corridors	3,583	3,583	4,934	4,934	4,934	4,931	4,934
Timbre Ridge Lake	0	0	294	294	294	294	294
Diverse Continuous Forest	88,969	5,846	53,771	43,762	28,423	28,387	24,841
Diverse Continuous Forest w/ OHV	32,254	21,041	31,323	20,081	15,115	15,539	15,115
Historic Forest	0	0	14,528	14,517	18,831	18,842	18,831
Historic Forest w/ OHV	0	0	0	11,240	16,206	15,782	16,206
Forest-Shrubland Mosaic	0	83,119	12,970	25,610	34,012	32,689	21,766
Forest-Shrubland Mosaic w/ OHV	0	11,213	0	0	0	0	0
Grassland-Forest Mosaic	0	0	3,095	3,095	3,095	3,095	3,095
Research Natural Areas	81	81	81	81	81	81	81
Future Old Forest	13,541	8,169	15,972	7,400	10,023	11,346	17,230
Future Old Forest w/ Mineral Activity	0	5,375	0	5,952	5,952	5,949	14,574
Special Areas	5,184	5,184	5,184	5,184	5,184	5,184	5,184
Candidate Areas	708	708	708	708	708	708	708
<b>Total</b>	<b>144,453</b>	<b>144,452</b>	<b>144,472</b>	<b>144,470</b>	<b>144,470</b>	<b>144,428</b>	<b>144,471</b>

**Table B - 9. Existing Rural ROS Acres by Alternative and Management Area.**

Management Areas	Inventoried (Existing) ROS Acres by Alternative and Mgmt. Area (Rural)						
	A	B	C	D	E	E <sub>mod</sub>	F
Developed Recreation	1,706	1,706	2,466	2,466	2,466	2,466	2,466
River Corridors	5,051	5,051	7,569	7,569	7,569	7,601	7,569
Timbre Ridge Lake	0	0	502	502	502	502	502
Diverse Continuous Forest	65,261	6,247	44,009	39,331	26,476	26,477	20,931
Diverse Continuous Forest w/ OHV	12,264	6,628	12,086	9,270	6,947	7,149	6,947
Historic Forest	0	0	3,341	3,341	7,306	7,304	7,306
Historic Forest w/ OHV	0	0	0	2,816	5,139	4,939	5,139
Forest-Shrubland Mosaic	0	59,015	9,656	16,416	23,227	21,567	13,811
Forest-Shrubland Mosaic w/ OHV	0	5,636	0	0	0	0	0
Grassland-Forest Mosaic	0	0	1,901	1,901	1,901	1,901	1,901
Research Natural Areas	36	36	36	36	36	36	36
Future Old Forest	4,927	1,434	7,677	1,392	3,472	5,131	8,986
Future Old Forest w/ Mineral Activity	0	3,493	0	4,205	4,205	4,205	13,651
Special Areas	2,362	2,362	2,362	2,362	2,362	2,362	2,362
Candidate Areas	273	273	273	273	273	273	273
<b>Totals</b>	<b>91,880</b>	<b>91,878</b>	<b>91,878</b>	<b>91,878</b>	<b>91,881</b>	<b>91,913</b>	<b>91,879</b>

**Table B - 10: Existing Urban ROS Acres by Alternatives and Management Areas.**

Management Areas	Inventoried (Existing) ROS Acres by Alternative and Mgmt. Area (Urban)						
	A	B	C	D	E	E <sub>mod</sub>	F
Developed Recreation	0	0	0	0	0	0	0
River Corridors	41	41	41	41	41	41	41
Timbre Ridge Lake	0	0	0	0	0	0	0
Diverse Continuous Forest	1,169	0	512	310	187	364	200
Diverse Continuous Forest w/ OHV	493	183	493	493	216	265	216
Historic Forest	0	0	0	0	320	143	320
Historic Forest w/ OHV	0	0	0	0	276	227	276
Forest-Shrubland Mosaic	0	1,169	320	522	325	324	202
Forest-Shrubland Mosaic w/ OHV	0	310	0	0	0	0	0
Grassland-Forest Mosaic	0	0	337	337	337	337	337
Research Natural Areas	0	0	0	0	0	0	0
Future Old Forest	0	0	0	0	0	0	110
Future Old Forest w/ Mineral Activity	0	0	0	0	0	0	0
Special Areas	0	0	0	0	0	0	0
Candidate Areas	0	0	0	0	0	0	0
<b>Totals</b>	<b>1,703</b>	<b>1,703</b>	<b>1,703</b>	<b>1,703</b>	<b>1,702</b>	<b>1,701</b>	<b>1,702</b>

### ROS Objective Assignment Process

All lands on the Forest, except areas where recreation use is essentially excluded, were administratively assigned an ROS objective under each alternative. This was done to provide a reasonable range of ROS classes in each alternatives and to communicate to the public the variation in potential recreation settings. These ROS objective assignments were based primarily on the management emphasis or desired future condition (DFC) of each proposed management areas. Generally, management areas with a DFC of providing the highest access to the Forest and the highest facilities development (i.e., Develop Recreation Management Area) were assigned the ROS objective Rural. Conversely, management areas with the a DFC of providing the lowest access to the Forest in terms of road development and providing the greatest opportunity for solitude (i.e. Future Old Forest Management Area) were assigned an ROS objective Semi-primitive Non-motorized. ROS assignment acres will vary across the alternatives because of the management area acreage allocation for each alternative.

A description of each ROS setting characteristics can be found in the ROS User’s Guide and Appendix A of the National ROS Inventory Mapping Protocol.

The following tables, Table B-11 through B-13, display the ROS objectives acreages by alternatives and management areas.

**Table B - 11. Semi-Primitive Non-Motorized ROS Objective Assignment by Alternatives and Management Areas (acres).**

Management Areas	Semi-Primitive Non-Motorized Objective Assignment by Alternatives and Management Areas (Acres)						
	A	B	C	D	E	E <sub>mod</sub>	F
Developed Recreation	--	--	--	--	--	--	--
River Corridors	--	--	--	--	--	--	--
Timbre Ridge Lake	0	0	796	796	796	796	796
Diverse Continuous Forest	--	--	--	--	--	--	--
Diverse Continuous Forest w/OHV	--	--	--	--	--	--	--
Historic Forest	--	--	--	--	--	--	--
Historic Forest w/OHV	--	--	--	--	--	--	--
Forest-Shrubland Mosaic	--	--	--	--	--	--	--
Forest-Shrubland Mosaic w/OHV	--	--	--	--	--	--	--
Grassland-Forest Mosaic	--	--	--	--	--	--	--
Research Natural Areas	--	--	--	--	--	--	--
Candidate Areas	--	--	--	--	--	--	--
Special Areas	--	--	--	--	--	--	--
Future Old Forest	18,470	9,603	23,649	8,793	13,496	16,478	26,326
Future Old Forest w/Mineral Activity	--	--	--	--	--	--	--
<b>Total</b>	<b>18,470</b>	<b>9,603</b>	<b>24,445</b>	<b>9,589</b>	<b>14,292</b>	<b>17,274</b>	<b>27,122</b>

**Table B - 12. Roded Natural ROS Objective Assignment by Alternatives and Management**

Management Areas	Roded Natural Objective Assignment by Alternatives and Management Areas (Acres)						
	A	B	C	D	E	E <sub>mod</sub>	F
Developed Recreation	--	--	--	--	--	--	--
River Corridors	8,682	8,682	12,544	12,544	12,544	12,544	12,544
Timbre Ridge Lake	--	--	--	--	--	--	--
Diverse Continuous Forest	155,408	12,079	98,292	83,405	55,089	55,267	45,971
Diverse Continuous Forest w/ OHV	45,010	27,851	43,901	29,846	22,278	22,953	22,278
Historic Forest	0	0	17,869	17,869	26,456	26,278	26,456
Historic Forest with OHV	0	0	0	14,054	21,622	20,947	21,622
Forest-Shrubland Mosaic	0	143,329	22,946	42,536	57,562	54,580	35,779
Forest-Shrubland Mosaic w/ OHV	0	17,159	0	0	0	0	0
Grassland-Forest Mosaic	0	0	5,334	5,334	5,334	5,334	5,334
Research Natural Areas	117	117	117	117	117	117	117
Candidate Areas	981	981	981	981	981	981	981
Special Areas	7,546	7,546	7,546	7,546	7,546	7,546	7,546
Future Old Forest	--	--	--	--	--	--	--
Future Old Forest w/Mineral Activity	0	8,867	0	10,154	10,154	10,154	28,225
<b>Total</b>	<b>217,744</b>	<b>226,611</b>	<b>209,530</b>	<b>224,386</b>	<b>219,683</b>	<b>216,701</b>	<b>206,853</b>

**Table B - 13. Rural ROS Objective Assignment by Alternatives and Management Areas (acres).**

Management Areas	Rural Objective Assignment by Alternative and Management Area (Acres)						
	A	B	C	D	E	E <sub>mod</sub>	F
Developed Recreation	1,839	1,839	4,078	4,078	4,078	4,078	4,078
River Corridors	--	--	--	--	--	--	--
Timbre Ridge Lake	--	--	--	--	--	--	--
Diverse Continuous Forest	--	--	--	--	--	--	--
Diverse Continuous Forest w/ OHV	--	--	--	--	--	--	--
Historic Forest	--	--	--	--	--	--	--
Historic Forest with OHV	--	--	--	--	--	--	--
Forest-Shrubland Mosaic	--	--	--	--	--	--	--
Forest-Shrubland Mosaic w/ OHV	--	--	--	--	--	--	--
Grassland-Forest Mosaic	--	--	--	--	--	--	--
Research Natural Areas	--	--	--	--	--	--	--
Candidate Areas	--	--	--	--	--	--	--
Special Areas	--	--	--	--	--	--	--
Future Old Forest	--	--	--	--	--	--	--
Future Old Forest w/ Mineral Activity	--	--	--	--	--	--	--
<b>Total</b>	<b>1,839</b>	<b>1,839</b>	<b>4,078</b>	<b>4,078</b>	<b>4,078</b>	<b>4,078</b>	<b>4,078</b>

---

## Effects Analyses

### Timber Management Modeling

The forest planning analysis problem can be stated as follows: Given a fixed area of land, what activities should be allowed to each land unit over the next 150 years to achieve the desired future conditions and still meet all physical, operational and regulatory constraints. To do this, the forest land area is divided into smaller homogeneous areas called analysis units. The planning horizon of 150 years is divided into fifteen 10-year periods. A computer program called Spectrum is used to analyze the forest planning alternatives. Spectrum is a decision support model, developed and supported by the Forest Service, which can simultaneously analyze the trade off between the many goals, constraints, management activities, timing options and land types which are necessary to manage a large forest. Spectrum uses a linear program software program called C-Whiz, which in turn uses the Simplex method.

Prior to the Spectrum analysis there was considerable work done to prepare data for input to the Spectrum model. This work included: identification of lands tentatively suitable for timber harvest (per 36 CFR 219.14); analysis unit development; timber yield table development; economic information development; management prescription development; and determination of suitable acreage within each alternative. The current and proposed Forest Plan Standards and Guidelines provided a framework for constraints, the design of analysis units and the development of possible timber management actions. Costs associated with various harvest activities and revenue from timber sales by product were developed as additional inputs to the model. Outputs from the timber harvest schedule model included an allowable sale quantity (ASQ) for each alternative, the timber management schedules to achieve each ASQ, and some indicators to track specific types of wildlife habitat. The analysis uses acreage figures derived from Geographic Information System (GIS) data.

### Suitability Criteria for Spectrum Model

In order to use the Spectrum model, timber stands must be classified as suitable or unsuitable for harvesting. The CDS (Combined Data System) database was used, in conjunction with the vegetation GIS layer, to determine suitability. In the CDS, individual stands have a LSC (Land Suitability Classification) code which identifies stand characteristics. Using these codes, unsuitable stands were removed from the dataset, leaving the suitable areas for the Spectrum analysis.

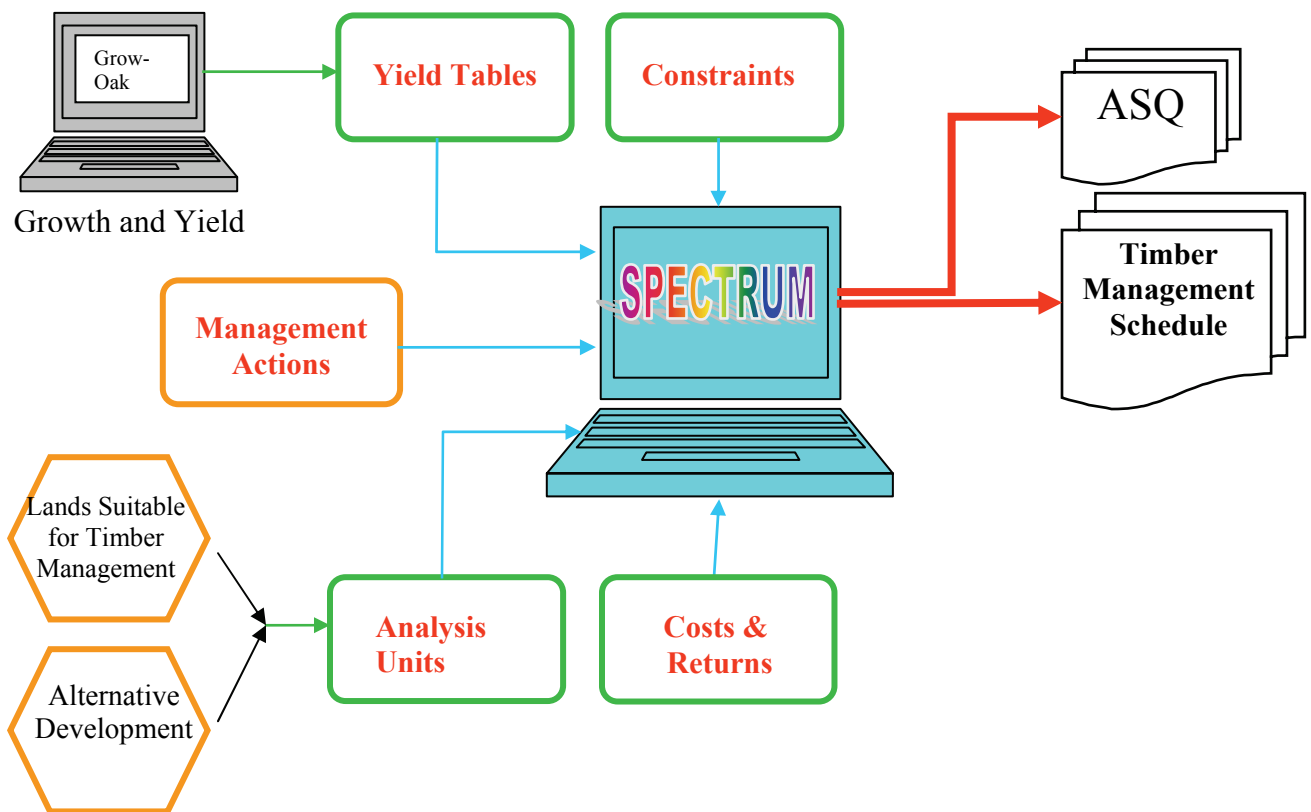
Starting with landbase of 233,638 acres, stands were removed for the following LSC codes:

- 8,679 acres – Non-forested
  - LSC 100 – Open water
  - LSC 200 – Non-forested land
  - LSC 210 – Designated Wildlife Openings
- 1,577 acres – Withdrawn from timber production
  - LSC 300 – Administratively Withdrawn  
(These are stands in Research Natural Areas, Special Areas and Candidate Special Areas. Since the plan, regardless of alternative, calls for an expansion of the number of these areas, stands not coded 300 but in one of these planned areas were also classified as unsuitable. The vegetation layer and alternative management areas layers were used to make this determination.)
- 1,218 acres – Not physically suited for timber production
  - LSC 720 – Irreversible damage  
(Stands with this code are on steep slopes of 55% grade or greater, have unstable soils or have a unique ecosystem.)
- 38,232 acres – Not appropriate for timber production
  - LSC 740 – Strip mined land
  - LSC 800 – Not presently appropriate for timber production
  - LSC 801 – Other resource precludes timber production  
(This category includes riparian areas, wildlife habitat, threatened and endangered species habitat and recreation areas.)
  - LSC 810 – Other use
  - LSC 820 – Timber production not cost effective
- 8,779 acres
  - No LSC Code
- 59 acres – The CDS database also has a site index for each stand.  
(Stands with a site index of less than 35 were also determined to be unsuitable.)

After the removal of the unsuitable acres, 175,094 acres of suitable land remained for the Spectrum model.

Spectrum chooses among alternative solutions, given a set of constraints and an objective such as maximizing income or timber volume. The model evolved from the Forplan optimization model that was used in the initial round of forest planning. Spectrum version 2.6 was used for the WNF Forest Plan revision. As a tool, the model is flexible and can be adapted to the needs of each individual planning problem. The model scheduled timber harvesting for the next 15 decades and provided an estimate of long-term sustained yield (LTSY) capability for each of the Plan alternatives.

## Timber Harvest Schedule Model – Process Overview



**Figure B - 2. Timber Harvest Schedule Model – Process Overview**

The results of the Spectrum model are not intended to be interpreted as an exact prediction of timber outputs. The actual timber harvest will be influenced by factors that we cannot know or cannot be modeled, such as climate change, national policy, and demand for wood products. The model is used only to estimate the relative differences between Plan alternatives. These differences will be one of many factors used to choose the preferred alternative.

There are two basic components of the Spectrum model the analysis units and the yield tables. The analysis units are basic land allocation units used by the model. The analysis units are defined by five levels of delineator (Table B - 14). Over a thousand different analysis units are potentially available. The yield tables provide the volume of trees available for harvest by 10-year age class. The Forest chose to use the same yield tables that were developed for the current Forest Plan (USDA, Forest Service, 1987 [DEIS], B3-42). Based on input from the WNF’s Forest Silviculturist and the researchers with the Northeast Forest Experiment Station in Delaware, Ohio, the planning interdisciplinary team believed these tables to be both accurate and adequate for the Plan revision calculations.

**Table B - 14. Layers Considered in Developing Analysis Units.**

<b>District</b>	Athens Ironton
<b>Management Area</b>	CA                    9. GFM DR                    10. HF DCF                   11. HFORV DCF/O                12. RNA FSM                    13. RC FSM/O                14. SA FOF                    15. TRL FOFMA
<b>Cover Type</b>	Hardwood Pine
<b>Age Class</b>	0-19 20-39 40-59 60-79 80-100 100+
<b>Condition Class</b>	Good Sites – Valley bottoms Average Sites – Midslopes Poor Sites – Ridge Tops

Analysis units and yield tables are linked by possible management actions. The model calculates potential timber harvest by first determining which management actions apply to each of the analysis units. The management actions were designed to cause the model to duplicate the vegetative conditions envisioned for the various management areas (Chapter 3). Openings would be created by simulating clear-cutting – two aged stands created by simulating partial harvests – and multiple age stands created by simulating selective single tree harvests. The model assigns the one management action to the analysis unit that will maximize the present value of the Forest. Management actions are each associated with a yield table. The volume harvested is calculated by multiplying the acres in the analysis area by the volume in the yield table.

A number of directions, also called constraints, were applied to the model. These constraints were developed to recognize the reality of how the Forest will have to conduct timber harvesting within the suitable base. The constraints were chiefly used to insure that management actions were applied to the management area at the level and intensity needed to meet Plan goals.

Examples of constraints that were applied on the suitable base are presented in Table B - 15.

**Table B - 15. Examples of Constraints used in the Spectrum Model.**

Description of Constraint	Purpose of Constraint
Uneven age harvested acres in any given decade is $\geq$ the previous decade	Insure that harvested acres are evenly distributed through time.
Even age harvest acres $\geq 0$	Insure that there will be some even aged harvest in every decade
Even age harvested acres in any given decade is $\geq$ the previous decade	Insure that harvested acres are evenly distributed and non-declining through time.
Economic activity is $\geq 0$ in all the decades	Insures that economically viable timber harvest will be modeled in each decade.
Uneven aged acres in RC $\leq 80\%$ and $\geq 75\%$ of total acres in RC	Between 75 and 80 percent of the acres in the RC management area will receive uneven age management.
Uneven aged acres in FSM $\leq 25\%$ and $\geq 10\%$ of total acres in FSM	Between 10 and 25 percent of the acres in management area FSM with receive uneven age management.
Acres of young hardwood in FSM $\leq 8\%$ of total acres in FSM	Insure that up to 8 percent of the FSM management area is kept in wildlife openings
Uneven aged acres in DCF $\leq 85\%$ and $\geq 75\%$ of total acres in DCF	Between 75 and 80 percent of the acres in the DFC management area will receive uneven age management.
Uneven aged acres in GFM $\leq 10\%$ and $\geq 1\%$ of total acres in GFM	Between 1 and 10 percent of the acres in management area GFM with receive uneven age management.

Spectrum is a linear programming model. It assumes that the relationship between outputs and the land base are linear, e.g., twice the number of similar acres yields twice the outputs. Other resource programs such as recreation are not addressed by Spectrum because their relationship with the land base is not linear. Spectrum builds a matrix of coefficients and transfers the file to a linear programming package for problem solution. Typical size of a matrix generated and solved for an alternative was on the order of 1,700 rows by 13,400 columns. The model then writes a report and produces a data file that contains the results. The data file can then be analyzed through comparisons with information in other databases.

### Model Assumptions

Assumptions made for modeling timber management area prescriptions, allocations, outputs, and scheduling activities are:

- The Forest Land and Resource Management Plan (Plan) will be a strategic plan that will guide broad land-based decisions to implement certain goals and objectives.
- “On-the-ground” decisions will utilize the standards and guidelines from the Plan and any applicable implementation guides, to meet the strategic goals and objectives of the Plan.
- That the models used in this analysis are sufficient for strategic planning.
- That each alternative would use the same standards and guidelines and that only the area of land allocated to a management area would vary. Each alternative uses the same tentatively suitable timber lands for the timber harvest scheduling analysis.
- The Combined Data System’s stand exam data is sufficiently accurate to use in the modeling.
- ASQ applies only to areas that permit commercial timber harvest by management area assignment.
- ASQ will not decrease between successive decades.
- Once lands are entered under a particular management strategy (uneven- vs. even-aged) and intensity (frequency of entry to harvest), that strategy and intensity will continue indefinitely on those lands without interruption.
- Two-aged prescriptions that initially involve regeneration harvest will be followed by an even-aged treatment strategy that includes thinning.
- The application of the Spectrum model on this Forest has a very limited spatial component, which does not consider adjacency and sale layout considerations. The model’s results will have to be adjusted in order to make the results better reflect actual practice.
- Treatment schedules will be constructed to allow for extensions from the optimally designed treatment strategy in order to provide a robust set of modeling options consistent with maintaining non-declining yield.
- Timber road reopening/construction/improvement costs will continue to be paid by the successful bidder and is reflected as part of the stumpage value.

### Species Viability

The process used in analyzing species viability on the WNF is fully discussed in Appendix E to this Final EIS entitled “Plant and Animal Diversity”. In the interest of saving printing costs and paper, it is not repeated here.

## Economic Analysis

### Introduction

This portion of the appendix is intended to provide additional details regarding the economic impact analysis. It should provide the reader with a general understanding of the methods used and some of the models employed in the process. In this context, economic impacts refer to the effect, or impact, a change in the economic environment will have on jobs and income. The changes that are introduced to the economic environment reflect the changes in activity levels, such as recreational use and levels of timber harvest, that are present in each of the alternatives. These various levels of activity cause the number of jobs and income to change. Comparing the levels of change in income and employment from current and between alternatives provide the basis for most of the economic effects analysis in Chapter 3 of the Final EIS.

### Defining the Economic Impact Analysis Area

The economic impact analysis area was defined as the counties that the WNF lies within or that have economic ties to the Forest: Athens, Gallia, Hocking, Jackson, Lawrence, Monroe, Morgan, Noble, Perry, Scioto, Vinton, and Washington. Since the counties are well connected through public road networks, it is reasonable to consider the counties as an entire area rather than individually. Additionally, most of the data available for economic research is available at the county level and therefore the counties provided a reasonable area in which to examine the economic activity and measure the Forest's economic impact. Researchers also concluded that it was appropriate to measure local effects, since the most significant economic impacts of activities on the Forest can often be felt by communities adjacent to or in close proximity to the Forest. The area of these counties captures all the towns adjacent to the Forest. It also includes some other larger communities that are geographically separated from the Forest but tend to be a primary source for goods and services for the adjacent communities.

By defining the economic impact analysis as this region, the data is therefore grouped together without geographical distinction or sub area categorization made within the models except where the activities on the Forest are isolated for the impact analysis. As the socio-economic affected environment section of Chapter 3 recognized, there are some economic qualitative differences present between the counties.

### Economic Impact Analysis Methodology

#### IMPLAN Model

Economic effects were estimated using an economic input-output model developed with IMPLAN Professional 2.0. The early version of this

software was originally developed by the Forest Service and has since been taken over by a private company, Minnesota IMPLAN Group, Inc. (MIG, Inc.). The model uses national input-output tables from the Bureau of Economic Analysis (BEA), secondary economic data at the county level from a variety of public sources, and proprietary procedures to develop an input-output model for a study area.

The Regional Economist assisted the WNF in developing its IMPLAN model. The income and employment data was derived from 2000 data, the most recent available data at the time.

Subsequent analysis was performed using an electronic worksheet tool (FEAST). FEAST was developed by the Forest Service's Inventory and Monitoring Institute to apply the coefficients and multipliers generated in IMPLAN to varying levels of inputs by alternative and display the outputs in terms of impacts on employment and labor income.

The impacts to local economies in the model are expressed in terms of employment and labor income. Employment is expressed in jobs; a job can be seasonal or year-round, full-time or part-time. The number of jobs is computed by averaging monthly employment data from state sources over one year. The income measure used was labor income in 2003 dollars. Labor includes both employee compensation (pay plus benefits) and proprietor's income (e.g. profits by self-employed).

### Timber

Information on timber stumpage values was derived from the timber volumes projected by the Spectrum model. Total revenues were calculated by multiplying these volumes by the average stumpage values of the most recent timber sales on the Forest.

### Recreation

Estimating the economic impacts of recreation on the Forest involved these steps:

- Determine how many visitors by recreational activity recreate on the Forest in a year. The number of visitors is converted to a standardized unit of measure termed a recreational visitor day (RVD) using an activity dependent length-of-stay factor. The basic numbers were taken from a formal survey of Forest users (National Visitor Use Monitoring Survey [NUVM], USDA Forest Service, 2004)) conducted in 2003 and 2004.
- Determine how much money the average visitor spends within the analysis area, by recreational activity, on a daily basis. This is referred to as a spending profile. Recreation spending categories used were based on NVUM national level averages.

- By recreational activity, multiply the number of RVDs by the activity’s spending profile to estimate the amount of money recreational visitors spend during a recreational visit to the Forest.

## Economic Efficiency Analysis

### Introduction

The economic efficiency analysis evaluates the alternatives in terms of their net public benefit. Net public benefit is defined as the “...overall long-term value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not” (36 CFR 219.3). It is very important to understand that these estimates are based on gross speculation as to future events and their impact on the WNF. These estimates are intended only as one measure to compare alternatives. The estimates presented here should not be used as predictions of the actual economic impact of the WNF. In this context, these various activities are generally timber related activities. Other activities, such as those related to recreation and minerals, while important, do not vary significantly between alternatives and were negligible compared to the impact of timber sales. Information as to the value of the resources was also very difficult to quantify. For the above reasons, this analysis does not include speculation as to the future value of minerals and recreation. The economic analysis uses net present value (NPV) to estimate an alternative’s overall net public benefit.

### Methodology

The economic efficiency analysis employs many of the inputs used in the economic impact analysis for the first decade. The economic and financial efficiency analysis extends the time horizon on these inputs to a period of 100 years instead of the average annual for the first decade of implementation used in the economic impact analysis. The NPV calculation, using an annual discount rate of four percent, is then calculated over the entire 100 year period to estimate the long-term value.

**Table B - 16. Employment by Program by Alternative (Average Annual, Decade 1).**

Resource	Total Number of Jobs Contributed					
	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Recreation	187	191	184	191	189	183
Wildlife and Fish	72	74	71	74	73	70
Grazing	0	0	0	0	0	0
Timber	35	145	184	189	191	156
Minerals	87	88	86	88	88	86
Payments to States/Counties	3	7	7	7	7	6
Forest Service Expenditures	177	189	189	190	190	189
Total Forest Management	560	694	720	740	738	689
Percent Change from Current	---	23.8%	28.5%	32.1%	31.6%	23.0%

**Table B - 17. Labor Income by Program by Alternative (Average Annual, Decade 1; \$1,000,000).**

Resource	Millions of dollars					
	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Recreation	\$3.9	\$4.0	\$3.8	\$4.0	\$3.9	\$3.8
Wildlife and Fish	\$1.6	\$1.6	\$1.5	\$1.6	\$1.6	\$1.5
Grazing	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Timber	\$1.1	\$4.4	\$5.6	\$5.7	\$5.8	\$4.7
Minerals	\$2.6	\$2.6	\$2.6	\$2.6	\$2.6	\$2.5
Payments to States/Counties	\$0.1	\$0.2	\$0.2	\$0.3	\$0.2	\$0.2
Forest Service Expenditures	\$7.3	\$7.8	\$7.8	\$7.9	\$7.9	\$7.8
Total Forest Management	\$16.5	\$20.7	\$21.6	\$22.1	\$22.0	\$20.6
Percent Change from Current	---	25.8%	31.0%	34.2%	33.8%	25.4%

**Table B - 18. Employment by Major Industry by Alternative (Average Annual, Decade 1).**

Industry	Total Number of Jobs Contributed					
	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Agriculture	10	11	10	11	11	10
Mining	4	5	4	5	5	4
Construction	68	72	70	72	72	69
Manufacturing	35	98	122	125	126	105
Transportation, Communication, & Utilities	15	20	20	21	21	19
Wholesale trade	16	20	21	22	22	20
Retail trade	141	156	155	160	159	152
Finance, Insurance, & Real Estate	17	21	22	22	22	21
Services	121	141	142	147	146	138
Government (Federal, State, & Local)	134	149	150	153	152	148
Miscellaneous	2	2	2	2	2	2
Total Forest Management	560	694	720	740	738	689
Percent Change from Current	---	23.8%	28.5%	32.1%	31.6%	23.0%

**Table B - 19. Labor Income by Major Industry by Alternative (Average Annual, Decade 1; \$1,000,000).**

Industry	Millions of dollars					
	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Agriculture	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2
Mining	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1	\$0.1
Construction	\$1.7	\$1.8	\$1.8	\$1.9	\$1.8	\$1.8
Manufacturing	\$1.3	\$3.3	\$4.0	\$4.1	\$4.1	\$3.5
Transportation, Communication, & Utilities	\$0.7	\$0.9	\$1.0	\$1.0	\$1.0	\$0.9
Wholesale trade	\$0.7	\$0.8	\$0.9	\$0.9	\$0.9	\$0.8
Retail trade	\$2.2	\$2.5	\$2.5	\$2.6	\$2.5	\$2.4
Finance, Insurance, & Real Estate	\$0.5	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6
Services	\$2.6	\$3.1	\$3.1	\$3.2	\$3.2	\$3.0
Government (Federal, State, & Local)	\$6.6	\$7.4	\$7.4	\$7.6	\$7.5	\$7.4
Miscellaneous	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
<b>Total Forest Management</b>	<b>\$16.5</b>	<b>\$20.8</b>	<b>\$21.6</b>	<b>\$22.2</b>	<b>\$22.1</b>	<b>\$20.7</b>
Percent Change from Current	---	25.7%	30.9%	34.0%	33.6%	25.3%

**Table B - 20. Forest Service Revenues and Payments to Counties (Annual Avg, Decade 1; \$1,000,000)**

Forest Service Program	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Recreation	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2
Wildlife and Fish	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Grazing	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Timber	\$0.2	\$0.8	\$0.9	\$0.9	\$0.9	\$0.7
Minerals	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Soil, Water & Air	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Protection	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
<b>Total Revenues</b>	<b>\$0.4</b>	<b>\$1.1</b>	<b>\$1.2</b>	<b>\$1.2</b>	<b>\$1.2</b>	<b>\$1.0</b>
Payment to States/Counties	\$0.1	\$0.3	\$0.3	\$0.3	\$0.3	\$0.3

**Table B - 21. Current Role of Forest Service-Related Contributions to the Area Economy**

Industry	Employment (jobs)		Labor Income (\$ million)	
	Area Totals	FS-Related	Area Totals	FS-Related
Agriculture	11,857	10	\$116.2	\$0.2
Mining	4,000	4	\$107.8	\$0.1
Construction	22,223	68	\$705.9	\$1.7
Manufacturing	39,270	35	\$1,809.0	\$1.3
Transportation, Communication, & Utilities	13,828	15	\$605.2	\$0.7
Wholesale trade	10,163	16	\$365.2	\$0.7
Retail trade	62,876	141	\$959.8	\$2.2
Finance, Insurance, & Real Estate	15,130	17	\$321.5	\$0.5
Services	85,894	121	\$2,304.5	\$2.6
Government (Federal, State, & Local)	53,488	134	\$2,011.9	\$6.6
Miscellaneous	1,817	2	\$15.8	\$0.0
<b>Total</b>	<b>320,548</b>	<b>560</b>	<b>\$9,322.8</b>	<b>\$16.5</b>
Percent of Total	100.0%	0.2%	100.0%	0.2%

## NPV Inputs and Assumptions

### Timber

The volume of timber sales was derived from Spectrum model volume output estimates per decade. Revenues for these sales are averages of actual average revenues of recent timber sales. Timber program costs were based on estimates of the average cost of the most recent sales.

### Economic Efficiency Results

The results of the economic efficiency estimates are shown in Table B-22. The timber program is the major contributor to the net present value of the Forest. The “other resources” category includes both recreation and minerals. The small differences seen across alternatives demonstrate that these activities are treated very much the same for all alternatives. The important distinction one must realize is that financial efficiency does not consider the value of non-monetary activities on the Forest. These types of activities would be primarily connected to recreational activities and as explained above would not vary significantly between alternatives.

**Table B - 22. Net Present Value (NPV\*) of Plan Alternatives (\$MM).**

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt E <sub>mod</sub>	Alt. F
Timber Revenue	\$260.4	\$2,777	\$1,251	\$1,274	\$1,262	\$1,248	\$1,008
Timber Cost	\$-240.1	\$-766	\$-365.5	\$-514	\$-626	\$-618	\$-539
Other Revenue	\$273.0	\$281.2	\$270.3	\$281.2	\$275.7	\$275.7	\$267.5
Total	\$293.3	\$2,292.2	\$1,155.8	\$1,041.2	\$911.7	\$905.7	\$736.5

\*NPV calculated over 100 years at a 4% discount rate

Alternative B is the most financially efficient of the alternatives when considered over a 100 year period. This is due to a mix of treatment strategies that emphasizes even-aged timber management to produce a relatively steady flow of net revenue. Alternative A has the lowest ASQ and produces the least net revenue in the first 10 decades. This alternative has a heavily constrained output in the first three decades which is the primary cause of the overall lower NPV. Alternatives C, D, E, and E<sub>mod</sub> would produce very similar timber outputs. The major difference between them is that Alternative D shows lower costs because it would produce more volume using relatively less costly even-aged management techniques. Alternative F would generate the second lowest timber volume and this is reflected in its NPV.

## Scenery Management System Inventory and Assignment Process

### Introduction

This appendix documents the Scenery Management System (SMS), a process implemented by the WNF concurrent with the Forest Plan revision. SMS presents a systematic approach for determining the relative value of scenery in and around a national forest. SMS is similar to the Visual Management System (VMS) but updates methodology, terminology, and is designed to be a valuable tool in developing desired future conditions and high quality settings in the context of ecosystem management. SMS follows a sequence of steps to inventory the Forest's existing scenic integrity and to produce a new set of scenic integrity objectives (SIO) for each Plan alternative.

The Handbook for Scenery Management, Agriculture Handbook No. 701, gives a detailed explanation of the SMS process. This appendix documents the Forest's interpretation of national direction and explains the use of the geographical information system (GIS) for data analysis and map production. Using GIS saves substantial analysis time, yields high quality map products, and allows flexibility to make changes more rapidly. The process ensures equitable consideration of scenery in development of plan alternatives and full integration with management of other resources. This appendix describes nine primary steps for integrating the SMS into the planning process. Other SMS components, such as standards and guidelines, and monitoring requirements, are included in the Forest Plan. The steps are as follows:

- Analyze existing scenic integrity
- Determine landscape character
- Determine inherent scenic attractiveness
- Map seen area and distance zones
- Determine constituent concern levels
- Determine initial scenic class assignments
- Consolidate scenic class assignments
- Assign scenic integrity objectives to management areas
- Analyze and ensure consistency with ROS.

Since the last Forest Plan revision (1988), changes have occurred in the Forest's social and ecological landscape.

## SMS Inventory Process

### Step 1: Analyze Existing Scenic Integrity

Existing scenic integrity (ESI) is defined as the current state of the landscape considering previous human alterations. Although ESI is not a direct contributor to final scenic class assignments, it serves multiple purposes in forest planning and provides important benchmarks for decision-making

Utilizing GIS technology, the Forest mapped its ESI using several land information layers to determine the extent of land disturbances in the landscape over the past decade. Land satellite imagery showing land and forest cover type, as well as strip mine and oil and gas development overlays were used. Numerical values were given for each land cover type with “1” having the lowest land value and “9” having the highest. (See Table B - 23)

**Table B - 23. Land Characteristic Values for Determining ESI.**

Land Characteristics	Points
Open Water	9
Low Intensity Residential	5
High Intensity Residential	3
Commercial/Industrial/Transportation	2
Bare Rock/Sand/Clay	1
Quarries/Strip Mines/Gravel Pits	1
Transitional	3
Deciduous Forest	9
Evergreen Forest	9
Mixed Forest	9
Shrubland	7
Orchards/Vineyards/Other	5
Grasslands/Herbaceous	5
Pasture/Hay	5
Row Crops	3
Small Grains	3
Fallow	3
Urban/Recreational Grasses	3
Woody Wetlands	9
Emergent Herbaceous Wetlands	9
Oil and Gas Wells	3

Source: WNF Forest Plan Project File for Scenery Management

To simplify the analysis, land values were lumped by watersheds and an ESI rating was assigned to each watershed (See Tables 24 and 25).

**Table B - 24. ESI Value Range**

ESI Rating	ESI Numerical Range
High	Greater than 8.0
Moderate	7.46 through 8.0
Low	Less than or equal to 7.45

Source: WNF Forest Plan Project File for Scenery Management

**Table B - 25. Average ESI Values by Watersheds**

Watersheds	Average ESI	ESI Rating	WNF Acres	Acres in Watershed
Ohio River below Fishing Cr. (WV) to above Leith Run	7.78	Moderate	8,673	31,394
Ohio River from above Leith Run to above Middle Island	8.13	High	7,513	12,968
Ohio River below Middle Island Cr. (WV)	7.77	Moderate	3,274	15,503
Crane-nest Fork above Rich Fork	7.87	Moderate	444	16,845
Rich Fork	7.88	Moderate	1,567	14,322
Little Muskingum River below Rich Fk. above Witten Fork	7.71	Moderate	3,119	13,561
Witten Fork	7.93	Moderate	4,678	27,091
Little Muskingum River below Witten Fk. to above Cl. Fk.	7.76	Moderate	4,957	23,494
Clear Fork	7.63	Moderate	5,099	31,220
Little Muskingum River below Clear Fk. to above Arch. Fk	7.67	Moderate	8,800	23,247
Archers Fork	7.96	Moderate	6,322	11,854
Fifteen Mile Creek	8.04	High	3,184	13,096
Little Muskingum River below Archers Fk. to Ohio River	7.82	Moderate	4,681	26,615
East Fork Duck Cr. below Elk Fk. to above Middle F	7.65	Moderate	312	25,784
Paw Paw Creek	7.71	Moderate	1,181	14,997
Duck Creek below confluence of E. Fk. and W. Fk.	7.97	Moderate	24	15,818
Duck Creek from Stanleyville to Ohio River	7.68	Moderate	130	11,856
Five-mile Creek	7.66	Moderate	430	9,188
Hocking River below Five-mile Cr. to above Monday Crk.	7.61	Moderate	7,947	26,903
Monday Creek headwaters to above L. Monday Creek	7.77	Moderate	12,908	23,405
Little Monday Creek	7.47	Moderate	2,302	16,070
Monday Creek below L. Monday Cr. to Hocking River	7.84	Moderate	9,900	17,306
Snow Fork	8.03	High	8,061	17,428
Sunday Creek headwaters above E. Branch	7.59	Moderate	3,506	15,434
East Branch Sunday Creek	8.22	High	5,895	21,188
West Branch Sunday Creek	7.99	Moderate	3,142	27,190
Sunday Creek below E. Branch to Hocking R.	8.18	High	6,583	24,961
Hocking River below Monday Cr. to above Sunday Cr.	7.75	Moderate	2,785	14,119
McDougall Branch above Mush Run	7.08	Low	1	8,955
Mush Run	7.64	Moderate	318	8,427
Hocking River from Athens to above Willow Cr.	7.95	Moderate	8	11,721
East Branch Raccoon Creek above West Branch	7.58	Moderate	4,348	12,762
West Branch Raccoon Creek above East Branch	7.14	Low	62	14,536
Raccoon Creek below W. Branch to above Brushy Fk.	7.36	Low	36	10,413
Brushy Fork	7.92	Moderate	1,333	21,625
Hewett Fork	8.08	High	1,012	25,942
Elk Fork above Wolf Run	8.36	High	386	20,965
Raccoon Creek below Indian Cr. to Ohio R.	7.66	Moderate	156	52,675
Symmec Creek headwaters above Black Fk.	7.71	Moderate	453	36,121
Black Fork [except Dirtyface Cr.]	8.05	High	2,411	31,490
Dirtyface Creek	8.37	High	4,869	8,632
Symmec Creek below Black Fk. to above Sand Fk.	8.01	High	5,204	9,805
Sand Fork	7.44	Low	2,842	27,169
Symmec Creek below Sand Fk. to above Buffalo Crk.	7.88	Moderate	5,463	15,990
Buffalo Creek	8.44	High	9,040	11,205
Symmec Creek below Buffalo Cr. to above Long Cr. [	7.59	Moderate	1,592	11,872
Johns Creek	8.23	High	7,880	14,471
Long Creek	7.81	Moderate	283	9,931
Symmec Creek below Long Cr. to Getaway	8.07	High	7,589	37,484
Ohio River below Ice Cr. to above L. Sandy R.(KY)	8.21	High	1,754	10,255
Storms Creek	8.30	High	8,861	23,601
Ginat Creek	8.25	High	272	8,821
Pine Creek headwaters above Hales Cr.	8.23	High	13,137	21,349
Hales Creek	7.66	Moderate	3,610	20,632
Pine Creek below Hales Cr. to above L. Pine Cr.	8.14	High	12,631	24,759
Little Pine Creek	8.27	High	8,636	18,874
Sperry Fork	8.22	High	4,259	7,128
Pine Creek below L. Pine Cr. to Ohio R. [except Sp	7.93	Moderate	511	18,344
Lick Run	8.19	High	186	6,772
Frederick Cr.	7.91	Moderate	357	10,039

Source: WNF Forest Plan Project File for Scenery Management

## Step 2: Determine Landscape Character

Landscape character descriptions were determined for the Forest, each focusing on key attributes found consistently throughout the WNF. Landscape descriptions give an overview of landform patterns, water characteristics, vegetation patterns, and cultural elements. Describing the Forest's landscape character not only gives a picture of the Forest landscape settings, but also provides context for completing the analysis. Landscape descriptions were developed within the ecological framework as described in the 1997 WNF Ecological Classification Handbook, and historical information acquired from Forest specialists (Archeologist, Foresters, etc.).

The WNF lies within one of Ohio's oldest landscape, the Southern Unglaciaded Allegheny Plateau Section (221E). The Forest occurs in a fairly homogenous landscape when compared to other national forests in the Eastern Region. The Land Type Associations (LTAs) on the Wayne are likely to be found in the East and West Hocking Plateaus (Ironton and Athens Units) and the Ohio Valley Hills (Marietta Unit) Subsections (USDA Forest Service, 1999).

## Step 3: Determine Constituent Concern Levels

Concern levels measure the degree of public importance and can be divided into three categories: levels 1, 2, and 3. A rating of 1 represents the highest level of public concern, sensitivity, or importance, and 3 denotes the lowest. Criteria found on pages 4 through 8 and 4 through 9 of the Scenery Management Handbook for mapping concern levels were used.

Due to the limited time that it had to complete the scenery management inventory, the Forest elected not to mail out visitor surveys to obtain constituent information related to scenery (as recommended by the SMS Handbook). However, the Forest rated the concern levels of travelways and use areas based on district employees' inputs and their professional knowledge and experience of public views and concerns for the Forest's scenic resources. Additionally, comments about scenery received during the Forest Plan scoping process and open houses were also considered.

All roads, trails, canoeable streams, lakes, developed recreational areas, or areas on the Forest where scenery is considered important were identified, assigned a concern level, and hand mapped. Once concern levels were hand mapped, the information was digitized into the Forest's GIS system to eventually produce the Forest's landscape visibility map.

#### Step 4: Map Seen Areas and Distance Zones

Distance zones were used to map the seen area (areas that can be “seen” from the inventoried use areas and travelways). Using GIS, distance zones as seen from use areas and travelways were mapped as foreground, middle ground, or background. Foreground was determined to be from 0 to ½ mile; middle ground was from ½ mile to 4 miles; and background was greater than 4 miles. After GIS ran the distance zone analysis, it was determined that the Forest has no “background”. This was expected due to relatively high road density and the absence of large topographic relief, such as mountains, on the Forest.

Using GIS, concern level information extracted from Step 3 were combined with foreground and middleground distance zone information from Step 4 to produce a Forest landscape visibility map and a distance zone/concern level matrix.

#### Step 5: Determine Inherent Scenic Attractiveness

The inherent scenic attractiveness (ISA) analysis measures the scenic importance of a landscape based upon human perceptions of the intrinsic beauty of landform, rock form, vegetation patterns, and water characteristics. Forest landscape character descriptions serve as frames of reference for determining ISAs. Features are compared singularly or in combination with those features found in a characteristic landscape. Using this comparison, an area’s overall inherent scenic attractiveness can be determined.

The three ISA classifications are:

- Class A – Distinctive
- Class B – Typical or common
- Class C – Undistinguished

District and Supervisor’s Officer employees were involved in assigning ISAs to all Forest lands. These lands were based on the employees’ perceptions of the inherent beauty of each area’s natural features and character. An ISA classification of “A” was assigned to areas with land features or natural characteristics that were considered unique or special to the Forest; ISA classification of “B” was assigned to areas with features or natural characteristics that are common to the Forest; and ISA classification of “C” was assigned to areas with features or natural characteristics that are unexceptional to the Forest, such as unreclaimed mined areas.

These classifications were used along with distance zones and concern levels to produce scenic class assignments.

**Step 6: Determine Scenic Class Assignments**

Using GIS, scenic classes were assigned by analytical correlation of the inherent scenic attractiveness classes, the distance zones and concern levels in accordance with the matrix displayed as Table 26. Scenic classes define the relative value of scenery on all lands and helped determine how scenic resources were allocated during the alternative development process.

**Table B - 26. Scenic Class Assignment Matrix**

ISA	Distance Zones and Concern Levels					
	FG1	MG1	FG2	MG2	FG3	MG3
A	1	3	2	4	3	4
B	1	4	2	5	4	5
C	2	5	4	7	6	7

Source: WNF Forest Plan Project File for Scenery Management and Scenery Management Handbook

**Step 8: Assign Scenic Integrity Levels to Management Areas**

The interdisciplinary team determined how scenic classes would be allocated to each management area to yield SIO assignments, as Table B - 27 illustrates. Management area boundaries are based on Desired Future Condition (DFC) boundaries, and they vary by Forest Plan alternative. Assigning SIOs by management area is the most logical and ecologically sound method because the relative management concern for scenery is linked closely to assigned management area DFCs.

**Table B - 27. Scenic Integrity Objective Assignment Matrix**

Management Areas	Scenic Classes					Scenic Integrity Levels
	1	2	3	4	5	
Candidate Area	H	H	M	M	M	Scenic Integrity Levels
Developed Recreation	H	H	H	H	H	
Diverse Continuous Forest	H	M	M	M	L	
Diverse Continuous Forest w/OHV	H	M	M	M	L	
Forest and Shrubland Mosaic	H	M	M	M	L	
Future Old Forest	H	H	M	M	L	
Future Old Forest w/Mineral Activity	H	H	M	M	L	
Grassland and Forest Mosaic	H	H	M	M	L	
Historic Forest	H	M	M	M	L	
Historic Forest w/OHV	H	M	M	M	L	
Research Natural Area	H	H	M	M	M	
River Corridor	H	H	M	M	M	
Special Area	H	H	M	M	M	
Timbre Ridge Lake Area	H	H	H	H	H	

Source: WNF Forest Plan Project File for Scenery Management

Scenic class assignment maps were produced for each Forest Plan alternative. Scenic class maps vary between alternatives based on their management area differences. Maps for each district and alternative are not shown, but are contained in the Forest Plan process records. Scenic Integrity Objective Assignments by Alternative are displayed in Table B - 27 below.

Proposed scenic integrity levels for the selected alternative become the scenic integrity objectives (SIOs) for the Revised Forest Plan.

**Table B - 28. Scenic Integrity Objective Assignments by Alternative (Acres and % of Forest)**

Scenic Integrity Objectives	Alt. A (acres and %)	Alt. B (acres and %)	Alt. C (acres and %)	Alt. D (acres and %)	Alt. E (acres and %)	Alt. E <sub>mod</sub> (acres and %)	Alt F. (acres and %)
High	63,693 (27%)	63,693 (27%)	71,147 (30%)	68,615 (29%)	71,147 (30%)	72,033 (30%)	79,337 (33%)
Moderate	166,164 (70%)	166,164 (70%)	158,709 (67%)	161,241 (68%)	158,709 (67%)	157,823 (67%)	150,519 (64%)
Low	8,156 (3%)	8,156 (3%)	8,156 (3%)	8,156 (3%)	8,156 (3%)	8,156 (3%)	8,156 (3%)

Source: WNF Forest Plan Project File for Scenery Management

### Step 9: Analyze and Ensure Consistency with ROS

Assigned SIOs were evaluated for consistency with minimum SIOs required for each ROS objective. (See Table 29)

**Table B - 29. ROS/SIO Minimum Consistency Crosswalk**

ROS Objective	SIOs
Semi-primitive non-motorized	High
Rural*	Moderate or higher
Roaded Natural	Low to Moderate

Source: WNF Forest Plan Project File for Scenery Management

Rural ROS objectives on the Forest are assigned only to the Developed Recreation Management Areas. However, the scenic resources in this management area are considered important to visitors, and therefore have been assigned higher scenic integrity levels. For this reason, no less than a “Moderate” SIO for minimum consistency have been assigned to the Rural ROS objective.

**Table B - 30. Trail Outputs by Alternatives.**

Trail Activity	Trail Outputs by Alternatives							Current Density or Miles
	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E <sub>mod</sub>	Alt F.	
New OHV Trail Construction (Density Range - miles/sq.mi)	3.2 to 6.4 mi/mi <sup>2</sup>	3.2 to 6.4 mi/mi <sup>2</sup>	2.0 to 3.5 mi/mi <sup>2</sup>	2.0 to 3.5 mi/mi <sup>2</sup>	2.0 to 3.5 mi/mi <sup>2</sup>	2.4 to 3.5 mi/mi <sup>2</sup>	2.0 to 3.5 mi/mi <sup>2</sup>	Current Average Density: .98 mi/mi <sup>2</sup>
New OHV Trail Construction (mileage range)	109 to 184 miles	109 to 184 miles	21 to 124 miles	21 to 154 miles	21 to 124 miles	21 to 124 miles	21 to 91 miles	Existing miles of OHV trails: 116 miles
New Hiking Trail Construction (mileage range)	5 to 14 miles	5 to 14 miles	5 to 30 miles	5 to 30 miles	5 to 30 miles	5 to 30 miles	5 to 30 miles	Existing miles of hiking trails: 81 miles
New Equestrian Trail Construction (mileage range)	5 to 30 miles	5 to 30 miles	5 to 50 miles	5 to 50 miles	5 to 50 miles	5 to 50 miles	5 to 50 miles	Existing miles of horse trails: 65 miles
New Mtn. Bike Trail Construction (mileage range)	15 to 30 miles	15 to 30 miles	15 to 30 miles	15 to 30 miles	15 to 30 miles	15 to 30 miles	15 to 30 miles	Existing miles of mtn. bike trails: 0 miles exclusively for mtn. bike use.
Non-motorized Trail Density (miles/sq.mi)	Up to 2.5 mi/mi <sup>2</sup>	Up to 2.5 mi/mi <sup>2</sup>	Up to 2.5 mi/mi <sup>2</sup>	Up to 2.5 mi/mi <sup>2</sup>	Up to 2.5 mi/mi <sup>2</sup>	Up to 2.5 mi/mi <sup>2</sup>	Up to 2.5 mi/mi <sup>2</sup>	Varied among different trail types

## OHV Areas – Potential Trails Analysis

### Trail Outputs Tables and Rationale

This section compares the Forest’s existing trail mileages and densities with mileage projections for new trail construction by alternatives in a tabular format. It also describes the rationale for how each trail output was generated.

**Table B - 31. Trail Outputs Rationale by Trail Activity.**

Management Activity	Recreation Outputs Rationale
New ATV/OHM Trail Construction (Density Range - miles/sq.mi)	<p>The 1988 Forest Plan provides two densities for motorized trails: 3.2 mi/mi<sup>2</sup> for M.A. 2.3 and 6.4 mi/mi<sup>2</sup> for M.A. 3.2. The current average density of motorized trails is approximately 1.0 mi/mi<sup>2</sup>. Not knowing how the 88’ Forest Plan densities were generated, the Forest decided to map out the maximum miles of trails that could be reasonably constructed (with some environmental constraints) within the newly proposed OHV management areas. The results of the GIS mapping were: 2.00 to 2.44 mi/mi<sup>2</sup> could be reasonably constructed within the current WNF land base allocated for motorized trail use. However, a 3.5 mi/mi<sup>2</sup> maximum was proposed to allow for additional trails to be added if maintenance level 1 and 2 roads were converted for trail use, some user-developed trails were designated as system trails, and/or for future land purchases within the OHV management areas.</p> <p>The new trail density range for Alternative E-modified is set at 2.4 to 3.5 mi/mi<sup>2</sup>. This is a derivative of the new construction mileage range of 50 to 124 miles for Alternative E-modified.</p>

Management Activity	Recreation Outputs Rationale
New ATV/OHM Trail Construction (mileage range)	<p>Mileage ranges were calculated using the following formula: Acres allocated for ATV/OHM use divided by 640 acres per mi<sup>2</sup> times proposed trail densities minus existing trail miles = Miles of new trail construction</p> <p>The bottom end of the mileage range (i.e. 21 miles shown for Alt. C-F) were calculated using the 2.0mi/mi<sup>2</sup> density, while the upper range of the trail miles were varied to provide a range among the alternatives.</p> <p>For Alternative E-modified, the lower end of the mileage range was increased from 21 miles to 50 miles while the upper end of the range remained at 124 new miles. This modification of Alternative E was made in response to public comments to the draft Revised Forest Plan and DEIS. The motorized vehicle community felt that the 21 to 124 miles initially proposed was too low to meet current and projected motorized trail use and demand. They requested a new mileage construction range to be set at 75 to 150 miles. The Forest felt it could reasonably construct 50 new miles within the next decade (and possibly more if additional funding and resources were available). However, the Forest did not feel it could exceed the current mileage maximum of 124 miles without adversely affecting natural resources. Therefore, the new mileage construction range for Alternative E-modified is set at 50 to 124 miles.</p>
New Hiking Trail Construction (mileage range)	<p>Alternatives A &amp; B mileage ranges were based on outputs found in the 1988 Forest Plan for hiking trails. Alternatives C - F mileage ranges (essentially doubled from Alt. A &amp; B) were based on miles of new hiking trails that were added in the previous decade (approx. 20 miles) and what the Forest with the help of volunteers could reasonably complete in the next decade with appropriate funding and resources.</p>
New Equestrian Trail Construction (mileage range)	<p>Alternatives A &amp; B mileage ranges were based on outputs found in the 1988 Forest Plan for horse trails. Alternatives C - F mileage ranges were based on what the Forest with the help of volunteers could reasonably complete in the next decade with appropriate funding and resources.</p>
New Mtn. Bike Trail Construction (mileage range)	<p>The 1988 Forest Plan does not provide any mileage or density projections for new mountain bike trail construction. No trail system has been constructed on the WNF exclusively for mountain bike use. The Forest wants to develop at least one mountain bike trail system by the end of the next decade. The projected mileage range given were based upon the miles trails users say they prefer for a mountain bike trail system and what the Forest with the help of volunteers could reasonably complete in the next decade with appropriate funding and resources.</p>
Non-motorized Trail Density	<p>The 1988 Forest Plan provides a density of up to 2.0 mi/mi<sup>2</sup> horse and hiking trails. The new trail density was increased to 2.5 mi/mi<sup>2</sup> to provide more opportunities for new trail construction in a particular area. This new density is within the land's maximum carrying capacity (conclusion drawn from mileage and density analysis completed for OHV trails, which are typically wider trails). Unlike the OHV trail system which is confined to within the OHV management areas, non-motorized trails are generally allowed to be constructed over most of the Forest (with exceptions). Therefore, the trail density is applied differently for non-motorized trails compared to OHV trails. The 2.5 mi/mi<sup>2</sup> density for non-motorized trails is applied on site specific basis rather than within a particular management (like how OHV trail densities are applied).</p>

**Table B - 32. OHV Trail Outputs by Alternatives.**

Trail Activity	WNF OHV Trail Outputs by Alternatives						
	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E <sub>mod</sub>	Alt. F
Existing OHV acres (FS only)	45,010	45,010	43,900	43,900	43,900	43,900	43,900
Square miles (total acres/640 acres per sq.mi.)	70	70	69	69	69	69	69
Existing OHV trail miles	116	116	116	116	116	116	116
Existing OHV Trail density (existing trail miles/sq.miles)	1.65	1.65	1.69	1.69	1.69	1.69	1.69
Potential new OHV trail miles	184	184	124	154	124	124	91
Projected maximum OHV miles (existing + new)	300	300	240	270	240	240	207
Density based on total OHV miles	4.27	4.27	3.50	3.94	3.50	3.50	3.02
Source of total trail miles/density	Current Forest Plan Projection	Current Forest Plan Projection	WNF 2004 mapping and analysis - Max. reasonable capacity. 20% less than Alt. A	10% less than Alt. A (to provide a reasonable range among alternatives.	WNF 2004 mapping and analysis - Max. reasonable capacity. 20% less than Alt. A	WNF 2004 mapping and analysis - Max. reasonable capacity. 20% less than Alt. A	1994 Trails Master Plan projection adjusted proportionately with 2004 acres allocated for OHV use.

**Criteria Used For Determining and Mapping OHV Trail Density**

- 25% maximum side slope
- 100’ from a known archeological site
- 100’ from oil and gas facilities
- 100’ from perennial streams
- 50’ from intermittent streams
- ¼ mile buffer from known hibernaculum
- 25’ from maintenance level 3-4 roads
- 50’ from center line of paved road
- 100’ from Forest boundary
- 100’ from newly reclaimed (10 years or less) watershed or mined area
- 100’ from riparian areas, marshes, wetlands, & ponds

- 200' exclusion zone from alignments A & C of proposed Nelsonville Bypass
- 500' from existing designated trail corridor

---

## **Content Analysis of Responses to Release of the Draft EIS and Draft Forest Plan**

The process used in analyzing the responses to release of the Draft EIS and the Proposed Revised Forest Plan is described in the document titled, “Response to Comments Appendix to the Final Environmental Impact Statement”.



## Appendix C

# Potential Roadless and Wilderness Areas Inventory

---

## Introduction

Forest Service planning regulations require that the roadless character of National Forest System land be evaluated when forest plans are revised.

To be recommended for wilderness, an area must first qualify as roadless. Criteria for identifying roadless areas in the eastern half of the United States recognize that much, if not all, of the land will show some signs of human activity and modification even if it displays high recuperative capabilities (FSH 1909.12, 7.11b, p. 3).

When the Wayne National Forest (WNF) was evaluated during the development of the *1988 Forest Plan*, no areas were found to possess either roadless or wilderness characteristics.

Since the previous evaluation, the Forest Service has acquired more than 50,000 acres now included in the WNF. In 2003, the entire Forest was inventoried for wilderness/roadless potential as part of the *Forest Plan Revision*. There is a vocal sector of the public that supports designating a roadless area on the forest, or for “growing” areas that could become roadless or wilderness at some point in the future. As this inventory was started, it was deemed important to not eliminate areas too quickly to ensure all potential areas were fully considered. This became a guiding premise for the inventory due to the WNF’s unique status as being one of the few national forests across the country to not have any designated roadless areas.

Three references guided the evaluation/inventory:

- 1) Forest Service Manual (FSM) 1920, Section 1923;
- 2) Forest Service Handbook (FSH) 1909.12, Chapter 7; and
- 3) USDA Forest Service Region 9 Direction for Roadless Area Inventory for Forest Plan Revision (August 13, 1997).

---

## Inventory Process

Three-steps were used to identify and inventory potential roadless areas for the 2005 *Plan Revision*. In addition, the guiding premise used in this analysis was to use the criteria from the three references listed above, but at each Step to look beyond the hard number criteria so that areas which might otherwise qualify, were not eliminated when they were close to, but did not meet the number criteria.

## Step 1

Using Geographic Information System (GIS) technology, the WNF mapped all three of its administrative units (Athens, Marietta, and Ironton) in search of contiguous land bases that might meet the size criteria for roadless areas as shown below.

- Areas containing 5,000 acres or more. (FSH 1909.12, 7.11, Criterion 1)
- Areas containing less than 5,000 acres but:
  - Due to physiography or vegetation, are manageable in their natural condition;
  - Are self-contained ecosystems such as an island; and
  - Are contiguous to existing wilderness, primitive areas, Administration-endorsed wilderness, or roadless areas in other Federal ownership, regardless of size. (FSH 1909.12, 7.11, Criterion 2)

### Size Criteria were determined as follows:

- 1) 5,000 acres: Based on Criteria 1 above;
- 2) 2,500 to 4,999 acres: Areas within this size class could potentially meet Criteria 2a above. Including these areas was in keeping with the analyses' guiding premise. These areas would be based on the recreation opportunity spectrum (ROS) setting of semi-primitive, non-motorized. No areas met Criteria 2b or 2c above; and
- 3) 1,500 to 2,499 acres: Areas within this size class could potentially meet Criteria 2a above. Including these areas was in keeping with the analyses' guiding premise. Such areas, when combined with larger adjacent areas, could potentially provide the solitude that recreationists seek in semi-primitive areas and therefore could possibly be managed as such.

Federal, State, county, township, and/or Forest Service system roads open and maintained for passenger cars (operation maintenance level 4 or 5) were used to delineate boundaries of the areas. An alphanumeric naming system was used to label each area (i.e. I-1 is the first area located on the Ironton Unit; I-2 is the second area located on the Ironton Unit; A-1 is the first area located on the Athens Unit, etc.). Table B-1 displays the results from this initial step.

**Table B-1. Forest Areas with Contiguous Land Base by Size Criteria and Administrative Unit**

Size Criteria	Athens Unit	Marietta Unit	Ironton Unit
5000 acres or more	None	None	I-6 (5265 acres) I-11 (5234 acres)
2500 – 4999 acres	A-2 (3077 acres) A-4 (4636 acres)	M-1 (2629 acres)	I-2 (2546 acres) I-3 (4457 acres) I-7 (3897 acres) I-10 (2922 acres) I-12 (3761 acres) I-13 (2838 acres) I-14 (4897 acres) I-15 (2510 acres) I-17 (2502 acres) I-18 (4573 acres)
1500 – 2499 acres	A-1 (1806 acres) A-3 (1725 acres) A-5 (2126 acres) A-6 (1996 acres) A-7 (1578 acres) A-8 (1877 acres)	None	I-1 (2074 acres) I-4 (1671 acres) I-5 (1881 acres) I-8 (1633 acres) I-9 (1586 acres) I-16 (1861 acres) I-19 (2258 acres) I-20 (1577 acres) I-21 (2474 acres) I-22 (1541 acres)

## Step 2

All 31 areas identified in Step 1 were carried forward to Step 2 so that no areas would be eliminated based solely on acreage. Keeping all areas in the analysis at this point was in keeping with the analyses' guiding premise. In Step 2, roadless eligibility was further analyzed to determine which areas warranted further consideration for roadless designation, looking at road density and other improvements.

Specifically, the following criteria were used in that analysis:

- The area contains evidence of historic mining (50+ years ago), excluding areas of significant current mineral activity, such as prospecting with mechanical earthmoving equipment. (FSH 1909.12, 711a, Criterion 4)
- The area contains no more than a half-mile of improved road for each 1,000 (K) acres, with road under Forest Service jurisdiction. (FSH 1909.12, 711b, Criterion 5)
- The location of the area is conducive to the perpetuation of wilderness values. Consider the relationship of the area to sources of noise, air, and water pollution, as well as unsightly conditions that would have an effect on the wilderness experience. The amount and pattern of federal ownership is also an influencing factor (FSH 1909.12 7.11b Criterion 4).

Historic mining in southeast Ohio was largely for coal, iron ore and clay. In addition,

oil and gas wells have been operating in the area for over 100 years. Most of the evidence of older mining operations (50 years or more) has been overgrown with vegetation. Some exception to this are the old mine entrances and waste piles (called gob piles) primarily from underground coal mines. While the gob piles and other mine related sites are causing watershed issues of acid mine drainage they have largely become visually subordinate except in their immediate location. These older, historic mining locations are reverting to mainly native vegetation and were not deemed to be excluding for any of the areas being considered in this inventory.

Existing minerals activity including existing oil and gas well developments on the WNF were identified. Existing underground coal mining did not impact any of the areas being inventoried. Area M-1 on the Marietta Unit was the only area with a high number of existing, producing wells with associated access roads and storage tanks such that it would not be able to be managed for roadless characteristics.

The density of Forest Service system roads of maintenance levels 2 through 5 was also computed. Roads with maintenance levels of 2, 3, 4, and 5 are improved roads that can be driven by low clearance passenger vehicles. Many of these roads access private land inholdings, access producing wells, or other developments. Some traverse an area but are maintained at a lower standard than roads used as boundaries. Table B-2 displays the results from this second step.

**Table B-2. Density of Improved Roads within Forest Areas Carried Forward from Step 1.**

Road Density Criteria	Athens Unit	Marietta Unit	Ironton Unit
½ mile or less per 1000 (K) acres	None	None	I-1 (0.44 mi/K ac)
			I-6 (0.47 mi/K ac)
			I-22 (0.05 mi/K ac)
½ mile to 1 mile per 1000 (K) acres	None	None	I-2 (0.55 mi/K ac)
			I-3 (0.77 mi/K ac)
			I-4 (0.56 mi/K ac)
			I-7 (0.71 mi/K ac)
			I-10 (0.59 mi/K ac)
			I-20 (0.90 mi/K ac)
Greater than 1 mile per 1000 (K) acres	A-1 (5.66 mi/K ac)	M-1 (2.77 mi/K ac)	I-5 (3.98 mi/K ac)
	A-2 (6.25 mi/K ac)		I-8 (1.73 mi/K ac)
	A-3 (5.45 mi/K ac)		I-9 (2.99 mi/K ac)
	A-4 (5.15 mi/K ac)		I-11 (3.00 mi/K ac)
	A-5 (2.48 mi/K ac)		I-12 (2.31 mi/K ac)
	A-6 (3.50 mi/K ac)		I-13 (1.60 mi/K ac)
	A-7 (2.59 mi/K ac)		I-14 (3.35 mi/K ac)
	A-8 (3.80 mi/K ac)		I-15 (2.41 mi/K ac)
			I-16 (2.37 mi/K ac)
			I-17 (3.87 mi/K ac)
			I-18 (2.83 mi/K ac)
		I-19 (1.50 mi/K ac)	
		I-21 (1.32 mi/K ac)	

## Analysis

Areas with more than one mile of improved road per 1,000 acres were eliminated from further consideration for roadless designation because they did not meeting Criteria 5 of FSH 1909.12, 711b.

While realizing that the areas with ½ mile to 1 mile of improved road per 1,000 acres also did not meet this criterion, they were kept in the analysis at this point to prevent eliminating an area that might otherwise be a potential roadless area except for this one factor. This was in keeping with the analyses' guiding premise.

Of the areas with less than one mile of improved road per 1,000 acres, areas I-1, I-2, I-4, I-10, I-20 and I-22 were eliminated because their narrow, irregular shape, or small size, and the close proximity of improved roads and private lands, could not be managed as a separate ecosystem and they are not conducive to providing wilderness values.

The first and second screenings yielded only three areas that met the size and/or road density criteria. All three areas were on the Ironton Unit. They include:

- 1) I-6 met all criteria used in the previous two steps and was larger than 5,000 acres;
- 2) I-3 did not meet the road density criteria, but contains between 2,500 and 4,999 acres and lies adjacent to I-6, separated only by a

county road. This area could potentially be managed in conjunction with I-6.

- 3) I-7 did not meet the road density criteria, but contains between 2,500 and 4,999 acres and lies adjacent to I-6, separated by a major Forest Service road (maintenance level 4). This area could potentially be managed in conjunction with I-6.

### Step 3

Using GIS, the roadless eligibility of the three Ironton areas that passed the first and second screenings were further scrutinized. These areas were examined against the following criteria:

- 1) The area has existing or attainable National Forest System ownership patterns, both surface and subsurface, that could ensure perpetuation of identified wilderness values. Region 9 Guidelines for Completing Roadless Area Inventories states that this is “a critical issue for roadless area inventories”. (FSH 1920.12, 7.11b, Criterion 3, and R9 Directions for Roadless Area Inventory for Forest Plan Revision, Aug. 1997, page 4, Criterion G)
- 2) When evaluating a possible expansion of an existing wilderness, or wilderness study area (WSA), consider National Forest System lands that adjoin the designated area but with no major barriers separating the two. There should be no improved road, railroad, or utility corridor separating the existing area from the expansion area. If a barrier separates the areas, evaluate the areas independently, each on its own merits. (R9 Directions for Roadless Area Inventory for Forest Plan Revision, Aug. 1997, page 3, Criterion C)

Review of areas I-3 and I-6 found a major utility corridor dissecting the east half of area I-6 and the west section of area I-3. Factoring in the utility corridor, the size and road density changed as follows:

Area	Acreage		Road Density (mi / k ac.)	
	Results from Step 1	Results from Step 3	Results from Step 2	Results from Step 3
I-3	4,457	3,416	0.77	0.66
I-6	5,265	4,378	0.47	1.00
I-7	3,897	3,897	0.71	0.71

Applying the boundary criterion of not crossing major utility corridors resulted in none of these three remaining areas meeting the size criterion (FSH 1909.12, 7.11, Criterion 1). They also do not meet the road density criterion (FSH 1909.12, 7.11b, Criterion 5). In addition, areas I-3, I-6, and I-7 each have substantial reserved and outstanding subsurface mineral rights over which the

Forest Service cannot control potential development. Because of the reserved and outstanding mineral rights, the Forest Service cannot ensure perpetuation of potential roadless values.

Because these areas did not satisfy the several of the inventory criteria for roadless areas (FSH 1909.12, Chapter 7.11), they were dropped from further consideration for roadless area nomination.

---

## Conclusion

In summary, upon completion of the 2003 Wayne National Forest roadless area inventory, the Forest Service found no areas eligible for roadless nomination.

This page intentionally left blank.

## Appendix D

# Range of Natural Variability, Old Growth, and Silvicultural Systems

---

## Range of Natural Variability

### Tree Characteristics

During the 1600s southeast Ohio was inhabited by the Shawnee Nation. It is believed that Native Americans frequently burned the forests of eastern North America to facilitate game hunting and to enhance the growth of herbaceous plants (Goebel and Hix, 1996). Berry and mast production also benefited from fire. The clearing of land for agriculture was probably restricted to fertile floodplains of larger river systems.

When the first European settlers viewed the forests of the Ohio Valley in the late 1700s, they found “hills clothed with a thick forest of trees, consisting of white, red, and black oak, hickory, ash, chestnut, sassafras, dogwood, and grape vine” (Goebel and Hix, 1996). The forests of southeast Ohio at the time of European settlement were dominated by white oak, which accounted for 40 percent of all witness trees documented by the original land surveyors of the Ohio Company Purchase from 1796 to 1802. American beech, sugar maple, and yellow poplar were frequently recorded in the “bottoms” (stream valleys) but they were not abundant overall (Dyer, 2001).

Although southeastern Ohio was almost entirely forested at the onset of Euro-American settlement (ca. 1800), written accounts of the landscape prior to 1800 describe more open conditions in some areas, as summarized in Sutherland and Hutchinson (2003). In several accounts, forests were described as open and park-like. In 1765, George Croghan, an Indian agent, frequently described “clear Woods” in eastern Ohio. Thaddeus Harris, traveling from Marietta, Ohio, to Wheeling, W.Va., in 1802 wrote “There is but little underwood; but on the sides of the creeks and near the river, the paw paw, spice bush or wild pimento, and dogberry grow in greatest abundance”. Traveling west from Pittsburgh, Penn., David McClure in 1772 noted that “the woods were clear from underbrush, the oaks and black walnut do not grow very compact, and there is scarcely anything to incommode a traveler in riding, almost in any direction, in the woods of the Ohio. The Indians have been in the practice of burning over

the ground, that they may have the advantage in seeing game at a distance among the trees.”

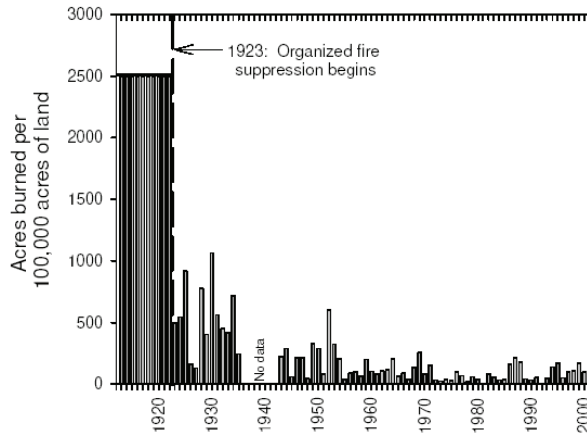
In southeast Ohio, frequent burning is believed to have favored the more fire resistant oaks and eliminated understories of mesic species such as American beech and sugar maple (Goebel and Hix, 1996). The forest conditions were predominated by oaks because they have several biological adaptations to fire. Oak stems have thick, corky bark, a tenacious ability to repeatedly resprout following top-kill due to high root:shoot ratio and dormant buds near the root collar, and the ability to compartmentalize wounds. In addition, oaks benefit from post-fire conditions, such as the open understory and reduced impact of fire intolerant competitors, and the xerification of the site through consumption of some of the duff and exposure of soil to greater solar radiation, allowing oak to dominate the advanced regeneration pool (Ruffner and Groninger, 2004).

Beginning at the time of European settlement in the early 1800s, the general level of disturbance was higher because land was cleared for agricultural crops. Fire was used to clear the land and it sometimes escaped to the woods, so that the level of fire disturbance remained similar to the conditions before the settlement of Europeans (Fralish, 2004).

In southeast Ohio, timber harvesting on the uplands was limited until the mid-1800s when the charcoal iron industry became prominent in the region. The charcoal industry (ca 1830 – 1890) was the primary cause of the clearcutting of many forest stands in southeast Ohio. In 1875 there were 69 iron furnaces in the Hanging Rock region of southeast Ohio and northeast Kentucky. To supply charcoal for a typical furnace 200 to 600 acres of forest were harvested annually, and the forest was harvested again at 20 to 30 year intervals. These cuts were essentially coppice harvests, whereby regeneration was of sprout-origin. This cutting regime ultimately fostered oak regeneration and reinforced its dominance (Abrams and Nowacki, 1992).

In southern Ohio the fire-return intervals during the period of the mid-1800s to 1925 was in the range of 3 to 7 years (Abrams and Nowacki, 1992). Fire scar data analyzed in Vinton County, Ohio show that the fire return interval averaged 3.6 years for low-intensity fires, and 7.5 years for major fires. The fires were probably ignited by people and occurred mostly in the dormant season or early spring, and only a few (6%) occurred during the summer. There is little indication that climate patterns caused the fire events since they were human-caused. The fires appeared to have burned until either weather extinguished them or they encountered barriers. (Sutherland, 1997) As shown in Figure D - 1, the acreage of land that experienced fire dropped dramatically after the late 1920s and early 1930s when fire control laws were passed and the general protection of the forest ecosystem began (Sutherland and Hutchinson, 2003).

Seemingly, fire reduction was a widespread phenomenon throughout the region; the same trend was documented in neighboring Pennsylvania (Abrams and Nowacki, 1992).



**Figure D - 1. Annual acreage burned per 100,000 of land for 10 counties in southeastern Ohio. (Source: Sutherland and Hutchinson, 2003)**

Since the early 1930s, previously established oak and hickory trees have continued to grow, but few seedlings reach sapling size before dying. Forested areas have remained relatively undisturbed for the past 70 years, and so scattered stems of fire-intolerant but shade tolerant species such as red and sugar maple and American beech have grown to tree size and become a major seed source. Now forest communities are converting from mid-successional oak and hickory species to shade tolerant climax mesophytes. The near absence of fire has permitted the development of this classical secondary successional process, particularly on mesic sites. (Fralish, 2004).

Table D - 1 shows the relative abundance of trees existing when the Ohio Company Purchase was surveyed in the late 1700s and early 1800s (based on witness tree documentation) versus the representation of the same species in 1991 when the Forest Inventory was reported. In southeast Ohio, the oak and hickory components have declined roughly 26 percent when comparing presettlement to current vegetation (Dyer, 2001).

**Table D - 1. The relative abundance of trees when the Ohio Company Purchase was surveyed in late 1700s and early 1800s compared to representation of the same species in 1991.**

Species Group	Percentage of Witness Trees 1796 – 1802	Percentage of Trees documented by FIA (as reported in 1991)	Change
White Oaks	40.0	14.5	- 25.5
Hickory	13.6	8.0	- 5.6
Black Oaks	12.2	13.6	+ 1.4
Beech	8.4	3.6	- 4.8
Sugar Maple	3.6	7.6	+ 4.0
Red maple	3.2	5.4	+ 2.2
Yellow Oak	3.2	7.2	+ 4.0
Yellow Poplar	2.9	10.8	+ 7.9
Ash	2.4	4.8	+ 2.4
Other	10.6	24.5	+ 13.9

In addition to a decrease in the dominant oaks and hickories with an increase of more shade tolerant species such as sugar maple, a second evident trend is a dramatic increase in early successional species such as yellow poplar, ash, pine, aspen, and black cherry. Past land practices have clearly favored those trees with greater seed dispersal ability (Dyer, 2001).

**Reliability of Public Land Survey Data**

Studies concerning the use of Public Land Surveys (PLS) to determine vegetation characteristics find some degree of variability among surveyors. These records do not constitute an unbiased sample of presettlement vegetation. Instead, one must understand the PLS data in their historical context. The data were created for legal, not ecological, purposes. These purposes affected the manner in which the surveyors collected the data. The surveyors also independently interpreted how best and easiest to meet these purposes. Sometimes these interpretations result in significant differences among surveyors as to the species they chose as witness trees, the diameters of those trees, and the distances traveled to record them.

The important question is how these levels of variability affect the biological significance of the PLS data, especially when representing large areas (>24,700 acres); the counties studied by Dyer (2001) and presented in the Table D - 1 included 1,235,550 acres. At such scales the effect of surveyor variability may not be strong enough to greatly influence results. For example, surveyors were constrained by which species were present at each point. These forests are usually dominated by only a few species. Thus, great deviations from which species would occur at a site were not

likely. Differences due to environmental variability may also exceed the effect of surveyor differences when examining the PLS data over areas of great extent. Over large areas, such as Dyer's (2001) study area, PLS data are appropriate for reconstructing the vegetation before European settlement (Manies et al., 2001).

To assess changes in forest composition and structure over the last 200 years in southeast Ohio, USDA Forest Service Forest Inventory and Analysis (FIA) data were summarized for the eight counties that encompass the original Ohio Company Purchase. Although the instructions established by Congress did not comment on witness tree selection, it is intuitive that surveyors were unlikely to select very small individuals; this is born out by an examination of the size-class distributions of witness trees. To facilitate comparison with the witness trees, FIA data for this analysis included trees  $\geq 9$  inches in diameter, in stands of natural origin ( $n = 364$  plots). Data on slope, aspect, physiographic class, and location also were obtained for each plot. Latitude and longitude coordinates for each plot are reported to the nearest 100 feet, so that the exact location of the site may be within 1.8 miles of what is reported. Although the nature of the witness tree data (point samples) and FIA data (area samples) preclude direct comparison, the limited conclusion can be drawn that the dominant forest taxa are occupying similar environmental sites today as they did in the presettlement forest, although relative abundances have changed significantly (Dyer, 2001).

### Understory Plants

Early accounts from Ohio indicate that presettlement forests were clear of underbrush and that one could travel through the woods on horse-drawn sleds (Goebel and Hix, 1996). The surveyors did make brief reference to oak and hickory underbrush (presumably saplings and seedlings) blocking their line of sight. Dogwood was also noted frequently, and spicebush (*Lindera benzoin*) was recorded in several valleys. Sapling species, which are presently abundant, such as red maple, sugar maple, and black gum were not recorded in the underbrush descriptions by the surveyors (Sutherland and Hutchinson, 2003).

Fire was no doubt used as a management tool in southeast Ohio as Hildreath in 1788 describes for Washington County "Yearly autumnal fires of the Indians, during a long period of time, had destroyed all the shrubs and undergrowth of woody plants, affording the finest hunting grounds" (Dyer, 2001).

Blueberry and other ericads were commonly found on the forest floor of a dry oak stand. The frequent fires of the past would have benefited the plants by top pruning and thinning the plants to encourage young growth, and the semi-open canopy would have allowed the plants to bear more fruit.

The present high density of seedlings, saplings, and small trees of mesophytic species within the central states oak-hickory forest is having a major deleterious effect on the herbaceous layer. Data collected from Trail of Tears State Forest in the Illinois Ozark Hills region indicates that as photosynthetically active radiation decreases and the amount of ground litter increases, there is a major decrease in the number of herbaceous species. Species richness increased 200 percent from an average of 10 species/108 square feet in a forest composed of black and white oak and hickory with a closed canopy of smaller sugar maple trees (dbh of 4-8 inches) to an average of 31.5 species/108 square feet in open stands dominated by black oak, white oak, and hickory without maple. In dense sugar maple dominated forest of the Ozark Hills region, few seedlings or herbs can be observed (Fralish, 2004).

A decrease has also been reported in the number of summer and fall flowering species between 1980 and 1988 and related this decrease to the increase in sugar maple importance in the tree canopy. At Land Between The Lakes (LBL) in Kentucky and Tennessee, about twice the number and double the cover of herbaceous cover species were found in shelterwood cut stands as compared to uncut post oak, black oak, and white oak dominated stands, suggesting that even in oak dominated stands, the light resource prevents full development of understory herbs. Therefore, it should be of no surprise that the added layers of branches and leaves, due to a midcanopy of mesophytic species, impoverishes the herbaceous stratum (Fralish, 2004).

Restoring the characteristics of an oak forest that is maintaining itself, and all the other forest types on the Wayne National Forest, will take several decades. Over time the treatments prescribed will slowly change the conditions that have developed over several decades. For example, since many of the current oak stands have many other species in the understory and mid-story, just one or two silvicultural practices will not change the ecosystem to what it was several hundred years ago.

## Ecosystem Descriptions

The previous discussion describes the general characteristics of a predominantly oak ecosystem on the Wayne National Forest in the past and possibly in the future.

Below are the characteristics of other ecosystems found on the Wayne National Forest. These describe, in general terms, common ecosystems that exist on the Wayne National Forest. Many sections of the forest will differ slightly from these descriptions, but the general concepts should be evident. Also, some areas will demonstrate traits common to one or more different ecosystem depending on the physical conditions, and past land management. These descriptions are intended to describe the most

common associations, but not to describe every ecosystem that may exist on the Forest.

The Wayne National Forest is within the Appalachian Unglaciated Plateau and within the central hardwood region; this region can be defined as the area south of the beech-maple forests, east of the Great Plains, and north and west of the southern pine forests. Within this central hardwood region are other subdivisions including Oak-Hickory and Mixed Mesophytic. (Hicks, 1998)

The **Mixed-Mesophytic Forest** is a high-diversity and predominately deciduous forests occurring on deep and enriched soils, usually in somewhat protected landscape positions such as coves or lower slopes. Dominant species include sugar maple (*Acer saccharum*), *American beech* (*Fagus grandifolia*), Yellow Poplar (*Liriodendron tulipifera*), and Red Oak (*Quercus rubra*). Trees may grow very large in undisturbed areas. The herb layer is very rich, often with abundant spring ephemerals. Many examples may be bisected by small streams. Shrub strata are open to sparse and can include spicebush (*Lindera benzoin*). Herbaceous strata are typically lush and diverse. A partial list of typical species includes Trillium (*Trillium erectum*), May-apple (*Podophyllum peltatum*), Tall White Violet (*Viola Canadensis*), water-leaf (*Hydrophyllum canadense*), and Sedge (*Carex austrocaroliniana*). (Natureserve, 2005)

The **Beech-Maple Forest** is found primarily on flat to rolling uplands to steep slopes with rich loam soils. This system is characterized by a dense tree canopy that forms a thick layer of humus and leaf litter leading to a dense and rich herbaceous layer. Sugar Maple (*Acer saccharum*) and American Beech (*Fagus grandifolia*) comprise up to 80% of the canopy. Other associates can include red oak (*Quercus rubra*), Basswood (*Tilia americana*), ironwood (*Carpinus caroliniana*), and hophornbeam (*Ostrya virginiana*). The relative dominance of sugar maple compared to other tree species varies across the range of this system based on regional climate and microclimate. The herbaceous layer is very diverse and typically includes spring ephemerals. Some common species include jack-in-the-pulpit (*Arisaema triphyllum*), bedstraw (*Galium aparine*), Woolly sweet-cicely (*Osmorhiza claytonia*), Smooth Solomon's Seal (*Polygonatum biflorum*), and trillium (*Trillium grandiflorum*). (Natureserve, 2005)

The **Mixed Oak – Hickory Forest** occurs on gentle to moderately steep slopes of dissected hills and plains. Soils are well-drained, shallow to deep, often over sandstone, cherts, or cherty limestone. Stands are dominated by a closed-canopy deciduous tree layer. The dominants are white oaks and red oaks. Typical associates include hickories (*Carya sp*), red and sugar maples (*Acer sp*), and Black Gum (*Nyssa sylvatica*). The shrub and small-tree layer contains dogwood *Cornus florida*), virginia creeper (*Parthenocissus quinquefolia*) is a typical vine. The low-shrub

layer may be dominated by blueberry (*Vaccinium pallidum*). The herbaceous layer contains Black cohosh (*Actaea racemosa*), tick trefoil (*Desmodium glutinosum*), bedstraw (*Galium pilosum*), and christmas fern (*Polystichum acrostichoides*). (Natureserve, 2005)

The **Virginia Pine- Shortleaf Pine Forest** includes Virginia Pine (*Pinus virginiana*) and shortleaf pine (*Pinus echinata*) dominated forests of ridges and steep upper slopes. This community occurs on narrow ridges, steep slopes, and other exposed topographic positions, over shallow, infertile soils. This mainly evergreen forest is often of low stature, with a somewhat open to closed canopy, sparse to very dense shrub cover dominated by ericaceous species, and a sparse herb stratum. Virginia pine and / or Shortleaf pine dominate the canopy, with various oaks also occurring. Deciduous species may form a subcanopy or sapling stratum, particularly in areas where fire has been excluded. Blueberries are a common shrub. Herbs are typical of infertile, xeric habitats such as lowbush blueberry (*Vaccinium pallidum*) and striped wintergreen (*Chimaphilla maculate*). (Natureserve, 2005)

The **Bottom Land Forest** is dominated by silver and red maple occurring in moist, deep, hydric soils associated with wetland depressions on level plains and floodplain backswamps. Soils are saturated for a few months of the growing season, but often are dry by late summer. Canopy cover is complete and dominated by Red maple (*Acer rubrum*), Silver Maple (*Acer saccharinum*), Sycamore (*Platanus occidentalis*), River Birch (*Betula nigra*), Ash (*Fraxinus pennsylvanica*), and Elm (*Ulmus Americana*). The subcanopy consists primarily of Red Maple (*Acer rubrum*) and Elm (*Ulmus americana*) underlain by a shrub layer which may contain a mixture of ironwood (*Carpinus caroliniana*), winterberry (*Ilex verticillata*), spicebush (*Lindera benzoin*), elderberry (*Sambucus Canadensis*), poison ivy (*Toxicodendron radicans*), and arrowwood (*Viburnum recognitum*). The depth and duration of flooding and light penetrating the forest canopy regulate density and diversity found in the herbaceous layer. Jewelweed (*Impatiens capensis*), jack-in-the-pulpit (*Arisaema triphyllum*), Fowl mannagrass (*Glyceria striata*), and a variety of sedges (*Carex* spp.) are among the most common species encountered. (Natureserve, 2005)

### Role of Mycorrhizae

Mycorrhizae are symbiotic associations of tree fine roots and certain soil fungi. Oak species are classified as ectomycorrhizal (possessing an external fungal mantle and Hartig net hyphae between cortical cells) while maples are classified as endomycorrhizal (with vesicles, arbuscules, and/or hyphal coils in cortical cells). Both types of mycorrhizae generally benefit

seedling establishment or growth through increased nutrient uptake and improved water relations in the roots.

In a study on Ohio's Zaleski State Forest, after thinning and burning, the extensive endomycorrhizal colonization of red maple in the study (59 to 76 percent) was high. Much of the herbaceous vegetation in the understory was classified as endomycorrhizal; therefore, a high level of soil inoculum may account for the high colonization levels in the study. A lack of effect due to thinning on endomycorrhizal colonization was observed: selective cutting had no negative effect on mycorrhizal community structure because of the rapid regeneration of mycorrhizal hosts and minor levels of soil disruption.

Oak species generally are considered as ectomycorrhizal; however, the study on the Zaleski State Forest observed both ectomycorrhizal and endomycorrhizal associations on black oak roots. Endomycorrhizal infection of predominantly ectomycorrhizal host plants might be increased in the presence of abundant endomycorrhizal hosts, as occurred in the understory at Zaleski State Forest. (McQuattie, Carolyn J.; Rebbeck, Joanne; Yaussy, Daniel A., 2004)

## Sudden Oak Death (SOD)

Sudden Oak Death (SOD) is a new disease that has spread rapidly since 1995 in California. It is caused by a newly discovered pathogen (*Phytophthora ramorum*). The disease has been found in nursery stock in the eastern United States, so infection of natural stands is possible. Fire suppression has been effective where SOD has emerged in the west. Analysis by Moritz and Odion demonstrates a strong and consistent negative relationship between locations of confirmed SODS and areas that have been burned since 1950. The potential for fire to influence the growth of spores and mycelia of fungal pathogens through direct effects of heat and/or smoke has long been known. (Moritz and Odion, 2005)

## Oak Decline

Periodic occurrences of decline and death of oaks over widespread areas have been recorded since 1900. The condition is often caused by a complex interaction of stresses and pests. Generally trees are weakened by environmental stresses such as droughts, frosts, or pests such as defoliating or sucking insects. Weakened trees are then invaded by other insects or diseases and the trees subsequently die. Healthy trees could

withstand the secondary pests, but in a weakened condition, there is not sufficient energy reserve to survive. Usually, the progression of decline is slow, occurring over several years. Control of oak decline is generally considered to involve keeping the trees healthy, and thus able to withstand pests and diseases. Certain causal factors such as drought and frost cannot be controlled, but management actions such as thinning can reduce competition for moisture and nutrients and thus promote a better physiological condition of the remaining trees. (Wargo, Houston, LaMadeleine, 1983)

## Old Growth

### Old Growth Forest Characteristics

As described above, frequent fires were a common occurrence and the fires had significant effects on the species and structure of the forests before fire suppression became common. Since fire did have a long and significant effect on the forests of southeast Ohio, the following descriptions of old-growth forests will be made with the recognition that frequent fires had significant influences in developing the forests that existed at the time of European settlement.

Because of ecological micro-climates, a fire has different effects depending on factors including temperature, fuel moistures, aspect, and humidity. For example, in a deep cove the intensity of a fire would likely be very different than on a south facing ridge top. A cove will be cooler in temperature, the fuels on the ground will be moister, and the humidity may be higher; therefore a fire will be smaller and cooler and so affect the vegetation differently than on the ridge top. A fire could go around the cove, or not burn at all, if the fuels are moist enough in the cove. Conversely, a fire is likely to burn hot on south slopes and ridge tops because the fuels are drier and air temperature is warmer. This same principal applies to some stream and river bottoms; these are often moister and more protected and thus do not burn as hot or as frequently as the uplands.

This concept would result in the plant species being different on more mesic sites. The size of these different microclimates can vary from less than an acre, for example, in a small cove and up to several hundred acres along some river corridors.

Definitions of old growth include several physical attributes combined with local plant species and their particular niches considering other events such as fire and weather.

Following are the physical characteristics of Old Growth that will be used on the WNF for all possible designations:

**Downed Logs** – Coarse woody debris (stems greater than 4 inches in diameter) are a common component of the forest floor. The downed logs are from a variety of size classes, and in various stages of decay, suggesting the logs are from a long-term process, not a single event such as a storm.

**Standing Snags** – Standing dead trees greater than 4 inches in diameter are prominent, indicating that trees have reached their natural mortality in place, and not selectively removed.

**Treefall Gaps** – There are many small blowdowns of one to several trees in each group. The gaps created by the blowdowns create a change in the understory microenvironment. As a greater solar radiation reaches the forest floor, advanced regeneration results in a forest with multiple layers (3 to 5) instead of the 1 to 2 typically found in a younger forest.

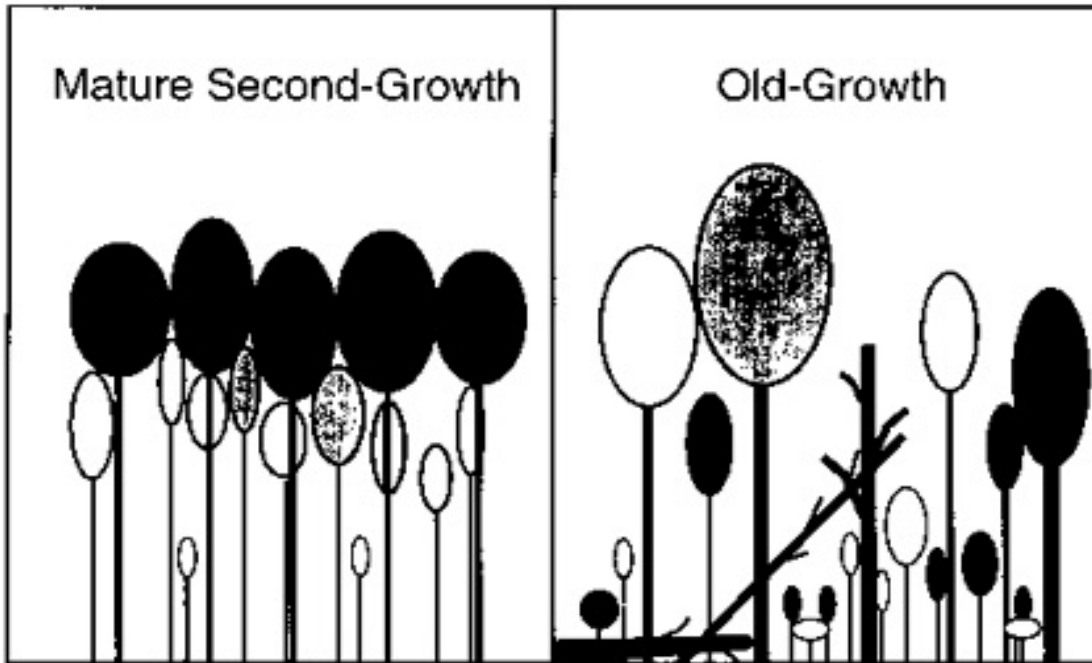
**Pit and Mound Topography** – The soil surfaces in old-growth is often dominated by a rolling topography produced by windthrown trees. When the trees are thrown, their root mat and associated soil is ripped up from the forest floor, creating a pit or depression. As the root ball decays, the soil is loosened and falls into a mound adjacent to the pit. These pits and mounds are important in forest nutrient cycling and understory diversity, but are generally absent from human-disturbed forests.

**Undisturbed Soils** – Old-growth forests typically have a soil which is high in organic matter, with a thick organic layer and considerable numbers of ferns, mosses, and fungi. Not having experienced recent heavy logging equipment, horses, dragged logs, or grazing livestock, the soils will not be compacted. Soil macropores (2 to 4 inches in diameter), formed by the dead decaying roots of old trees, are often present in the upper soil profile.

**Uneven-Aged Canopy Structure** – Eastern old-growth forests are generally characterized by trees of all ages and diameters. They typically exhibit a reverse-J age distribution, whereby younger stems are at a much higher density than older stems. The shape of the age distribution often (but not always) parallels that of the diameter distribution. The age/diameter structure is driven largely by small-scale natural disturbances and differential shade tolerance among species. To be considered an old growth stand, the number of large/old trees must be fairly well distributed across the area, and fit the reverse-J curve as described above.

Figure D - 2 shows the physical structure of a mature second growth stand compared to an old growth forest. The mature second growth forest has a closed canopy, very few small trees on the forest floor, and very little dead woody materials. In the old growth sketch, notice the many different sized

trees, gaps in the tree canopy created by the fallen trees, and the standing dead snags (McCarthy, 1995).



**Figure D - 2. Physical structure of a mature second growth stand compared to an old growth forest. (Source: McCarthy, 1995)**

Overtime, old growth characteristics will likely be present in forest stands on the WNF in each of the alternatives. These old growth stands would occur in the three forest systems found on the WNF: Central Appalachian Cove Forest System, Allegheny-Cumberland Dry Oak Forest and Woodland System, and Cumberland Dry Circumneutral Forest and Woodland System (TNC 2003; also refer to Draft EIS, Appendix E for more information about these forest systems).

Each of these forest systems are characterized by an association of various tree species. In addition to the old growth characteristics described previously, the stands would contain some trees of great age. Following are brief descriptions of these forest systems, along with examples of species and ages of older trees likely to be associated with future old growth stands. Tree ages were determined by adding 50 percent to the biological lifespan as listed in the *Silvics of North America* (Burns and Honkala, 1965), a method proposed by Dr. Brian McCarthy, Forest Ecologist, Ohio University (McCarthy, 1995). Old Growth in a pine type was not formulated because pine in southeast Ohio is generally a pioneer species that is replaced by hardwoods.

Forest stands with old growth characteristics would occur on a contiguous block of land at least 4 acres in size. When mapping forest stands, the Wayne National Forest's October 2002 *Guidelines for Delineating Stands*

calls for stands to be greater than or equal to 10 acres, unless something significant is present, then the minimum mapping unit is to be 4 acres.

#### **Allegheny – Cumberland Dry Oak Forest Old Growth:**

These stands would likely be located on the dry to moderate sites on the forest. Typical locations would be ridgetops, the upper one-third of the hills, southwest to southeast slopes, and some west slopes. This type was perpetuated in the past because of the frequent fires. Eventually, without fire, this type will evolve into a mixed-mesophytic type except for on the driest sites.

Typical tree species and ages of the older individual trees within the stand are:

- White oak – 300 years old
- Northern red oak – 180 years old
- Chestnut oak – 180 years old
- Hickory – 300 years old

#### **Central Appalachian Cove Forest Old Growth:**

These stands would likely be located on northerly and easterly slopes, on some lower slopes, and in coves. The sites where this type developed in the past were in locations where frequent and hot fires were rare. This allowed the fire-sensitive and shade tolerant trees to develop and mature.

Typical tree species and ages of the older individual trees within the stand are:

- Sugar maple – 375 years old
- American beech – 375 years old
- Red maple – 120 years old
- Yellow poplar – 300 years old
- Hemlock – 600 years old

#### **Bottomland Hardwood Old Growth:**

These stands would likely be located adjacent to major streams and rivers. The sites where this type developed were on soils that frequently flooded and stayed moist most of the year. Frequent and hot fires were rare.

Typical tree species and ages of the older individual trees within the stand are:

- Silver maple – 200 years old
- American elm – 250 years old
- Red maple – 120 years old

Sycamore – 300 years old

---

## Silvicultural Systems

### Even-aged Management

Even-aged forests occur naturally after a major disturbance initiates the processes involved in stand regeneration. Even-aged stands generally have one age class, although two age classes can be found in some two-layered natural or managed stands. These stands generally have a well-developed canopy with a regular top at a uniform height.

Pure even-aged stands generally have a nearly bell-shaped diameter distribution. This means that most trees are in the average diameter class. However, diameter distributions should be viewed cautiously because diameter can be a poor criterion for age. The smallest trees in natural even-aged stands are generally spindly, with vigor suppressed by the overstory.

### Clearcutting

In a clearcut system the stand overstory is generally removed in one harvest. The following silvicultural considerations are provided by Sanders and Graney (1992).

If there are adequate numbers of advanced oak seedlings that are vigorous and have well-developed root systems, clearcutting is the most effective method to regenerate the stand to species dominated by oak and hickory. Although understory species may appear to dominate the stand for about 10 years following clearcutting, the oaks and other overstory species begin to assert dominance, and by age 10-15 the understory species are generally in a subdominant position.

Stands should be a minimum of 2 acres in size. If the advanced oak reproduction potential is not adequate and the stand is clearcut, the new stand will be dominated by a varying mixture of species, but likely oaks and hickories will not dominate the site. With the exception of yellow-poplar, the species that dominate the advance reproduction will be predominant in the new stand. Yellow-poplar will also be abundant if it is present in the overstory, and some oaks will probably be present.

If the clearcut stand is on southeast or northwest middle and upper slopes, we can expect to have a stand at about age 20 that can be molded into an essentially pure oak stand by thinning. On north and east aspects and lower slopes, the stand composition may be highly variable. Yellow-poplar will likely be abundant. Other species such as white ash, black cherry, and red and sugar maples will also be present. However, if the oak

advance regeneration is adequate, expect to have a predominantly oak stand 20 years after clearcutting.

In practice, the WNF will not normally prescribe true clearcuts, in which ALL merchantable trees would be cut from an area. The Wayne is likely to prescribe *Clearcutting with Reserves*, which is a clearcutting method in which varying numbers of reserve trees are left standing to attain goals other than regeneration. The overstory trees that would be retained, called reserve trees, may be small or large trees, or combinations of small and large trees, retained for:

- Future growth

- Certain species components

- Current or future den trees; future sources of snags or coarse woody debris

- Visual quality

### Shelterwood

In general, a shelterwood treatment is the cutting of most of the trees, but leaving those needed to produce seedlings in a moderated microclimate (SAF, 1998). In particular on the WNF and in the central hardwoods, when the regeneration potential of the existing oak advance reproduction is not adequate to replace the stand, the shelterwood method can be used to develop the required advanced reproduction. The minimum number of advanced reproduction is determined by inventorying the area to discover the amount and size of oak seedlings and estimating the number of stump sprouts after cutting. The procedure is outlined in (Sander et al. (1976). The following silvicultural considerations are taken from Sander and Graney (1992).

When oak advance reproduction is small, scarce, or absent, the regeneration method most likely to produce the best results is the shelterwood method. However, the method must be tailored to produce the micro-environments required by oaks for successful seedling establishment and early seedling growth.

Without any specific treatment, oak advance reproduction is most likely to be inadequate on the middle and lower north- and east-facing slopes; south-facing slopes and ridge tops may develop advanced oak regeneration without specific treatments because of the dry and open microclimate.

When applying the shelterwood method to develop oak regeneration, following are some general practices (Sander and Graney, 1992). Depending on site-specific conditions some or all of these treatments are probable.

Control the understory that will compete with the small oaks by cutting or preferably killing the non-oak species by prescribed burning or applying herbicides.

Reduce the overstory to 40-80 percent stocking. Leave the best dominant and codominant oaks as uniformly spaced as possible.

If possible, apply the understory and overstory treatments before seedfall in a good seed year.

Monitor seedling establishment and growth and make additional light cuts to keep the overstory from restricting growth.

Apply additional understory control if the understory redevelops to a point where it restricts the oak reproduction growth. This control may be desirable 5-10 years after the original treatment; treatment could be by prescribed burning or applying herbicides.

When the regeneration potential of the oak reproduction is adequate to replace the stand, remove the remaining overstory sufficiently to allow the oaks to fully develop. The length of time required to establish oaks and grow them to adequate size under a shelterwood will probably be 10 to 20 years or more.

When using prescribed fire to develop oak seedling development, more than one burn may be needed if oak regeneration is not adequate after one burn. In many situations within the Central Hardwood Region and beyond, decades of fire exclusion have allowed oak competitors to become so firmly established that oak regeneration may not be as plentiful as desired. Oak dominance of the advance regeneration can be increased with repetitive burning (Van Lear, 2004).

In one study, Brose and Van Lear conducted a shelterwood harvest, followed by a variety of prescribed burns. Oak regeneration density was not reduced by any fire prescription, but yellow poplar density was reduced and resprouting poplar stems exhibited accelerated growth for only one year. Red maple density was significantly reduced after moderate to high intensity prescribed burning. Results indicated that prescribe burning after a shelterwood is a promising approach to regenerating oaks on productive sites. (Brose, P , Van Lear, D. 2004)

Another silvicultural treatment that has proved effective on more mesic sites is to remove midcanopy and some lower canopy trees and leaving a main canopy with no large gaps, the survival and growth of small oak advance reproduction increases. This treatment allows the population of small oak advance reproduction to develop after a few years into a population of larger advance reproduction, making oaks more competitive after release. Plus, this process also reduces competition from other species. Potential sprouts from midcanopy and lower canopy trees are treated with herbicides or prescribed fire, thereby directly reducing

competition from these trees both before and after overwood removal. The reduction in competition from yellow-poplar is more subtle. First, while the residual canopy with no canopy gaps is sufficient to allow oak seedlings to develop, it is not sufficient to allow the establishment and development of yellow poplar. Secondly, new yellow-poplar seedlings that become established after overwood removal will be in an inferior competitive position, at least on a patch-wise basis, because of the development of large advance reproduction of oaks and other species (Loftis, 2004).

## Two- Aged Management

The two-aged system regenerates a timber stand and maintain two age classes (SAF, 1998). Various other publications refer to this type of management scenario as deferment cutting, irregular shelterwood, or a shelterwood with reserves. As applied on the Wayne, the objectives of the harvest would include the need to develop early-successional wildlife habitat, while at the same time retaining an important overstory component. The Forest would retain 15 to 20 square feet of basal area per acre of the original overstory; the selection of the “leave trees” would be based on plant and animal habitat needs. For example, if the average diameter of the retained trees was 18 inches, this would be approximately 9 to 12 trees per acre. To regenerate the two-aged areas to an oak-hickory forest type, the same adequate numbers of healthy and well distributed oak seedlings must exist as was discussed for clearcut harvests prior to applying the two-aged harvest.

Perkey et al. (1999) reported the following observations regarding the development of two-aged stands after a regeneration cut in the central Appalachians.

Leaving 12 to 15 residual overstory trees per acre and cutting all other trees 1-inch dbh and larger resulted in hardwood reproduction similar to that expected after clearcutting.

In the Fish Trough treatment area, a sample of 10 yellow-poplar overstory crop trees was remeasured at about age 94 to determine if they were still growing well; they were. During the first 16 years of the study they grew at a rate of 2.9 inches/decade. During the last 3 years they grew at a rate of 3.2 inches/decade.

Residual overstory trees (the older age class) were still free to grow, with an average of 20 feet of growing space between adjacent crowns; these trees were scattered over the area, not left in clumps or corridors.

At 10 years, 70 to 85 percent of codominant reproduction had the potential to become timber crop trees. Three of the four treatment areas can be regarded as successfully regenerated with acceptable quality stems.

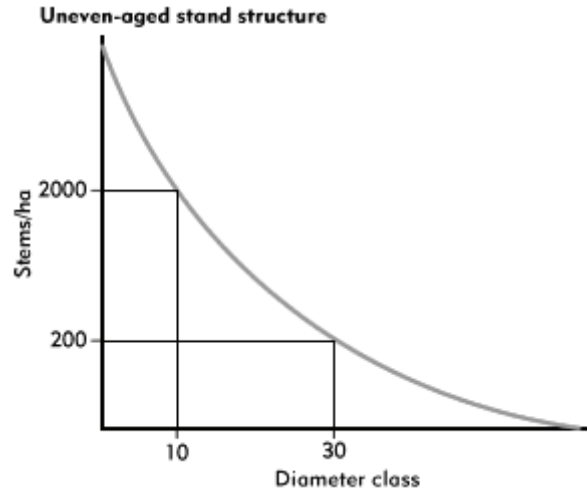
The canopy of the younger age class was nearly closed after 10 years.

Frequently, grapevine control work is needed in the younger age class of two-aged stands, just as it is needed in young stands regenerating after a clearcut

Tree regeneration in the two-age harvest areas would be adequate if implemented as described. Experimental harvests on the Monongahela National Forest applied from 1979 to 1983 indicated that reproduction developed included a wide variety of species, similar to that observed after clearcutting. Also, the experiments found that 89 percent of the larger trees left uncut had survived, 76 – 100 percent of the survivors maintained their initial grade, and diameter growth increased for most species (Miller et al., 1997).

### Uneven-aged Management

Uneven-aged management treatments work towards the goal of creating and maintaining an area in an uneven-aged condition. An uneven-aged stand has trees of three or more distinct age classes, either intimately mixed or in small groups (SAF, 1998). Also, uneven-aged stands have an uneven and highly broken or irregular canopy (often with many gaps). This broken canopy allows for greater light penetration and encourages deeper crowns and greater vertical structure in a stand. Most stems occur in the smallest age/size class, as regeneration quickly fills the canopy gaps. The number of small trees declines through normal species competition as age/size classes increase, to the point where the large trees are low in number and scattered (although distribution may be highly regular). In its ideal form, where diameters approximate age, distribution of diameters in uneven-aged management will approach the classic inverted-J form. As you progress through the diameter classes, the number of stems per acre drops in an inverted geometric fashion, giving a dipping curves relationship which looks like the mirror image of a "J" without the top. Figure D - 3 shows the distribution of trees in an uneven-aged condition. Note that there are a large number of very small trees and very few large trees per acre.



**Figure D - 3. Distribution of trees in an uneven-aged condition**

Initially, to convert an even-aged stand to an uneven-age stand, the objective is to develop new age classes, but not to immediately create a structure as pictured in the graph above. Eventually, a more formalized uneven-aged regulation method can be implemented to supplement and guide the retention of given levels of stocking in the different age classes. Although a q-factor based approach is essential for maintaining an established uneven-aged structure in an oak-dominated system, using q-factor ratios is not applicable when beginning to convert stands from an even-aged to an uneven-aged structure.

Conversion of a stand to an uneven-aged structure cannot be accomplished in the same manner as the maintenance of stand structure in an existing uneven-aged stand. Generally with the objective of changing the stand's structure to uneven-aged, the first harvest in the stand would be a reduction across the stand of one-third but no more than 60 percent stocking. Depending on the stand's age or species mix, the cutting could target different trees. Considerations would include such concerns as whether the stand has a component of short-lived trees which could not survive through the time that would be required to develop the uneven-aged structure. Therefore, the exact prescription must be tailored to each stand (Loewenstein and Guldin, 2004).

The larger trees that are retained in an uneven-aged harvest will add to the visual character of the area, provide important wildlife habitat, and will provide large quantities of seed from individuals that have been successful on that site.

### Single-tree selection system

Single-tree selection methods are most appropriate for stands in which the desired species composition is to be composed of primarily shade-tolerant species such as beech and maple. Therefore, the single tree selection method generally is considered inappropriate for regenerating oak forests (Hicks, 1998).

The establishment and development of oak regeneration is not as likely or consistent using the single-tree selection system. Harvesting single trees to achieve and maintain a specific diameter distribution does not provide the microclimate needed for oak regeneration, but does provide the conditions needed for the establishment and growth of shade-tolerant species (Sander, Graney, 1992). Over time, single-tree selection in a mature oak stand will convert the area to predominantly shade-tolerant species such as beech and maple.

However, empirical and experimental data suggest that under certain specific conditions, oak stands can be managed using uneven-aged methods (Loewenstein and Guldin, 2004). By applying oak advanced regeneration techniques, such as controlling the mesic seedlings, the oak component of the resulting uneven-aged stand can be increased, but it is unlikely that oak and hickory will be majority components of the stands in the long term. If the more shade tolerant and mesic species are controlled, the more xeric parts of the stand, such as south-facing slopes and ridgetops, may have significant oak and hickory components, but the mesic parts of a stand, such as the lower elevations, coves and north slopes, will likely be occupied by more mesic species such as yellow poplar, maple, and beech.

Oak seedlings have been found to show greatest response and successful establishments in the centers of forest clearings and a retardation of growth on the edges of openings. High levels of sun light are required for the survival and growth of advanced oak regeneration and that these light conditions cannot be achieved by the single tree selection method (Fischer, 1979).

### Group Selection Systems

Group Selection is a system of tree regeneration in which the objective is to create an uneven-aged stand by regenerating parts of the stand by cutting small “groups”. The stand is managed as a whole, including the groups cut and the uncut portions in between the groups. Individual groups are not managed as individual stands. As applied on the WNF, to regenerate oak-hickory types, each group can be up to 2 acres in size. When regenerating shade tolerant species, such as maple and beech, the groups are up to the height of two mature trees (0.4 to 0.7 acres).

Group selection can be used to reproduce oaks satisfactorily, assuming (Sander and Graney, 1992):

The oak advance reproduction is adequate

Culls and small trees within the groups are cut or killed, unless specifically retained for wildlife or other.

The growth and development of the reproduction will be similar to the responses after clearcutting, except that reproduction growth will be retarded in a large part of the opening area because of the influence of the surrounding stand (Sander and Graney, 1992).

If the oak advance reproduction is not adequate, cutting the trees to create the opening will not result in oak reproduction, and the opening will be filled by whatever species are present in the understory and by species that have seeds on the site, such as yellow poplar. If there is not adequate advanced oak regeneration, the procedures for developing it as described above for the shelterwood, would be implemented first (Sander and Graney, 1992).

Frequently at the same time as the groups are being cut to create a young age-class, the other parts of the stand will be thinned to enhance oak reproduction establishment and growth throughout the stand.

## Intermediate Silvicultural Treatments

### Effects of Cleaning Treatments and Precommercial Thinning

Cleanings are release treatments performed during the sapling stage to free selected trees from competition of overtopping trees of comparable age (or woody vines and shrubs) and to favor the trees that are needed to meet wildlife habitat or other management objectives.

It is better to wait until the stand is well into the sapling stage and has a closed canopy in order to make better decisions regarding future crop trees and to assure that stump sprouts will not overtake the desirable trees. Simply cutting most broadleaved trees and shrubs will normally stimulate sprouting, and often with increased vigor. To prevent this, workers might apply an herbicide (Nyland, 1996).

Benefits of release from cleaning vary with species, age, degree of suppression, and completeness of a treatment. Generally, cleaning works best in young stands while the preferred trees still have sufficient vigor to respond to release.

Timber crop tree management can provide high-quality timber products from individual trees growing at a rapid rate. The limiting factors in managing for crop trees are:

The existing number of good-quality trees

Increasing their growth while retaining their valuable characteristics.

Crop tree selection criteria include:

Select dominant/codominant trees at least 20 feet tall with large healthy crowns. On the WNF, this height would be attained when the regeneration is from 10 to 20 years old.

Select low-origin stump sprouts with U-shaped connections. Stump sprouts that originate close to the ground are suitable crop tree candidates if they are stable and have good form.

Select trees with no epicormic branches. For most species, dominant/codominant trees with large crowns and good vigor are not likely to epicormic branch to a significant degree.

Select trees without leans or forks

### Grape Vine Control

When wild grapevines grow into the tree crowns, especially in young trees, they can damage trees by breaking the tops and limbs, twisting and bending the tree boles, and uprooting trees. Wild grapevines grow best on moist soils and in full sun; prolonged shade reduces growth and will kill the vines. The vines sprout prolifically when cut.

Since grapevines are intolerant of shade, the vines will generally die or not be a problem if they are cut near ground level, and the crown of the surrounding stand has closed so that the ground is well shaded.

If grapevines are present in the stand before harvest, and an even-aged harvest is planned, it can be assumed that grapevines will be a problem in the regenerating stand because of the combination of sprouting vines and multiple seedlings after harvest plus the increase in available sunlight. Grape seed stays viable for many years.

Solutions to a grapevine problem are most commonly (Smith, 1984):

After an even aged or group selection harvest, in the first 10 years after the ground is shaded, sever the grapevines at ground level; the vines will resprout, but will die.

At least 4 to 5 years before an even aged or group selection harvest, sever the grapevines at ground level; the vines will resprout, but will die before the harvest.

If a harvest is planned within 4 years, treat the vines with an herbicide treatment.

(Note: If the area is treated before the harvest, it is likely that a post treatment may be necessary, particularly on better than average sites, also because of the seedlings that will start from the seed already on the forest

floor. However, the growth rate of the vines from the seedlings would be much less than that from established roots, so the damage will be less.)

All of the grape vines will not be eliminated from an area. Any sensitive or rare species of grape will be retained. Grape arbors (large concentrations of vines in a small localized area) will be left untreated. The wildlife habitat impacts will be considered before any control is begun.

### Commercial Thinning

As the trees in a stand of timber grow, they compete with each other for nutrients, water, space, and sunlight. Each tree attempts to grow as fast and large as possible so that it can maintain a good position to compete for food, water and sunlight. As time passes however, there is always a limiting factor that prevents all of the trees from their full potential. Sometimes the species of tree or genetic make-up of individual trees predispose individuals to be less effective competitors. Trees that do not grow as fast as the others become weakened and increasingly less competitive for sunlight, water, nutrients, and/or space. These trees are those with small live crowns that cannot reach direct sunlight because they are shorter than the best competitors. These trees are more vulnerable to damage from insects and diseases, and will likely die before their normal life spans would predict.

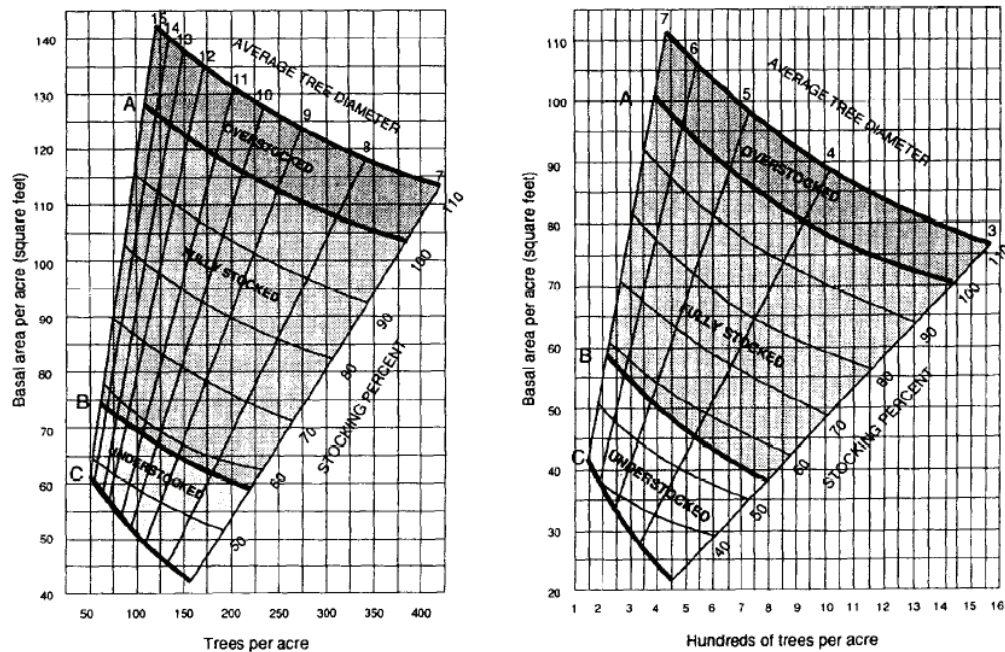
Also, even trees that have succeeded in becoming dominant or codominant trees often have different natural life spans. For example on the WNF, individual white oak trees can live to be a maximum of 200 to 600 years old, whereas the oldest scarlet oak trees normally can live only 100 to 150 years. These ages are for individual trees; like people, some die young while others live beyond the averages. However, as can be seen when comparing scarlet and white oak longevity, some species are more likely to live longer than others.

As the stand of trees is growing, the lower the density of trees on the site, the healthier and larger the individual trees will be since the available nutrients, water, space, and sunlight is shared among fewer individuals.

Thinning the forest by reducing the density of trees is normally done to accomplish one or more of the following objectives:

- Improve growth of the remaining trees
- Enhance the overall health of the forest's trees so they can withstand insects and diseases
- Recover potential mortality
- Favor the species of trees that will best meet the objectives of the area.

The relative stand density is determined using one of several stocking guides or charts developed for eastern hardwoods. The relative density of the stand is then compared to management stocking levels. Acceptable growing stock (AGS) is defined as trees of acceptable species, form, and quality that could be selected as crop trees. One common method of quantifying and comparing relative stocking is by using the graphs in Figure D - 4 that was developed by Gingrich in 1967 (Gottschalk, 1993). A stocking level of 80 percent defines the upper management zone (sufficient mortality increase, growth decline, and volume present to thin). The lower management zone is 60 percent or B-level stocking (minimum residual level to thin to). Stands between 60 and 80 percent stocked usually do not need to be thinned (Gottschalk, 1993).



**Figure D - 4. Relative stand density for upland hardwood stands, including oak. (Source: Gottschalk, 1993)**

Oak, and other, stands could be thinned when they have greater than B-level density of acceptable growing stock that are more than 15 years from maturity and have more than 80 percent relative density. Under normal management, they would receive a commercial thinning from below. The commercial thinning would reduce relative stand density to 60 percent, but not remove more than 35 percent in any one cut. It should remove unacceptable growing stock, harvest anticipated mortality, increase the growing space for residual trees, and possibly decrease the rotation length depending on the overall objectives for the area. The result is an increase in average stand diameter, a reduction in rotation length, and an improvement in stand quality and value. (Gottschalk, 1993)

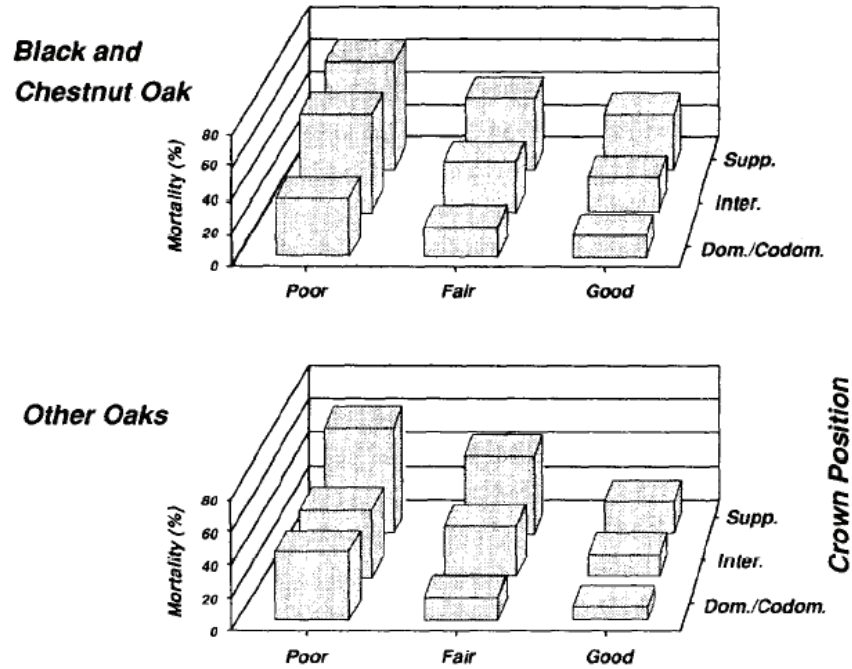
---

## Gypsy Moth

The Gypsy Moth (a non-native) is advancing across the northeastern United States. The population has reached the northeastern edge of the Forest, and will likely spread across the remainder of the WNF in the next 10 to 15 years.

To preserve the health and future composition of the Forest, several treatments, such as the “Slow-the-Spread” campaign will likely be instituted by different agencies such as the USDA Forest Service (State and Private Forestry) and the Ohio Department of Natural Resources. In addition to these tactics, thinning the forest in advance and after the Gypsy Moth infestations can help to minimize damage and guard against significant impacts to the Oak component of the Forest. Presalvage thinning is designed to reduce damage by removing highly vulnerable (high hazard) trees before they are defoliated and die; the major objective is to reduce stand vulnerability. Secondary objectives of the treatment are to increase stand and tree vigor (and crown condition), to remove structural features or refuges for gypsy moth larvae and pupae, and to promote predator and parasite habitat. (Gottschalk, 1993)

The chances of oak trees dying after Gypsy Moth infestation is tied to the health and position of the tree’s crown. The charts in Figure D - 5 show the rate of tree mortality based on these two factors; as can be seen, the trees with crown in the understory that have poor conditions (small and sparse) most commonly die after an infestation.



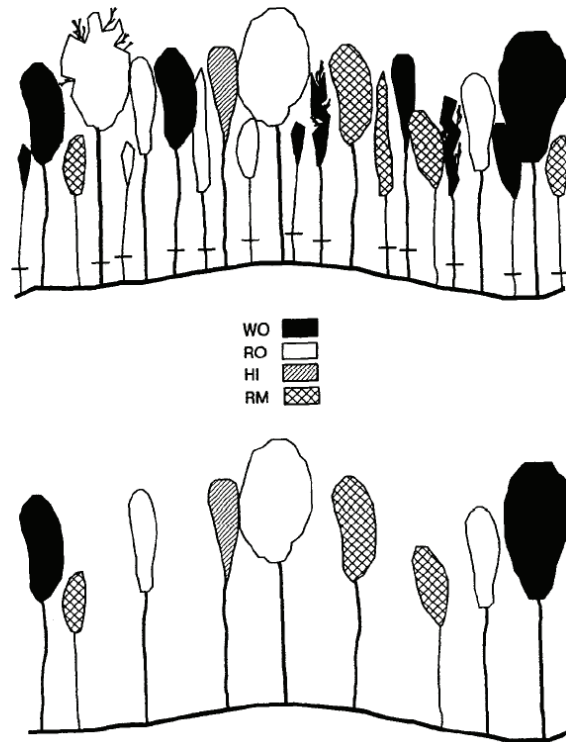
**Figure D - 5. Rate of tree mortality based on health and position of the tree's crown. [Supp. = Suppressed; Inter. = Intermediate; Dom./Codom. = Dominant and Codominant] (Source: Gottschalk, 1993)**

When presalvage thinning before the Gypsy Moth has arrived, the normal thinning prescription must be altered slightly. In stands with more than 50 percent of their basal area in gypsy moth-preferred food species, as is the case for most of the WNF, the normal thinning prescriptions will not reduce the preferred food species enough to significantly change the stand's susceptibility. Presalvage thinning concentrates on reducing vulnerability. It is necessary to implement presalvage thinning 1 to 3 years before defoliation because the stand needs time to recover from the stress and disturbance caused by the thinning. As part of the stress induced by thinning, stands may be temporarily disposed to attack by certain damaging agents. However, these harmful effects gradually reduced by the increased tree growth and vigor that occur eventually (Gottschalk, 1993).

As a supplement to normal thinning guidelines (such as removing unacceptable growing stock and targeting a specific density), priorities for marking trees to be removed are (highest to lowest): 1) oaks with poor crowns, 2) non-oak species with poor crowns, 3) oaks with fair crowns, and 4) non-oak species with fair crowns.

The upper drawing in Figure D - 6 depicts marking priorities for presalvage thinning in an older stand (-) (WO = white oak, RO = red oak,

HI = hickory, RM = red maple). The lower drawing shows the result of thinning.



**Figure D - 6. Marking priorities for presalvage thinning in an older stand (upper) and the result of thinning (lower).**

---

## Oak Management in the Historic Forest Management Area

As described in the desired future conditions for the HF and HFO management areas (see proposed Revised Forest Plan), one of the main visions is that the land in these management areas will eventually mimic the conditions of several hundred years ago when oak dominated the landscape. The treatments that are likely include intensive thinning (to maintain a 50 percent to 60 percent stocking), frequent prescribed burns to control the more mesic species and promote oak regeneration, and herbicide treatment.

The herbicide treatment will likely be necessary initially when the forest community is being transformed into the desired conditions because the mesic species, such as maple and poplars, will be too large to be effectively controlled by prescribed burns. Once the structure and composition of the forest community has reached the desired condition and the number of maples and poplars are minimal and small, the periodic fires will likely control these species.

For the first 2 or 3 decades, thinning may be needed as the crowns of the trees expand to levels outside the desired condition. After the historic forest system is in place and functioning (in 30 to 50 years), some periodic timber removal may be necessary to release seedlings to grow.

### Effects to Understory Vegetation

Between 1993 and 1995 a ground-layer vegetation study was done in Indiana on 150 on mesic slope and dry-mesic slope forests plots to determine how the understory of these forests responded to forest management (Jenkins and Parker, 1998). Since the ecology of this study area and the Wayne National Forest are similar, the effects would likely be reasonably close. Four different stand types, clear-cuts (5-30 acres), group-selection openings (0.25-4 acres), single-tree selection openings (0.25-4 acres) and uncut 80–100 y-old reference stands were sampled. There was little relationship between the percent cover of most ecological species groups and opening age or size on either mesic or dry-mesic slopes. While clear-cuts and group-selection openings had significantly greater cover of several ecological species groups (used to classify mesic and dry-mesic slopes) than reference stands, single-tree selection openings did not differ significantly from reference stands in the cover of any ecological species group. More ground-layer species were significantly correlated with opening size than opening age, suggesting that the size of the initial opening has more influence on species composition than opening age. Overall, forest management has not constituted a severe enough disturbance to shift ground-layer species composition away from that associated with the sampled ecological landtype phases (mesic and dry-mesic slopes). Aspect was the dominant factor determining species distribution of ground-layer vegetation in both openings and reference stands.

In openings, the cover of species dependent on disturbance decreased with opening age and will eventually return to that of reference stands. Other studies have shown that this flush of disturbance species dominance is relatively short-lived (and may be important in retaining the nutrient capital of a site after disturbance) (Jenkins and Parker, 1998).

Forest management does favor some ecological species groups. The cover of Canadian wild ginger (*Asarum spp.*) within group-selection openings on mesic slopes was three times that in reference stands. Conversely, the

cover of blueberry (*Vaccinium spp.*) in clear-cuts on dry-mesic slopes was five times that of reference stands. The increased light reaching the forest floor on dry-mesic slopes may combine with low water availability to allow blueberry (*Vaccinium spp.*), a species group more typical of dry slopes and ridges, to increase in cover. On mesic slopes, the reduced competition for light and water may have allowed the increased importance of the wet-mesic Canadian wild ginger (*Asarum spp.*) (Jenkins and Parker, 1998).

Opening size may be more important than opening age in determining the species composition of silvicultural openings. While a given area may follow a distinctive sequence of post-harvest recovery, the size of the initial opening determines the rate of recovery. The forest floor of large openings has higher light intensities for a longer time, thus allowing early successional and shade-intolerant species to persist longer. Species composition has been shown to change little after the creation of smaller openings (Jenkins and Parker, 1998).

Openings on mesic slopes have greater species richness than reference stands. This increased richness was mostly due to an influx of disturbance and Canadian wild ginger (*Asarum spp.*). However, the cover of early successional species should continue to decrease with increasing stand age, thereby returning species to reference stand level (Jenkins and Parker, 1998).

Overall, after Central Hardwood forests have passed through the stand initiation phase of development, ground-layer species composition returns to a state similar to that of uncut 80 to 100 year old stands (Jenkins and Parker, 1998).



## Appendix E

# Plant and Animal Diversity and Management Indicators

---

## Plant and Animal Diversity

This section summarizes the analyses that were conducted to ensure the conservation of the wide variety of terrestrial and aquatic species integral to maintaining ecological, social, and economic sustainability on the Wayne National Forest. It also demonstrates how the results of the analyses were incorporated into the development of the alternatives. This section outlines the:

- Legal requirements, policy, and public participation that are relevant to addressing and analyzing plant and animal diversity
- Methodology and scientific accuracy of the species viability evaluation process
- Identification of management indicator species to address legal requirements, policy, and public issues relevant to addressing and analyzing plant and animal diversity.

## Legal and Policy Framework

The legal and policy framework for the development of alternatives, other than NEPA, is provided primarily by these regulations:

- **36 CFR 219.19 (1982):** “Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area.”<sup>1</sup>
- **Department of Agriculture Regulation 9500-4:** “Manage habitats for existing native and desired non-native plants, fish, and wildlife species in order to maintain at least viable populations of such species.”
- **36 CFR 219.19 (1982):** “For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area. In order to insure that viable populations will be maintained habitat

---

<sup>1</sup> The 2005 Planning Regulations, 36 CFR 219.14(e) (January 5, 2005) allow the use of the 1982 planning regulations for this Plan since it was initiated prior to the transition period defined at 36 CFR 219.12(b).

must be provided to support at least a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area.”

- **36 CFR 219.26 (1982):** “...provide for diversity of plant and animal communities and tree species consistent with the overall multiple use objectives of the planning area.”
- **36 CFR 219.6 (2):** “Ensure that the Forest Service understands the needs, concerns, and values of the public.”

We considered the public’s interest in and need for plant and animal diversity, which included:

- The public’s comments on their needs, concerns, and values for plant and animal resources (see Draft EIS, Appendix A for a summary of the public involvement process)
- Review of annual Forest Plan monitoring reports, and development of the Analysis of the Management Situation
- Discussions with researchers with the Forest Service’s Northeast Forest Experiment Station who are responsible for conducting research on the role of fire in southeastern Ohio’s oak ecosystem
- Coordination with State & Private Forestry on future insect and disease threats to forest communities on NFS lands
- Compilation and review of scientific literature pertaining to conservation of biodiversity, and plant and animal species of viability or conservation concern
- Discussions with recognized taxonomic experts (i.e., persons recognized by their peers as having expertise in one or more species gained through research, education, study, or experience) on viability concerns for native and desired non-native species found within the WNF
- Coordination with other public planning efforts which included The Nature Conservancy’s Western Allegheny Plateau broad scale assessment and the Ohio Department of Transportation’s Nelsonville Bypass Project
- Coordination with other state and federal agencies with an interest in or responsibility for plants and animals and their habitats.

### Integrating Biological Diversity into the Revised Forest Plan

Regulations and policy require the Forest Service to be concerned with all species of plants and animals on NFS lands. This section will demonstrate how we used the best available scientific information to identify species and habitats that are considered rare or declining, and how we

incorporated conservation measures into the development of the alternatives to conserve and restore these habitats and species.

## Analyses Completed to Support the Development of Alternatives

### Broad Scale Assessment of the Western Allegheny Plateau Ecoregion

We used The Nature Conservancy's (TNC) broad scale assessment of the Western Allegheny Plateau ecoregion to identify ecologically significant landscapes for the WNF. These ecologically significant landscapes (i.e., matrix forming landscapes, ecological drainage units, and aquatic ecological systems) received special attention during alternative development.

The Nature Conservancy, in association with numerous ecological experts, conducted a broad scale assessment of the Western Allegheny Plateau, an ecoregion which aligns itself closely with the Southern Unglaciaded Allegheny Plateau (TNC, 2003). The purpose of the assessment, in part, was to characterize the biological diversity of the area and highlight areas on the landscape critical to biodiversity conservation.

As a coarse-filter strategy for conserving terrestrial biodiversity, TNC utilized the concept of matrix-forming landscapes in their broad scale assessment. Matrix-forming landscapes are made up of all forest types, and form extensive cover on the scale of thousands to millions of acres. These matrix-forming landscapes are often influenced by disturbances or ecological processes such as ice storms, insect outbreaks, and fire. Within the matrix-forming landscapes, smaller patch-forming communities occur and are characterized by a mosaic of successional forest stages resulting from disturbance processes (TNC, 2003). Through this coarse-filter strategy, matrix-forming landscapes would play an important role in the conservation of most species, including wide ranging fauna such as predators, forest interior birds, and rare species.

Potential matrix-forming landscapes were evaluated as to their size or "resistance" (i.e., 15,000-20,000 acre minimum), condition or "resilience" (i.e., low road density, large regions of core interior habitat, large patches of more mature forest), and landscape context or "persistence" (i.e., continuous forest cover, presence of wide-ranging species). Three of the 18 matrix-forming landscapes identified in the Western Allegheny Plateau ecoregion were located on the WNF, one on the Marietta Unit and two on the Ironton Ranger District.

The Wayne has a relatively homogeneous landscape. However, landform and aspect have the most influence on forest communities (USDA Forest Service, 1999), and because of that a mix of three forest systems can be found within the three matrix-forming landscapes: Central Appalachian Cove Forest System, Allegheny-Cumberland Dry Oak Forest and

Woodland System, and Cumberland Dry Circumneutral Forest and Woodland System (TNC, 2003).

As a coarse-filter strategy for conserving aquatic biodiversity, TNC utilized the concept of ecological drainage units and aquatic ecological systems. Ecological drainage units are thought to contain aquatic systems with similar patterns of physiography, drainage density, hydrologic characteristics, connectivity and zoogeography. Aquatic ecological systems are defined as dynamic spatial assemblages of aquatic ecological communities that occur together in an aquatic landscape with similar geomorphologic patterns, ecological processes (e.g., hydrologic and nutrient regimes, access to floodplains), and environmental gradients (e.g., temperature, chemical, and habitat volume). They form a robust, cohesive and distinguishable unit on a hydrography map that can be used to partition and classify environmental patterns. Aquatic ecological systems are intended to characterize the potential aquatic communities and species occurring in different stream types.

Two priority ecological drainage units identified in TNC's broad scale assessment encompass parts of the WNF. The Marietta Unit is within the Glaciated Ohio Tributaries ecological drainage unit and the Ironton Ranger District is within the Southern Allegheny Plateau ecological drainage unit. These ecological drainage units represent a historically diverse aquatic fauna, which have been impacted by dam construction, resource extraction, agriculture, industrial effluents, and non-native species introductions. This has resulted in a decline in native fishes and an increase in non-native fishes.

Two aquatic ecological systems occur on the Marietta Unit. These can both be described as having low to moderate elevation and acidic sedimentary bedrock. The aquatic ecological systems differ in size and dominant landforms within the watersheds. The larger downstream system is dominated by sideslopes with large amounts of coves, gently sloping flats and slope bottoms. The two smaller systems which drain into the larger aquatic ecological system have very high amounts of summit/upper slope and sideslope/coves with some gentle slopes. These collectively represent the Little Muskingum watershed, an ecoregionally significant watershed (TNC, 2003).

Two ecologically significant watersheds occur on the Ironton Ranger District, Symmes Creek and Pine Creek watersheds. These are located in two aquatic ecological systems, both of which have low elevations with acidic sedimentary bedrock. The downstream system is larger and dominated by sideslopes and gently sloping flats with larger amounts of slope bottoms and some upper slopes, flat summits, coves, and patchy surficial sediments. The smaller aquatic ecological system has large amounts of sideslope/cove/summits with substantial gentle slopes, and

more dry flats on fine grained sediments than any other aquatic ecological system in the Southern Allegheny Plateau ecological drainage unit.

## Species Viability Evaluations

Our evaluation of plant and animal species viability is our best judgment at this time. Due to the complexities of ecosystems and inevitable gaps in information, viability evaluations are not an exact science. However, we used the best available scientific information and requested input about species of viability concern from recognized taxonomic experts. These experts are considered to have knowledge and expertise of the species and biological communities within the WNF and Ohio, and the Southern Unglaciaded Allegheny Plateau Ecoregion. They are affiliated with the Ohio Division of Wildlife, Ohio Division of Natural Areas and Preserves, U. S. Fish and Wildlife Service, Ohio EPA, The Nature Conservancy, Cleveland Museum of Natural History, Museum of Biological Diversity at The Ohio State University, the Ohio Historical Society, universities, and other natural resource agencies and heritage programs in neighboring states, as well as individuals not affiliated with any particular institution. The following describes our species viability evaluation process.

### Step 1

We used taxonomic experts to develop a list of plant and animal species of viability and conservation concern for the WNF.

Species of viability concern included federally listed species and Regional Forester sensitive species.

The U.S. Fish and Wildlife Service lists nine endangered (E) or threatened (T) species as occurring within or adjacent to the Forest. These include the Indiana bat (E), bald eagle (T), American burying beetle (E), fanshell (E), pink mucket pearly mussel (E), running buffalo clover (E), northern monkshood (T), Virginia spiraea (T), and small whorled pogonia (T).

Twenty-nine species were recognized by the Forest Service as Regional Forester sensitive species for the WNF when we started this process. These species were identified through the Region 9 Regional Forester's Sensitive Species designation process (FSM 2672, R9 Supplement No. 2600-2000-1). During that process, many species were evaluated, including those identified by Forest Service biologists and taxonomic experts and other interested people. Risk evaluations used to identify species and to maintain the Regional Forester sensitive species list are on file at the Supervisor's Office in Nelsonville, Ohio. Regional Forester sensitive species are documented in the Biological Evaluation (Appendix F).

Other species were identified for which there was a viability or conservation concern now or in the future with continued implementation

of the Forest Plan (Alternative A). This list of species was derived from various sources:

- Conservation targets identified by The Nature Conservancy in their broad scale assessment of the Western Allegheny Plateau
- Species ranked as S1 (critically imperiled) or S2 (imperiled) in Ohio
- WNF management indicator species with declining population trends
- Avian species of concern on the Audubon Watch List and Partners in Flight Watch List
- Plant species on the Committee on International Trade of Endangered Species (CITES) list.

These data sources produced a list of 118 plant and animal species of viability or conservation concern with documented occurrences within the Forest proclamation boundary (i.e., planning area) within the last 25 years.

## Step 2

We took the list of 118 plants and animals of viability or conservation concern and grouped them by broad habitat categories. For each species, we made a determination as to what broad habitat it required (e.g., early successional hardwood forest, mature hardwood forest, etc.) or what broad aquatic habitat type it required (e.g., riverine-riffle, riverine-pools, wetland, etc.). We also considered management needs that would reduce or eliminate threats to viability when grouping species. For example, the taxonomic experts identified some plant species which are threatened by fire suppression because they are fire-adapted (e.g., juniper sedge), and therefore they would benefit from management that prescribes low intensity ground fires. In some cases, there was not enough known about a species to be able to place it into a certain habitat category or management need grouping.

For purposes of this species viability evaluation process, one or more species were chosen to serve as focal species for the remaining species in each of the habitat or management needs groups. Focal species were selected because they were believed to be indicative of the status of a larger functioning group of species, could be reflective of the status of a key habitat type, or because they encompass the habitat requirements of many other species due to their large area requirements or use of multiple habitats (COS, 1999). This list of focal species, in addition to all known federally listed species known to occur in the planning area and any species that could not be grouped with others because of a lack of information, were reviewed by the taxonomic experts.

Based on comments by the taxonomic experts, a list of 60 species was developed and carried through the remainder of the process (Table E - 1). This process, described below, included an exhaustive review of information to enable us to learn as much as we could about the needs of these species.

**Table E - 1. Plant and animal species carried through the species viability evaluation process**

<b>Mammals</b>	<b>Fishes</b>	<b>Plants</b>
Indiana bat	Eastern sand darter	Dwarf iris
River otter	Ohio lamprey	Featherbells
<b>Birds</b>	Ohio muskellunge	Juniper sedge
Bald eagle	Slenderhead darter	Kral's sedge
Cerulean warbler	Western lake chubsucker	Lined sedge
Field sparrow	<b>Mussels</b>	Marshes St. John's wort
Henslow's sparrow	Little spectaclecase mussel	Pale straw sedge
Louisiana waterthrush	Round pigtoe	Pigeon grape
Prairie warbler	Salamander mussel	Pinxter flower
Prothonotary warbler	<b>Insects</b>	Rock skullcap
Red-headed woodpecker	American burying beetle	Small-flowered alumroot
Ruffed grouse	Green-faced clubtail	Smooth beardtongue
Yellow-breasted chat	Grizzled skipper	Sparse-lobed grape fern
Wood thrush	Gilded river cruiser	Striped gentian
Worm-eating warbler	Olympia marble	Tall nut rush
<b>Amphibians</b>	Rapids clubtail	Thyme-leaved pinweed
Blanchard's cricket frog	Wabash river cruiser	Umbrella magnolia
Four-toed salamander	<b>Plants</b>	Yellow crownbeard
Hellbender	American ginseng	Yellow-fringed orchid
Mud salamander	Bicknell's panic grass	Yellow gentian
<b>Reptiles</b>	Blue scorpionweed	
Box turtle	Butterfly pea	
Timber rattlesnake	Carolina thistle	

### Step 3

We conducted a thorough review of the scientific literature to compile information about the 60 species for three geographic areas:

- Their range
- The Southern Unglaciaded Allegheny Plateau Ecoregion
- The planning area

For each species, a Species Data Collection Form was used to organize the information into five subject areas:

- Historical and current occurrence information
- Historical and current population information
- Life history
- Habitat, food, and population trends
- Identification and description of potential threats to viability for two time periods, 10 years and 100 years into the future

The literature review focused on peer-reviewed research and gray literature (e.g., natural resource agency reports).

When the Species Data Collection Forms were completed for each of the 60 species, one-day meetings were held with the taxonomic experts for the purpose of discussing each species. To facilitate the participation of the most taxonomic experts, six one-day meetings were held to discuss Open Area Plants; Woodland Plants; Sedges, Rushes and Grasses; Amphibians and Reptiles; Aquatic Species; and Insects. Follow-up meetings or telephone conversations were held with experts who could not participate during the one-day meetings. The topics covered at each meeting consisted of the following discussion points:

- Identification of missing or inaccurate information in the Species Data Collection Forms
- Validation of the threats to viability identified in the Species Data Collection Forms
- Discussion of the role of the WNF in maintaining viability of the species in its range
- Discussion of management methodologies or tools that help mitigate or eliminate threats to viability
- Identification of monitoring methodologies
- General discussion of potential effects to population viability from Forest Service management activities
- Identification of any further species groupings
- Discussion of whether viability of the species in the planning area is tied to landscape-level forest management or to site-specific management needs
- Discussion of whether viability of the species in the planning area is truly at-risk

After meeting with the taxonomic experts, six species were eliminated from the process. We found that three species thought to occur within the planning area did not occur within the WNF proclamation boundary: gilded river cruiser, Olympia marble, and Wabash river cruiser. Population trends were stable or increasing for three other species and taxonomic experts did not consider their viability or conservation to be at risk in the planning area now or in the future: river otter, box turtle, and field sparrow. The habitat and management needs for these six species were considered to be covered by one or more of the 54 remaining species, and therefore removal of these six species from the species viability evaluation process did not affect habitat or management need representation of any other plant or animal species.

#### Step 4

Based on the information collected through the literature review phase and from information generated from discussions with taxonomic experts, we developed **conservation approaches** and determined **viability outcomes** for each of the 54 remaining focal species. The conservation approaches and viability outcomes are incorporated into the Species Data Collection forms for each of the 60 species.

The development of **conservation approaches** focused on the primary threats to loss of viability in the planning area for each species. These were proactive measures to improve habitat conditions or measures that could be employed to mitigate or eliminate both short-term and long-term risks to viability in the planning area.

After reviewing the scientific literature and information from the taxonomic experts, we identified two groups of species we labeled landscape-level focal species and site-specific focal species. Eleven plant and animal species were identified as landscape-level focal species because threats to their viability could best be addressed by conservation approaches that incorporated landscape-level vegetation management (Table E - 2). These eleven focal species were believed to represent the habitat needs of other species in five broad habitat categories. Based on the habitat needs of these eleven focal species, we confirmed that a diversity of habitats must be provided to maintain viable populations of plants and animals on the WNF.

**Table E - 2. Landscape-level focal species and associated broad habitat categories**

<b>Focal species</b>	<b>Habitat Category</b>
Henslow's Sparrow	Grassland
Prairie Warbler Yellow-breasted Chat	Early successional forest
Ruffed Grouse	Mosaic of hardwood successional habitats (early-, mid-, and late-successional forest)
American Burying Beetle Indiana Bat	Open to semi-open mature hardwood forest
Cerulean Warbler Worm-eating Warbler Wood thrush Louisiana Waterthrush Rock Skullcap	Mature interior forest

Viability or conservation concerns for the remaining 43 plants and animals are only partially addressed through landscape-level forest vegetation management for various reasons:

- They tend to occur in localized areas of the WNF, and in most cases potential for expansion of their range on the Forest is limited because they are associated with a specific habitat feature
- Threats to viability or conservation are related more to management of Forest visitors rather than habitat

Threats to viability of these 43 species can be addressed through conservation approaches such as development of Forest-wide goals, objectives and standards and guidelines and management area standards and guidelines that supplement landscape-level forest vegetation management direction (Table E - 3).

**Table E - 3. Conservation approaches for site-specific focal species.**

Conservation Approach	Species
Promote restoration or improvement of riparian area structure and function	Louisiana waterthrush, prothonotary warbler, bald eagle, hellbender, four-toed salamander, Blanchard's cricket frog, mud salamander, Ohio muskellunge, Ohio lamprey, western lake chubsucker, slenderhead darter, eastern sand darter, round pigtoe, little spectaclecase, salamander mussel, rapids clubtail, green-faced clubtail, pigeon grape, large marshes St. John's wort, pale straw sedge
Maintain herbaceous vegetation or open sunlight conditions (mowing)	Blanchard's cricket frog, grizzled skipper, yellow gentian, thyme-leaved pinweed, smooth beardtongue, featherbells
Maintain open to filtered sunlight conditions (prescribed fire)	Striped gentian, pinxter flower, dwarf iris, blue scorpionweed, yellow gentian, yellow-fringed orchid, yellow crownbeard, thyme-leaved pinweed, Carolina thistle, butterfly pea, tall nut rush, Bicknell's panic grass, juniper sedge, Kral's sedge, red-headed woodpecker
Maintain open to filtered sunlight conditions (uneven-age or even-aged timber harvest methods)	Timber rattlesnake, red-headed woodpecker
Maintain filtered sunlight conditions (uneven-aged timber harvest methods)	Grizzled skipper, striped gentian, dwarf iris, yellow gentian, yellow-fringed orchid, pigeon grape, Bicknell's panic grass, juniper sedge, Kral's sedge
Maintain closed-canopy forest	Four-toed salamander, umbrella magnolia, sparse-lobed grape fern, lined sedge
Manage non-native invasive plant species	All plant species, wood thrush, worm-eating warbler, Louisiana waterthrush
Manage recreation activities	American ginseng, small-flowered alumroot, pinxter flower, Ohio muskellunge
Education and awareness	Timber rattlesnake

The **viability outcome** is a judgment and should be thought of as an index of the capability of the environment to support population abundance and distribution, but not as an actual prediction of population occurrence, size, density or other demographic characteristics. A scale of five viability outcome levels was developed for use by Region 9 National Forests for summarizing the existing conditions in the planning area, and for summarizing the knowledge of the species distribution, population trend, life history needs and threats (T. Schenck, pers. comm.).

The viability outcomes represent points along a gradient ranging from broadly distributed with a high likelihood of persistence to poorly distributed with a high likelihood of extirpation. It is important to note that the concept of ecological conditions, distribution, and quality must be based on the knowledge of the species distributional range and life history. For example, some species may have received a viability outcome level of D or E. Some plants, reptiles, amphibians, fishes, mussels, and insects naturally occur in a localized or patchy distribution, and thus would never occur in the conditions described in outcome levels A, B, or C.

We used the following viability outcome scales for each focal species to:

- Summarize existing conditions on NFS lands in the planning area
- Summarize existing conditions on all lands within the planning area.

### **Viability outcomes for NFS lands in the planning area:**

**Outcome A** – Suitable ecological conditions are broadly distributed and of high abundance across the historical range of the species within the planning area. The combination of distribution and abundance of ecological conditions provides opportunity for continuous or nearly continuous intraspecific interactions for the species.

**Outcome B** – Suitable ecological conditions are either broadly distributed or of high abundance across the historical range of the species in the planning area, but there are gaps where suitable ecological conditions are absent or only present in low abundance. However, the disjunct areas of suitable ecological conditions are typically large enough and close enough to permit dispersal among subpopulations and potentially to allow the species to interact as a metapopulation across its historical range within the planning area.

**Outcome C** – Suitable ecological conditions are distributed frequently as patches and/or exist at low abundance. Gaps where suitable ecological conditions are either absent, or present in low abundance, are large enough that some subpopulations are isolated, limiting opportunity for species interactions. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations. For species for which this is not the historical condition, reduction in overall species range from historical within the planning area may have resulted from the isolation.

**Outcome D** – Suitable ecological conditions are frequently isolated and/or exist at very low abundance. While some of the subpopulations associated with these ecological conditions may be self-sustaining, there is limited opportunity for population interactions among many of the suitable environmental patches. For species for which there is not the historical condition within the planning area, reduction in overall species range from historical condition within the planning area may have resulted from this isolation.

**Outcome E** – Suitable ecological conditions are highly isolated and exist at very low abundance, with little or no possibility of population interactions among suitable environmental patches, resulting in strong potential for extirpations within many of the patches, and little likelihood of re-colonization of such patches. There has likely been a reduction in overall species range from historical within the planning area, except for

some rare, local endemics that may have persisted in this condition since the historical record.

**Viability outcomes for all lands within the planning area (i.e., cumulative effects analysis area):**

**Outcome A** – The combination of environmental and population conditions provides opportunity for the species to be broadly distributed and of high abundance across its historical range within the cumulative effects analysis area. There is potential for continuous or nearly continuous intraspecific interactions at high population size.

**Outcome B** – The combination of environmental and population conditions provide opportunity for the species to be broadly distributed and/or of high abundance across its historical range within the cumulative effects analysis area, but there are gaps where populations are potentially absent or present only in low density as a result of environmental or population conditions. However, the disjunct areas of higher potential population density are typically large enough and close enough to other subpopulations to permit dispersal among subpopulations and potentially to allow the species to interact as a metapopulation across its historical range within the cumulative effects analysis area.

**Outcome C** – The combination of environmental and population conditions restrict the potential distribution of the species, which is characterized by patchiness and/or areas of low abundance. Gaps where the likelihood of population occurrence is low or zero are large enough that some subpopulations are isolated, limiting opportunity for species interactions. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations. For species for which this is not the historical condition within the planning area, reduction in overall species range from historical condition may have resulted from this isolation.

**Outcome D** – The combination of environmental and population conditions restrict the potential distribution of the species, which is characterized by areas with high potential for population isolation and/or very low potential abundance. While some of these subpopulations may be self-sustaining, gaps where the likelihood of population occurrence is low or zero are large enough that there is limited opportunity for interactions among them. For species for which there is not the historical condition within the planning area, reduction in overall species range from historical has likely resulted from this isolation.

**Outcome E** – The combination of environmental and population conditions restricts the potential distribution of the species, which is characterized by high levels of isolation and very low potential abundance. Gaps where the likelihood of population occurrence is low or zero are large enough there is little or no possibility of interactions, strong potential for extirpations, and little likelihood of recolonization. There has likely been a reduction in overall species range from historical within the planning area, except for some rare, local endemics that may have persisted in this condition since the historical period.

### Step 5

The results of the species viability evaluations were made available to the public to ensure information on species of viability and conservation concern was available to those who wanted to participate in the Forest Plan revision process. A general summary of the species viability evaluation process and results was posted on the WNF web site in September 2003, along with the Species Data Collection Forms for each of the 60 species (including those species eliminated from the process), and has remained on the web site throughout the Forest Plan revision process. Hard copies and CDs were available to the public upon request. A presentation about the species viability evaluation process and results was presented to participants at the three collaborative public workshops held in October and November 2003.

### Step 6

We used the results of the species viability evaluation process to develop management area prescriptions, alternatives, and to aid in the selection of management indicator species. The details on how we used this information is provided in the next section.

## Use of the Western Allegheny Plateau Ecoregion Assessment and Species Viability Evaluations to Develop Alternatives

The scientific literature recognizes the coarse filter and fine filter approaches as strategies for incorporating conservation of biological diversity into land management planning (Haufler, 1999). Haufler (1999) defines the coarse filter and fine filter approaches as follows:

- **Coarse Filter** – Strategy for setting biodiversity planning goals based on providing an appropriate mix of ecological communities across a planning landscape, rather than focusing on the needs of specific species.
- **Fine Filter** – Strategy for setting biodiversity planning goals based on the needs of individual species or guilds of species, thus providing for the needs of those species or guilds.

## Coarse Filter Approach

### Terrestrial and Semi-Aquatic Biodiversity

We developed the **Historic Forest and Historic Forest with OHVs Management Areas** after review of TNC's broad scale assessment of the Western Allegheny Plateau ecoregion (TNC, 2003), the fire/oak ecosystem research results from the Northeast Forest Experiment Station (Sutherland and Hutchinson, 2003) and other researchers (e.g., Yaussy, 2000; Spectich, 2004), and the Species Data Collection Forms for the 60 species.

Fire played a role in the maintenance of the oak ecosystem. Fire suppression, in part, has led to the increase of shade tolerant forest species in the understory and mid-canopy layer of these mixed oak communities and the concern for the potential decline in oak-hickory on the landscape in the future. The species viability evaluations demonstrated that certain fire-adapted plant species maintain healthy populations with fire as a periodic disturbance (e.g., juniper sedge, yellow gentian, Carolina thistle) and that there are animal species on the WNF that are dependant on the oak and hickory species for food and shelter (e.g., ruffed grouse, Indiana bat). The Historic Forest and Historic Forest with OHVs prescriptions incorporate the use of fire as a natural disturbance on the landscape to maintain fire-adapted communities.

We used TNC's findings about matrix-forming landscapes to spatially locate these two management areas on the ground. Two of the three matrix-forming landscapes, both found on the Ironton Ranger District, occurred in areas large enough to accommodate natural disturbance regimes and area sensitive species (>15,000 contiguous acres). Both areas had a mixture of all ecological land types found on the Athens Unit and Ironton Ranger District (USDA Forest Service, 1999) and exhibited condition factors (e.g., large regions of core interior habitat, large patches of more mature forest, composition dominated by native non-weedy species, confirmed evidence of forest breeding species) to provide the best opportunity for restoration to mature and overly mature age classes, which are currently under-represented in all forest landscapes in Ohio (TNC, 2003). These matrix-forming landscapes would play an important role in the conservation of most species, including wide ranging fauna such as predators, forest interior birds, and rare species.

The third matrix-forming landscape identified by TNC in their broad scale assessment, was located on the Marietta Unit in an area with a sparse and relatively scattered NFS land ownership pattern. We considered this matrix-forming landscape, but we believed the scattered NFS land pattern would not accommodate the use of prescribed fire on a landscape basis. Instead, we identified an area on the Athens Unit, which had been identified as a potential matrix-forming landscape during the preliminary

stages of the Western Allegheny Plateau broad scale assessment. It had areas of contiguous NFS land ownership patterns which would enable the Forest Service to use prescribed fire on a landscape basis, and had a representation of the ecological land types found on the Athens Unit and Ironton Ranger District.

In total, we identified three areas on the Wayne to place the historic Forest and Historic Forest with OHVs Management Areas. The number and location of these management areas were varied by alternative.

The species viability evaluations were used, in part, to formulate the vegetation management prescriptions for **nine management areas** (Table E - 4). One coarse-filter approach to conserving biodiversity incorporates active management of ecosystems to maintain a mix of stand structures across the landscape, from early successional forest to older growth (Oliver, 1992 and 1994 in Haufler, 1999). In discussions with taxonomic experts, we discovered that threats to the eleven landscape-level focal species could be best addressed by providing five broad categories of terrestrial habitat across the landscape. Our assumption was that by managing for a representation of habitats needed by the landscape-level focal species, most terrestrial and semi-aquatic plant and animal species on the WNF would be associated with one or more of these habitats during their life cycle.

**Table E - 4. Management areas developed to provide habitat for focal species.**

Focal Species	Broad Category of Habitat	Management Area*
Henslow's Sparrow	Extensive grassland	Grassland and Forest Mosaic
Prairie Warbler Yellow-breasted Chat	Early successional forest; area sensitive	Forest and Shrubland Mosaic; Forest and Shrubland with OHVs; Grassland and Forest Mosaic
Ruffed Grouse	Mosaic of early, mid, and late successional hardwood forest; oak (mast)	Forest and Shrubland Mosaic and Forest and Shrubland with OHVs
Cerulean Warbler Worm-eating Warbler Wood Thrush Louisiana Waterthrush	Mature hardwoods; generally extensive tracts; forest interior; variable canopy structure	Diverse Continuous Forest and Diverse Continuous Forest with OHVs
Rock Skullcap Louisiana Waterthrush	Closed-canopy mature hardwood forest	Future Old Forest and Future Old Forest with Mineral Activity
American burying beetle Indiana bat	Open to semi-open mature hardwoods	Historic Forest and Historic Forest with OHVs

\*Refer to the Revised Forest Plan for management area descriptions

The allocation of these nine management areas was varied in amount and spatially among the alternatives. As a proactive conservation measure, we used known occurrence data for all plants and animals carried through the species viability evaluations process to help locate placement of specific management areas on-the-ground, as well as corridors for dispersal and species interactions across the landscape. We also ensured through

vegetation management prescriptions and spatial allocation that the broad categories of habitat were well-distributed across the planning area.

### Aquatic and Semi-Aquatic Biodiversity

We used the results of the Western Allegheny Plateau Ecoregion Assessment and the species viability evaluations to develop the **River Corridor Management Area**. Streams have been degraded by a myriad of past land use activities, but TNC (2003) found that the WNF contained ecoregionally significant aquatic ecological systems. The species viability evaluations similarly identified these same systems as having species of viability or conservation concern inhabiting them. The River Corridor Management Area was developed to emphasize the restoration and enhancement of the inherent ecological processes and functions associated with riverine systems.

We used TNC's findings to identify ecoregionally significant Aquatic Ecological Systems, significant watersheds, and the spatial locations of the River Corridor Management Area on the ground. Symmes Creek and the Little Muskingum River were identified by TNC as ecologically significant. Corridors along Symmes Creek and the Little Muskingum River that occurred in the 1988 Forest Plan were maintained, but the spatial extent of the corridors was enlarged to account for biologically important tributaries.

An area along the Ohio River was also designated in the River Corridor Management Area. The Nature Conservancy did not consider the Ohio River under the jurisdiction of the Forest Service in their broad scale assessment; however it was identified as an ecologically significant aquatic ecological system (TNC, 2003). We chose to recognize the Forest Service's obligation to contribute to the restoration of the Ohio River aquatic ecosystem by designating an area on the Marietta Unit as a River Corridor Management Area.

### Fine Filter Approach

Conservation of every plant or animal in the planning area cannot rely wholly on a coarse filter approach in the planning process. We also incorporated a fine filter approach in the development of the alternatives and the direction and guidance found in the Revised Forest Plan. The species viability evaluation process identified those species for which there was a viability or conservation concern now or in the future, and we considered all of the species carried through the process during the development of management areas and the Revised Forest Plan.

In addition to locating management areas on-the-ground where these species occurred and would benefit overall from the management prescriptions, we identified three fire-adapted oak barrens communities on the Ironton Ranger District that included plant species of viability and

conservation concern (Bluegrass Ridge, Fradd Hollow, Handley Branch). These three areas were designated as **Special Areas**, along with seven Candidate Areas identified in the 1988 Forest Plan. Special Areas are regionally or locally significant and emphasize the preservation, management, and study of unique natural areas.

The species viability evaluations identified certain species which naturally occur in localized areas of the planning area, and do not likely have the potential for significantly increasing their range in the planning area. **Forest-wide direction and guidance** in the Revised Forest Plan not only ensures that the populations of these species are protected from management activities, but allows for proactive management for species that need various forms of disturbance to maintain population viability within the planning area (Table E - 5).

We recognized that aquatic biodiversity cannot be maintained only by focusing on the mainstem of the larger streams; we must account for the entire drainage network that begins in the headwaters. Therefore, we enhanced Forest-wide aquatic and riparian corridor direction and guidance along all perennial, intermittent, and ephemeral streams to better maintain and improve habitat quality for aquatic and riparian-dependant species (Table E - 5). The values of streamside areas are recognized and the Revised Forest Plan directs and guides us to protect, restore or improve functions such as sediment filtering, recruitment of nutrients and large woody debris into aquatic systems, and flood conveyance, storage and ground water recharge.

**Table E - 5. Methods for incorporating conservation approaches for site-specific focal species into the alternatives and Revised Forest Plan (RFP).**

Conservation Approach	
Promote restoration or improvement of riparian area structure and function	Established the River Corridor and Timbre Ridge Lake management areas. Developed Forest-wide goals and objectives to promote healthy watersheds, and riparian and aquatic ecosystems that sustain ecological processes and functions, and a variety of plant and animal communities, including viable populations of native and desired non-native species (RFP, Chapter 2, Goals 2.1 and 3.1 and associated objectives). Incorporated Forest-wide standards and guidelines to protect aquatic and riparian resources from management activities (RFP Chapter 2, 2.1-WSH; 3.1-ARR; others found throughout Chapter 2).
Maintain herbaceous vegetation or open sunlight conditions (mowing)	Developed Forest-wide goals and objectives to promote healthy terrestrial ecosystems that sustain a variety of plant and animal communities, including viable populations of native and desired non-native species (RFP, Chapter 2, Forest-wide Goal 4.1; Objectives 4.1a, 4.1f, 4.1g). Incorporated Forest-wide standards and guidelines to protect and enhance habitat (RFP, Chapter 2, Forest-wide standards and guidelines WLF- 3 to WLF-13; TES-35).
Maintain open to filtered sunlight conditions (prescribed fire)	Developed Forest-wide goals and objectives to promote healthy terrestrial ecosystems that sustain a variety of plant and animal communities, including viable populations of native and desired non-native species, and to reintroduce fire into fire-adapted ecosystems to conserve biodiversity and promote ecosystem structure and function closer to the historic range of variability (RFP, Chapter 2, Forest-wide Goals 4.1 and 6.2; Objective 6.2a). Incorporated Forest-wide standards and guidelines to protect and enhance habitat (RFP, Chapter 2, Forest-wide standards and guidelines WLF- 2; FIRE-7, 8, 12, 13, and 14).
Maintain open to filtered sunlight conditions (uneven-age or even-aged timber harvest methods)	Incorporated the use of uneven-aged and even-aged timber harvesting methods into several management area prescriptions (see RFP, Chapter 3). Incorporated Forest-wide standards and guidelines to protect and enhance habitat (RFP, Chapter 2, Forest-wide standards and guidelines TES-36).
Maintain closed-canopy forest	Established FOF and FOFM management areas. Incorporated Forest-wide standards and guidelines to protect and enhance habitat (RFP, Chapter 2, Forest-wide standards and guidelines TES-32, 33, and 34).
Manage non-native invasive plant species	Developed Forest-wide goals and objectives to control non-native invasive plant species (RFP, Chapter 2, Forest-wide Goal 7.2; Objectives 7.2a and 7.2b). Provided guidance on non-native invasive species treatment and prevention of spread (RFP, Chapter 2, Forest-wide standards and guidelines WSH-6 and 7; FH-1-3, 8-26).
Manage recreation activities	Numerous Forest-wide objectives and standards and guidelines promote quality recreation opportunities in an environmentally safe manner (RFP, Chapter 2, Forest-wide goals 11.1 and 11.2). Examples include a Forest-wide standard to protect populations of sensitive species by allowing rock climbing and rappelling only at designated sites (RFP, Chapter 2, REC-13) and a Forest-wide objective to reduce adverse effects to species from illegal OHV trails (FRP, Chapter 2, Objective 11.2e).
Education and awareness	Established a Forest-wide goal to collaborate with partners to promote education and conservation (RFP, Chapter 2, Forest-wide Goal 1.1). Developed a Forest-wide objective to use interpretive and education services and programs to develop public interest and understanding of the Forest's natural environment, and educate the public on the safe and legal use of the Forest (RFP, Chapter 2, Forest-wide Objective 11.1c).

## Evaluating Effects of Alternatives

In brief, the 1982 regulations [36 CFR 219.19 (a) (1)] require the Forest Service to select “management indicator species” in order to estimate the

effects of each alternative on wildlife. The following types of species were to be considered:

- Species on state or federal endangered and threatened lists for the planning area;
- Species with special habitat needs that may be influenced significantly by planned management programs;
- Species commonly hunted, fished, or trapped;
- Species of special interest; and
- Species believed to indicate the effects of management activities on other species of major biological communities or on water quality.

As part of the planning process, the Forest Service is directed to “select management indicators that best represent the issues, concerns, and opportunities to support recovery of Federally-listed species, provide continued viability of sensitive species, and enhance management of wildlife and fish for commercial, recreational, scientific, subsistence, or aesthetic values or uses. Management indicators representing overall objectives for wildlife, fish, and plants may include species, groups of species with similar habitat relationships, or habitats that are of high concern (FSM 2621.1).”

The process of making a final selection of management indicators that address the 36 CFR 219.19 requirements took into account the limitations of using single species to represent a wide range of habitats and associated species. The concept of indicator species has been used widely, but has been criticized. Some people consider life history requirements of single species to be so complex and unique that they cannot reliably serve as indicator species and reflect the needs or responses of other species (Thompson et al., 1995). The Committee of Scientists (1999) stated that habitat alone cannot be used to predict wildlife populations, however. The presence of suitable habitat does not ensure that any particular species will be present or will reproduce. They suggested that populations of species must also be assessed and continually monitored, and these species will provide information about the integrity of the larger ecosystem to which they belong.

During the development of the 1988 Forest Plan, biologists worked closely with recognized wildlife and fisheries experts to select twenty management indicator species. Appendix B of the 1988 Forest Plan contains a detailed analysis of the relationship of the 1988 management indicators to other vertebrates native to the Forest, which remains valid today. We reviewed the 1988 Forest Plan and annual Forest Plan monitoring reports to evaluate whether or not there was a need to change

management indicator species during the revision process (refer to the Analysis of the Management Situation).

### Management Indicators for the Revised Forest Plan

Table E - 6 provides rationale for the selection of management indicators for the Revised Forest Plan. The overall approach we took was to use a limited number of management indicator species, in combination with three management indicator habitats considered to be of special importance for maintaining viable populations of native and desired non-native species in the planning area. By selecting a limited but appropriate set of management indicator species/habitats, resources for inventory and monitoring activity can be focused where needed. Our approach is consistent with 36 CFR 219.14 (f). We placed emphasis on:

- Selecting those that guided the development of the alternatives for the Revised Forest Plan
- The availability of credible monitoring protocols
- Those that can be effectively and efficiently monitored

Eight bird species, in combination with three forest community types or habitats, were selected as management indicators (Table E - 6). Table E - 7 displays the management indicator species used in the 1988 Forest Plan, and describes the rationale for selecting or not selecting these species.

Management indicator monitoring methods should account for situations where population trends of migratory or resident bird populations may respond not only to habitat management activities conducted on the WNF, but also to winter range conditions outside the Forest, weather or climate conditions, hunting pressure, disease, or cyclical phenomena. Because methodologies to determine population numbers and/or estimate trends vary by species, conclusions that relate management indicator species population trends to habitat conditions are also reached through a variety of methods. These include:

- Population trends can be determined through the use of 100-percent population counts or can be estimated through the use of population sampling designed to estimate actual population numbers. Although rarely used, 100-percent population counts can be feasible for some species, such as for populations in very restricted geographic areas. These are the most intensive and rigorous methods, usually reserved for some federally-listed species or some high risk globally-imperiled species selected as management indicators.
- Population trends can be estimated through the use of population indices. Indices are not estimates of actual population numbers, but are aimed at reflecting population trends or relative abundance for

a species. Properly designed population indices are a well accepted method for assessing populations for many taxa. Examples could include state hunting/fishing information, track counts, and bird point counts. Population indices are commonly used in natural resource management.

- Population trends can be estimated using population occurrence data. This approach would be appropriate for a management indicator where the risk to local or broad extirpations is low to moderate (i.e., the cost of making a management decision that would adversely affect the species is low to moderate) and there is high correlation and understanding for a management indicator and its associated habitat(s) (i.e., there is a high likelihood the conclusions regarding population trends would be correct).
- When population data is not available, population trends may be inferred using species-habitat relationships information. This approach involves inferring population trends from trends in amount and condition of habitat over time, based on known relationships between species and habitat.

Site-specific monitoring or surveying of a proposed project or activity area is not required by the NFMA regulations. At the project-level, habitat analysis will be conducted to determine the effects, including cumulative effects, for each alternative on each management indicator selected for the project. The effects to management indicators for the project are put into perspective by discussing forest-wide management indicator species/habitat conditions and trends.

**Table E - 6. Management indicators for the Revised Forest Plan and the rationale for selection.**

Management Indicator	Habitat	North American Landbird Conservation Plan Ranking*	Rationale for Selection
Oak-hickory Forest	Forest stands dominated by oak and hickory species	N/A	Oak and hickory are considered keystone species in the central hardwood region. A number of species are dependent upon mast production, highly diverse herb layer, bark characteristics, and other structural characteristics of oak and hickory species.
Native Pine Forest	Forest stands dominated or partially comprised of one or more native pine species	N/A	Native pine forest was selected to supplement monitoring efforts of our management activities. Native pine occurs on only a small percentage of the WNF, but provides habitat for certain species.
Early Successional Forest	Forest stands less than 20 years of age	N/A	Approximately 35% of the terrestrial vertebrate species that are known to occur on the WNF use early successional forest habitat during some part of their life cycle. The herbaceous plants and shrubs provide dense cover that is necessary for predator avoidance and they produce a variety of soft mast that is nutritionally important. It is a habitat component that has declined significantly over time on the WNF and in the eastern U. S., and is recognized as a conservation issue in the North American Landbird Conservation Plan.
Pine Warbler	Mature pine and pine hardwood communities	Stewardship Species	The pine warbler relies upon pine habitat for breeding. Pine and mixed pine-hardwood comprises only a minor component of the WNF, yet there are some species that feed, hide or breed in these forest stands.
Pileated Woodpecker	Mature to overmature hardwood forest with snags and coarse woody debris on the forest floor	None	The pileated woodpecker is a primary cavity excavator that relies on the availability of dead and dying trees. The dead and dying trees in a forest community are important for many other species, including the Indiana bat. Many of the species that rely on dead and dying trees are considered cavity-dependant species, and are secretive in nature and difficult to monitor. The pileated woodpecker is a relatively easy species to monitor because of its size, appearance and vocalizations.
Cerulean Warbler	Mature interior hardwood forest with a heterogeneous canopy	Watch List Species	The needs of the cerulean warbler were considered in the development of the DCF and DCFO Management Areas. It requires large tracts of interior forest. It is a canopy nester that is generally associated with uplands and oak-hickory forest on the WNF with gaps in the canopy and taller trees exposed above the canopy.
Worm-eating Warbler	Mature interior hardwood or pine-hardwood forest on hillsides with a dense understory and coarse woody debris on the forest floor	Watch List Species	The needs of the worm-eating warbler were considered in the development of the DCF and DCFO Management Areas. It requires large tracts of interior forest. It is a ground nester that favors mesic areas and ravines on the WNF, but is dependant upon disturbance to create dense understory conditions.
Louisiana Waterthrush	Mature riparian forest corridors along headwater streams; healthy aquatic habitat	Stewardship Species	The Louisiana waterthrush is sensitive to declining stream quality and loss of riparian forest. It was selected as a management indicator species because the taxonomic experts involved in our species viability evaluations indicated this species could reflect stream quality because it relies on aquatic invertebrates for food, and thus may also be an indicator of riparian forest condition. It is an early ground nester, often initiating nesting in March.

Management Indicator	Habitat	North American Landbird Conservation Plan Ranking*	Rationale for Selection
Ruffed Grouse	Mosaic of early-, mid-, and, late-successional forest	None	The ruffed grouse is of great interest to hunters. The needs of the ruffed grouse were considered in the development of the FSM and FSMO Management Areas. Many species rely on the oak-hickory forest during some aspect of their life cycle, and ruffed grouse in the Appalachian states exemplify this in that its population trends may be correlated to oak mast production. It is a species that not only relies on early successional forest for brood rearing; it needs mid and late successional oak forests located near early successional forest for food and cover during part of the year.
Yellow-breasted Chat	Early successional forest habitat	None	The needs of the yellow-breasted chat were considered in the development of the FSM, FSMO and GFM Management Areas. It is an area-sensitive shrub nesting species, meaning it needs larger tracts of early successional forest habitat to successfully reproduce. Managing for shrub nesting birds often is compatible with actions to conserve American woodcock and other game species.
Henslow's Sparrow	Extensive grasslands	Watch List Species	The needs of the Henslow's sparrow were considered in the development of the GFM Management Area. It is area-sensitive and is considered a grassland obligate species. Grassland habitat did not naturally occur within the WNF, but occurs now as a result of past surface mining activities.

\* Rich et al. (2004a)

Table E - 7. Disposition of the 1988 Forest Plan management indicator species.

Management Indicator Species	Habitat Component (as defined in 1988 Forest Plan)	Disposition
Pine warbler	Conifers	Maintained as a management indicator.
Pileated woodpecker	Mature hardwoods	Maintained as a management indicator.
Cerulean warbler	Closed-canopied, mature to overmature hardwoods	Maintained as a management indicator.
Ruffed grouse	Early hardwoods	Maintained as a management indicator.
White-eyed vireo	Late succession	Not maintained as a management indicator. Habitat is tracked by the early successional forest, yellow-breasted chat, and ruffed grouse management indicators.
Common yellowthroat	Middle succession	Not maintained as a management indicator. Habitat is tracked by the early successional forest and yellow-breasted chat management indicators.
Field sparrow	Early succession	Not maintained as a management indicator. Habitat is tracked by the early successional forest and yellow-breasted chat management indicators. The field sparrow is not representative of area sensitive species that require early successional forest habitat.
Eastern bluebird	Park like	Not maintained as a management indicator. Habitat tracked by the Henslow's sparrow management indicator. The bluebird is not representative of area sensitive species that require grassland species.
Wood duck	Beaver ponds/oxbows	Not maintained as a management indicator. Habitat tracked by the Louisiana waterthrush and pileated woodpecker management indicators.
Virginia rail	Marsh	Not maintained as a management indicator. This species is rarely detected in southeast Ohio. Similar habitat is required by Blanchard's cricket frog, which is evaluated in the Biological Evaluation as a species proposed for RFSS designation.
Western chorus frog	Fishless ponds in fields	Not maintained as a management indicator. It has been rarely detected during frog and toad monitoring surveys. Similar habitat is required by Blanchard's cricket frog, which is evaluated in the Biological Evaluation as a species proposed for RFSS designation.
Wood frog	Vernal pools in hardwoods	Not maintained as a management indicator. It calls only briefly in the early spring and has a weak call that is difficult to hear. Similar habitat is required by the four-toed salamander, which is evaluated in the Biological Evaluation as a species proposed for RFSS designation.
Bluegill	Artificial impoundment	Not maintained as a management indicator species. The Ohio EPA considers this species moderately tolerant of pollution. Its population trends are artificially manipulated by the Ohio Division of Wildlife to provide recreational fishing opportunities for the public.
Southern redbelly dace	Small stream/intermittent stream	Not maintained as a management indicator. Fish community indices are used rather than single species to assess impacts to aquatic habitat quality. Its habitat is tracked by the Louisiana waterthrush, a species that relies on quality aquatic habitat for its prey. A Forest-wide, long-term aquatic monitoring program is identified as part of the monitoring plan in Chapter 4 of the Proposed Revised Forest Plan. Such a monitoring program would follow standardized protocols to monitor changes to the physical habitat and to biological communities across the WNF.
Redfin shiner	Medium stream with sand/gravel pools	Not maintained as a management indicator. Same as southern redbelly dace.
Blackside darter	Medium stream with silt pools	Not maintained as a management indicator. Same as southern redbelly dace.
Rainbow darter	Medium stream with riffles	Not maintained as a management indicator. Same as southern redbelly dace.
Golden redhorse	Large stream with pools	Not maintained as a management indicator. Same as southern redbelly dace.
Sand shiner	Large stream with sand pools	Not maintained as a management indicator. Same as southern redbelly dace.
Banded darter	Large stream with riffles	Not maintained as a management indicator. Same as southern redbelly dace.



# Appendix F1

to the  
Final Environmental Impact Statement  
for the  
Wayne National Forest 2006 Land and Resource  
Management Plan

Final Biological Assessment  
on the  
Wayne National Forest Land and Resource  
Management Plan

Prepared by

USDA, Forest Service  
Wayne National Forest  
August 31, 2005



**Biological Assessment**  
for the  
**Wayne National Forest**  
**Revised Land and Resource Management Plan**



**Prepared by:**

**USDA Forest Service  
13700 U. S. Highway 33  
Nelsonville, Ohio 45764**

**Submitted to:**

**U. S. Fish and Wildlife Service  
Ecological Services Field Office  
6950 American Parkway, Suite H  
Reynoldsburg, Ohio 43068**

**August 31, 2005**



# Biological Assessment

## Organization of the Biological Assessment

This Biological Assessment is prepared in accordance with the Endangered Species Act (Section 7(c)(1)). It includes detailed information about the proposed action, as well as the effects analyses for federally listed species (Table 1).

**Table 1. Contents of the Biological Assessment.**

	<b>Page</b>
Introduction	1
Description of the Selected Alternative	7
Consultation History	12
Species Evaluated	14
Overview of the Effects Analysis	15
Federally Listed Terrestrial Animal Species	
Indiana Bat	17
Bald Eagle	77
American Burying Beetle	91
Federally Listed Aquatic Animal Species	
Fanshell	109
Pink Mucket Pearly Mussel	124
Federally Listed Terrestrial Plant Species	
Northern Monkshood	129
Small Whorled Pogonia	146
Virginia Spiraea	164
Running Buffalo Clover	178
List of Preparers and Reviewers	198
Literature Cited	198
Appendix	
Conservation Plan	211

## Introduction

The Land and Resource Management Plan (Forest Plan) is a strategic document that establishes land allocations as well as goals, desired conditions, objectives, standards and guidelines for the Wayne National Forest (WNF). The Forest Service initiated the Forest Plan revision process in April 2002 with the publication of the Notice of Intent to revise the Forest Plan in the Federal Register.

As part of the Forest Plan revision process, six alternatives were developed to address issues raised during public involvement and comment periods. A Biological Evaluation was prepared and published in the Draft Environmental Impact Statement (EIS) (Appendix F). This Biological Evaluation identified and addressed the potential effects of the six alternatives on federally listed species, Regional Forester sensitive species, and species proposed for Regional Forester sensitive species designation.

Upon consideration of public comments received during the 90-day formal comment period of the Draft EIS (April 1- July 1, 2005), the Regional Forester made the decision to modify the Preferred Alternative (E), resulting in what will now be designated as the Selected Alternative, or Alternative E<sub>mod</sub>.

Pursuant to 50 CFR 402.12, this Biological Assessment will evaluate the potential effects of the Selected Alternative (Alternative E<sub>mod</sub>) on listed and proposed species identified as occurring in or near the WNF. In addition, it will demonstrate how Alternative E<sub>mod</sub> meets requirements of Forest Service Manual 2672.3 (i.e., the objectives of the Forest Plan must include overall goals of effecting recovery and achieving eventual delisting of any federally listed species known to occur within the National Forest).

## Location and Ecological Setting of the Proposed Action

### Wayne National Forest

The WNF proclamation boundary encompasses 853,531 acres in 12 southeastern Ohio counties: Athens, Gallia, Hocking, Jackson, Lawrence, Monroe, Morgan, Noble, Perry, Scioto, Vinton, and Washington. There are 238,053 acres of NFS lands within the WNF proclamation boundary; the remaining lands are state-owned, privately-owned, or lands owned by local governments. The WNF is broken into three administrative units (Athens, Ironton, and Marietta).

The WNF is located in the Southern Unglaciaded Allegheny Plateau (Ecological Section 221E). The topography is characterized by numerous narrow ridges and deep valleys. Topographic relief ranges from a minimum of 500 feet to a maximum of over 1,000 feet. Slopes are typically benched or segmented with alternating steep and moderate slope gradients. Most gradients average 25 to 55 percent.

The bedrock geology is characterized by inter-bedded sedimentary strata of Permian age on the Marietta Unit, while bedrock underlying the Athens Unit and the Ironton Ranger District is of Pennsylvanian age. Most of the surface soils are silt loam, loam or sandy loam. However, the subsurface

soils range from sandy loam to clay. Soil type and topography contribute to some areas of the WNF having high potential for soil erosion.

The WNF is located in the heart of Ohio’s oil, gas and coal deposits. Industrial minerals such as sand, gravel, limestone, clay, shale, sandstone, and salt are also found within the Forest. About 40% of the WNF is currently underlain by federally owned minerals, including oil and gas. Reserved and/or outstanding minerals wholly or partially encumber the remaining 60% of the National Forest.

Extraction of coal, clay, limestone and iron ore have occurred in southeastern Ohio during the last 150 years. Today, remnants of this industrial era are present on the WNF in the form of abandoned surface and underground mines. Features associated with these abandoned mine lands affect riparian and water quality.

The WNF is part of the mixed mesophytic forest region. Approximately 80% of all lands within the WNF proclamation boundary are forested (Ohio Land Use Cover, based on Landsat TM 1994). Just over 94% of NFS lands are forested with the remaining 6% covered by non-forest lands such as roads, water, grasslands and other openland. National Forest System lands are dominated by hardwood forest types, however some pine is present (Table 2).

**Table 2. Acres of forest types by age class on National Forest System lands\*.**

Age (years)	Pine	Pine - Hardwood	Oak - Hickory	Yellow Poplar	Lowland Hardwood	Maple-Beech	Upland Hardwood	Total
No Age	52	23	138		74		34	321
0-9	55	279	110	13	275		312	1,044
10-19	953	640	4,632	93	349	74	4,974	11,715
20-29	1,217	532	4,343	614	747	196	4,725	12,374
30-39	4,470	1,811	4,417	1,088	2,297	274	6,962	21,319
40-49	3,539	3,157	3,024	2,129	1,844	189	7,427	21,309
50-59	2,233	3,093	5,724	3,019	1,281	596	9,239	25,185
60-69	1,405	1,986	10,493	2,792	720	443	8,221	26,060
70-79	364	650	13,120	1,691	505	675	6,254	23,259
80-89	85	297	13,722	899	257	755	3,179	19,194
90-99		352	13,628	347	69	347	2,021	16,764
100-109		34	14,131	125	63	360	1,073	15,786
110-119			10,524	93	17	148	574	11,356
120-129			6,625	12		117	172	6,926
130-139		22	1,859		34	70	51	2,036
140-149			988			20	78	1,086
150+			197			15	28	240
<b>Total</b>	<b>14,373</b>	<b>12,876</b>	<b>107,675</b>	<b>12,915</b>	<b>8,532</b>	<b>4,279</b>	<b>55,324</b>	<b>215,974</b>

\*Data in this table do not include the approximately 9,300 acres of NFS lands where a silvicultural examination has yet to be conducted.

Of the forested NFS lands, oak-hickory is the major forest type, comprising 47% of all forested stands. The majority of the WNF has been harvested one or more times since the late 1700s. Cultivation or grazing followed the harvest of many forest stands. Today, many of the forest communities were established after timber harvesting that occurred about 80-140 years ago.

All streams in the WNF proclamation boundary flow towards the Ohio River. There are 31 fifth-level watersheds that contain part of the WNF proclamation boundary; however only 15 of these watersheds contain more than 1% NFS lands (Table 3).

**Table 3. Fifth level watersheds covering the WNF proclamation boundary.**

Watershed Name	Hydrologic Unit Code	Watershed Size (acres)	NFS land (%)
Monday Creek	0503020406	74,209	44.7
Pine Creek	0509010302	117,859	36.5
Symmes Creek (Black Fork to Buffalo Creek)	0509010109	64,168	35.1
Little Muskingum River (Clear Fork to Ohio R.)	0503020110	106,032	26.5
Ohio River (Sunfish Cr. to Muskingum River)	0503020102	87,344	22.3
Sunday Creek	0503020407	88,773	21.9
Symmes Creek (Buffalo Creek to Ohio River)	0509010110	96,987	17.9
Little Muskingum River (above Clear Creek)	0503020109	95,313	15.5
Ohio River (below Big Sandy R. to Pine Cr.)	0509010301	83,471	13.1
Hocking River (Enterprise to Monday Cr.)	0503020405	80,819	10.4
Symmes Creek (headwaters to Black Fork)	0509010108	76,244	10.1
Raccoon Creek (headwaters to Hewett Fork)	0509010102	86,715	6.7
Hocking River (Monday Creek to Athens)	0503020408	65,523	5.2
East Fork of Duck Creek	0503020111	87,190	1.7
Raccoon Creek (Hewett Fork to Elk Fork)	0509010103	99,234	1.4
Little Scioto River (Rocky Fork to Ohio River)	0509010304	97,405	0.37
Federal Creek	0503020409	92,547	0.34
Middle Fork of Salt Creek	0506000208	69,738	0.17
Raccoon Creek (Little Raccoon Cr. to Ohio R.)	0509010106	90,082	0.17
Duck Creek (except East Fork)	0503020112	95,765	0.16
Salt Creek (Queer Cr to Scioto River)	0506000210	85,157	0.07
Hocking River (Athens to Ohio River)	0503020410	70,213	0.01
Wolf Creek	0504000409	98,776	0
Seneca Fork Wills Creek	0504000501	96,296	0
Ohio River (Muskingum R. to Hocking R.)	0503020201	90,407	0
Rush Creek (Little Rush Cr. to Hocking River)	0503020403	87,046	0
Ohio River (Fish Creek to Sunfish Creek)	0503020101	79,210	0
Moxahala Creek	0504000405	69,353	0
Rush Creek (headwaters to Little Rush Creek)	0503020402	63,267	0
Ohio River (Kanawha River to Raccoon Cr.)	0509010101	29,064	0
Ohio River (Raccoon Cr. to Symmes Cr.)	0509010107	88,976	0
<b>Total</b>		<b>2,523,191</b>	<b>9.43</b>

Riparian areas, wetlands and floodplains have been affected by extensive disturbance and modifications. Nearly all floodplains and riparian areas, and most of the wetlands on NFS lands were cleared, drained, and farmed in the past. Transportation corridors, including roads and railroads, were developed through these areas by early settlers. Riparian and aquatic resources have also been affected by stream channel alteration (typically by straightening stream channels and the filling in of oxbows), streamside forest clearing, livestock access to streams, cultivation of fields up to the edge of the channel, and more recently from increased development of residential sites in the floodplain on private lands. Such activities have resulted in altered hydrologic regimes, increased erosion and sedimentation within stream channels, degraded water quality and aquatic habitat.

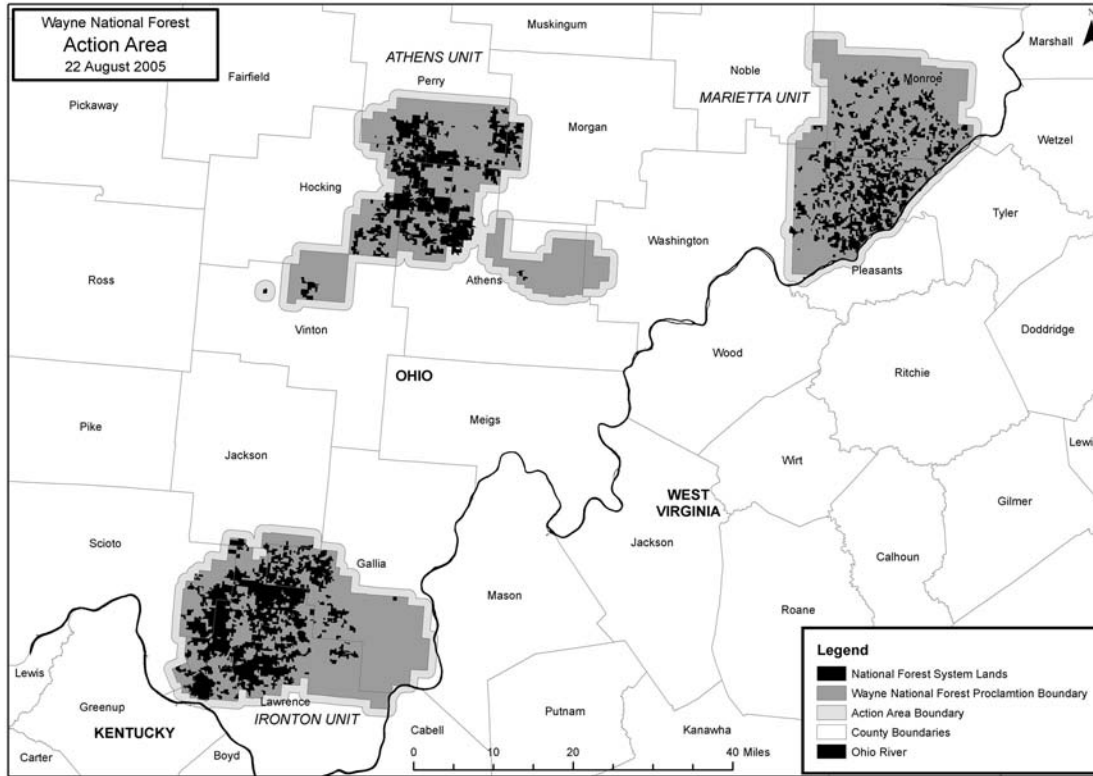
The landscape of the WNF, including NFS lands and other ownerships, is fragmented by residences, farms, mines and quarries, industrial developments, and towns. The scattered pattern of NFS lands, including subsurface ownership of minerals, has resulted in the construction of roads and utility corridors across NFS lands to access these private inholdings.

### Action Area

The term action area is used in the formal consultation process to define the area that will include all direct and indirect effects of implementing the Selected Alternative. Direct and indirect effects of activities associated with the Selected Alternative would occur on NFS lands, and could extend off NFS lands and onto other ownerships.

For purposes of this Biological Assessment, the action area is defined as all lands inside the WNF proclamation boundary and within one mile to the outside of the WNF proclamation boundary. In addition, the action area will also include all lands within one mile of the edge of those NFS lands located outside the WNF proclamation boundary (Figure 1).

The action area encompasses 1,108,199 acres in Ohio, West Virginia and Kentucky, where 238,053 acres of that area (i.e., 21%) are National Forest System (NFS) lands managed by the Forest Service (Table 4). National Forest System lands are intermixed with private and state owned lands. The ecological setting of the action area is the same as that described for the Wayne National Forest, in previous paragraphs.



**Figure 1. Action area.**

**Table 4. Action Area Description\***

<p><u>Land Area</u></p> <p>Kentucky – 915 acres</p> <p>Ohio – 1,083,545 acres</p> <p>West Virginia – 23,739 acres</p>
<p><u>Ownership</u></p> <p>Wayne National Forest – 238,053 acres</p> <p>Corps of Engineers – 100 acres</p> <p>Ohio River Islands National Wildlife Refuge – 508 acres</p> <p>State of Ohio – 25,446 acres</p> <p>New Page/Escanaba Timber – 5,697 acres</p> <p>The Nature Conservancy – 4,116 acres</p> <p>Private/Local Government – 834,280 acres</p>
<p><u>Land Use</u></p> <p>Forest – 79%</p> <p>Agriculture – 19%</p> <p>Open Water – 1%</p> <p>Residential – &lt;1%</p> <p>Transportation/Industry – &lt;1%</p>

*\*Data were obtained from WNF GIS and LandSat (1994) except for TNC and FWS acreages.*

---

## Description of the Selected Alternative (Alternative E<sub>mod</sub>)

The National Forest Management Act requires the development and analysis of a broad range of reasonable alternatives that respond to the issues and concerns identified during the planning process. For purposes of this Forest Plan revision, each alternative had a different approach to managing the resources on the WNF. While all alternatives provided a wide range of multiple uses, goods and services, they addressed the issues in different ways.

Preliminary themes for revised Forest Plan alternatives were developed during public and employee collaborative workshops in 2003. These themes were designed to address the issues and concerns identified early on in the planning process. The themes were used to develop five alternatives, in addition to the No Action Alternative (Alternative A) that carried forward the emphasis of the current Forest Plan.

Alternative E was identified as the Preferred Alternative with the release of the Draft EIS and Proposed Revised Forest Plan (announced in the Federal Register on April 1, 2005). After review of public comments received during the subsequent 90-day comment period, the Regional Forester chose to modify the Preferred Alternative, and identified E<sub>mod</sub> as the Selected Alternative.

**The Selected Alternative (Alternative E<sub>mod</sub>) provides the management strategy that will guide all resource management activities and will establish management direction for the WNF for the next 10-15 years.**

Management Areas (MA) are the foundation of a Forest Plan (see Chapter 3 of the revised Forest Plan). Each MA emphasizes different management prescriptions and uses (Table 5). Alternative E<sub>mod</sub> consists of a specific arrangement of MAs on the ground, otherwise known as the MA allocation. Allocation includes the type, amount and distribution of the MAs referenced in Table 5.

For comparison purposes, Table 6 is provided to show how Alternative E<sub>mod</sub> falls within the range of MA allocations analyzed for Alternatives A-F (see the Biological Evaluation - DEIS, Appendix F). Table 6 shows that the acreages associated with the MA allocation for Alternative E<sub>mod</sub> are within the range of those acreages analyzed for Alternatives A-F.

To achieve the desired future condition for each MA, various management activities are projected to occur as the Selected Alternative is implemented. For analysis purposes, the intensity of management activities is projected out for 10 years. Table 7 is provided to show how the projected management activities associated with Alternative E<sub>mod</sub> fall within the range of management activities previously analyzed for Alternatives A-F (see the Biological Evaluation - DEIS, Appendix F).

Various conservation measures are integrated into Alternative E<sub>mod</sub> to further the recovery of the nine federally listed species addressed in this Biological Assessment. These measures include Forest-wide goals, objectives, standards and guidelines specific to federally listed species, and other Forest-wide direction relating to protection of potentially suitable habitat. Such conservation measures will be highlighted for each species in the following sections of this Biological Assessment. In addition, a *Conservation Plan for Federally Listed Species* has been included in Alternative E<sub>mod</sub> (as Appendix D, located in the revised Forest Plan). This Conservation Plan is appended to this Biological Assessment (Appendix 1).

**Table 5. Brief description of the management areas.**

Management Area Name	Description
Candidate Areas (CA)	Emphasis is on the preservation of potentially unique natural areas. These areas possess potentially significant natural or historic characteristics. Management is directed at protecting the potentially unique characteristics of these areas until they can be studied for designation as research natural areas, special areas, or other management areas.
Developed Recreation (DR)	Emphasis is on the management of existing recreation facilities and the future needs for the highly developed sites that serve large numbers of people. It covers the most developed range of recreation opportunities provided on the Forest. By offering a variety of recreation opportunities, services, and facilities in a natural setting, the Forest intends to provide visitors with a quality outdoor recreation experience.
Diverse Continuous Forest (DCF)	Provides mature forest habitat for conservation of forest interior species.
Diverse Continuous Forest with OHVs (DCFO)	Emphasizes trails for motorized recreation and mature forest habitat for conservation of forest interior species.
Forest and Shrubland Mosaic (FSM)	Sustains a distribution of early successional habitat conditions interspersed throughout a forested landscape. Dispersed, non-motorized recreation opportunities are offered in this management area.
Forest and Shrubland Mosaic with OHVs (FSMO)	Emphasizes trails for motorized recreation as well as early successional habitat conditions interspersed throughout a forested landscape.
Future Old Forest (FOF)	Characterized mostly by old forest that change only as a result of natural disturbances and natural succession. These areas offer Forest visitors opportunities to experience solitude and closeness to nature. Such opportunities may be limited in the vicinity of private oil and gas rights until the oil and gas reservoirs are depleted.
Future Old Forest with Mineral Activity (FOFM)	This management area is located on the Marietta Unit of the Athens Ranger District. It continues a primarily custodial regime of vegetation management. Its two objectives are (a) promotion of mostly old forest that changes only as a result of natural disturbance and succession; and (b) opportunities for relatively primitive recreation experiences. Unlike the FOF Management Area, surface occupancy of federal oil and gas leases is permitted in this management area. Many oil and gas wells are already present within this management area, both on lands in private surface ownership and on NFS land where the subsurface minerals are privately owned (outstanding and reserved rights).
Grassland and Forest Mosaic (GFM)	Emphasizes habitat for grassland-dependent wildlife species on expanses of reclaimed coal mine lands. Dispersed, non-motorized recreation opportunities are offered in this management area.

Management Area Name	Description
Historic Forest (HF)	The emphasis of this management area is moving conditions toward the “historic range of variability.” This includes maintaining and increasing the predominance of oaks and hickories on most sites, featuring larger and older trees with more open stands than currently cover most of this area. These conditions would be promoted through a combination of mostly uneven-aged timber harvest, frequent prescribed fire, and herbicide use, where necessary, to promote oak and hickory regeneration.
Historic Forest with OHVs (HFO)	Emphasizes trails for motorized recreation as well as moving forest conditions back toward their “historic range of variability”. This includes maintaining and increasing the predominance of oaks and hickories on most sites, with larger, older trees and stands more open than those currently found in this area. These conditions are to be attained by a combination of mostly uneven-aged timber harvest, frequent prescribed fire, and herbicide use, where necessary, to promote oak and hickory regeneration.
Research Natural Areas (RNA)	Includes designated Research Natural Areas which emphasize preservation of unique ecosystems for scientific purposes; and research to better understand natural processes.
River Corridors (RC)	Emphasizes retaining, restoring, and enhancing the inherent ecological processes and functions associated with riverine systems. Management will protect or enhance the scenic quality of these areas. As a result, high-quality riverine recreation opportunities should be available in these river corridors. Areas allocated to this management area are linear-shaped and occur along the mainstem of Symmes Creek, the Hocking River, the Little Muskingum River, and along the Ohio River.
Special Areas (SA)	Emphasizes the preservation, management, and study of unique natural areas. These areas are regionally or locally significant and have been formally designated after recommendation by a review committee and approved by the Regional Forester. These areas meet one or more of the following criteria: (a) be representative of unique geological, ecological, cultural or other scientific values; (b) be an appropriate area for scientific research; and (c) have potential to be a regional or national landmark based on its natural or cultural values.
Timbre Ridge Lake (TRL)	Focus of this management area is the scenery and recreation afforded by the 100-acre Timbre Ridge Lake and the rugged, wooded hills that surround it.

**Table 6. Management area allocation by acres of NFS lands across the alternatives.**

	A <i>No Action</i>	B	C	D	E	E <sub>mod</sub> <i>Selected</i>	F
Candidate Areas	981	981	981	981	981	981	981
Developed Recreation	1,839	1,839	4,078	4,078	4,078	4,078	4,078
Diverse Continuous Forest	155,408	12,079	98,292	83,405	55,089	55,267	45,971
Diverse Continuous Forest with OHVs	45,010	27,851	43,901	29,846	22,278	22,953	22,278
Forest and Shrubland Mosaic	0	143,329	22,946	45,536	57,562	54,580	35,779
Forest and Shrubland Mosaic with OHVs	0	17,159	0	0	0	0	0
Future Old Forest	18,470	9,603	23,649	8,793	13,496	16,478	26,326
Future Old Forest with Mineral Activity	0	8,867	0	10,154	10,154	10,154	28,225
Grassland and Forest Mosaic	0	0	5,334	5,334	5,334	5,334	5,334
Historic Forest	0	0	17,869	17,869	26,456	26,278	26,456
Historic Forest with OHVs	0	0	0	14,054	21,622	20,947	21,622
Research Natural Areas	117	117	117	117	117	117	117
River Corridors	8,682	8,682	12,544	12,544	12,544	12,544	12,544
Special Areas	7,546	7,546	7,546	7,546	7,546	7,546	7,546
Timbre Ridge Lake	0	0	796	796	796	796	796
<b>Total</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>

**Table 7. Upper limits of projected outputs for management activities for the first decade.**

Units of measure – acres (unless otherwise noted)	A <i>No Action</i>	B	C	D	E	E <sub>Mod</sub> <i>Selected</i>	F
<b>Vegetation Management</b>							
Even-aged Hardwood Timber Harvest	0	5,960	1,630	1,780	1,820	1,725	1,370
Even-aged Pine Timber Harvest	0	200	200	200	200	200	200
Uneven-aged Timber Harvest	5,000	5,000	16,120	15,470	14,590	14,556	13,500
Thinning	0	0	940	1,230	1,540	1,460	970
Crop Tree Release	1,150	3,250	3,239	2,786	2,142	2,113	1,719
Grape Vine Control	1,500	3,720	4,148	3,544	2,711	2,683	2,212
Site Prep for Native Pine	200	200	200	200	200	200	200
Reforestation	500	500	500	500	500	500	500
Prescribed Fire							
Oak Regeneration	6,764	12,214	35,725	40,599	46,611	46,215	44,537
NNIS	200	200	200	200	200	200	200
Herbaceous Habitat	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Hazardous Fuels	61,355	55,905	32,394	27,520	21,508	21,904	23,582
Herbicide Application							
Oak Regeneration	800	4,376	7,236	9,005	11,155	10,994	10,846
NNIS	600	600	600	600	600	600	600
Development of Permanent Forest Openings	500	500	500	500	500	500	500
Maintenance of Permanent Forest Openings and other Herbaceous Habitats (Mechanical)	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Control of Non-Native Invasive Species							
Mechanical	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Biological	100	100	100	100	100	100	100
Wetland Restoration & Enhancement	150	150	150	150	150	150	150
Waterhole Construction	15	15	15	15	15	15	15
Fishing Pond/Lake Construction	15	15	15	15	15	15	15
Restoration & Improvement of Aquatic/Riparian Habitat							
Lentic	150	150	150	150	150	150	150
Lotic	20 miles	20 miles	20 miles	20 miles	20 miles	20 miles	20 miles
Installation of Bat-Friendly Gates on Mines	20-30 gates	20-30 gates	20-30 gates	20-30 gates	20-30 gates	20-30 gates	20-30 gates

Units of measure – acres (unless otherwise noted)	A <i>No Action</i>	B	C	D	E	E <sub>Mod</sub> <i>Selected</i>	F
<b>Recreation Management</b>							
OHV Trail Construction	223	223	150	187	150	150	110
Hiking Trail Construction	8.5	8.5	18	18	18	18	18
Horse Trail Construction	36	36	61	61	61	61	61
Mountain Bike Trail Construction	36	36	36	36	36	36	36
Recreation Facility Construction & Parking Lots	60	60	60	60	60	60	60
<b>Transportation Management</b>							
Temporary Road Construction	118	130	146	146	145	146	140
Permanent Road Construction	52	68	74	74	74	74	71
Permanent Road Reconstruction	145	223	320	317	311	318	284
Road Decommissioning	29	29	29	29	29	29	29
Skid Trails and Landings	198	441	747	739	718	740	634
<b>Energy Minerals Management</b>							
Surface Coal Mining Activities	1,250	1,250	1,250	1,250	1,250	1,250	1,250
Reclamation of Depleted or Orphan Wells	128 wells (70 acres)	128 wells (70 acres)	128 wells (70 acres)	128 wells (70 acres)	128 wells (70 acres)	128 wells (70 acres)	128 wells (70 acres)
Oil & Gas Well Development	234 wells (121 acres)	234 wells (121 acres)	234 wells (121 acres)	234 wells (121 acres)	234 wells (121 acres)	234 wells (121 acres)	234 wells (121 acres)
<b>Special Uses Management</b>							
Utility Corridor Development & Maintenance	50	50	50	50	50	50	50
Agricultural Crop Production & Grazing	50	50	50	50	50	50	50
<b>Watershed Management</b>							
Treatment of AMD	270	270	270	270	270	270	270
Surface Mine Reclamation	20	20	20	20	20	20	20
Closure of Open Mine Portal/Subsidence	232	232	232	232	232	232	232
Stabilization of Disturbed Areas	100	100	100	100	100	100	100
<b>Fire Management</b>							
Reduction of Hazardous Fuels - Mechanical	10,181	10,181	10,181	10,181	10,181	10,181	10,181
<b>Lands Acquisition Management</b>							
Land Acquisition	Up to 40,000 acres	Up to 40,000 acres	Up to 40,000 acres	Up to 40,000 acres	Up to 40,000 acres	Up to 40,000 acres	Up to 40,000 acres
Land Exchange	400	400	400	400	400	400	400

---

## Consultation History

In 1986, the Forest Service initiated informal consultation with the Fish and Wildlife Service, Reynoldsburg Field Office during the development of the 1988 Forest Plan. It was determined that there were no federally-listed endangered, threatened, or proposed species within the vicinity of the Wayne National Forest which could be affected by National Forest management (1988 Forest Plan, page 4-44).

Informal consultation was conducted as part of the 1992 amendment of the Forest Plan (Amendment 8). This amendment recognized four species as having part of their range on the Wayne National Forest: Indiana bat (*Myotis sodalis*), bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), and Kirtland's warbler (*Dendroica kirtlandii*) (Forest Plan Amendment 8, Page H-1).

The discovery of the Indiana bat on NFS land in 1997, along with reports of other federally listed species occurring near the WNF, prompted the Forest Service to begin amending the Forest Plan. Formal consultation was completed on September 20, 2001, when the Fish and Wildlife Service, Reynoldsburg Field Office, issued its Biological Opinion. The Forest Service incorporated the non-discretionary Reasonable and Prudent Measures and Terms and Conditions, as well as the discretionary Conservation Recommendations, into Forest Plan Amendment 13 on May 22, 2003.

The Forest Service and Fish and Wildlife Service signed a Consultation Agreement on January 23, 2003 to address early coordination on the revision of the Forest Plan, which tiered to the national *Memorandum of Agreement on Section 7 Programmatic Consultations and Coordination among Forest Service, Bureau of Land Management, Fish and Wildlife Service, and National Marine Fisheries Service* signed August 30, 2000.

On September 19, 2003, the Forest Service and the Fish and Wildlife Service discussed the draft Species Data Collection Forms (the products of the species viability evaluations) for the Indiana bat, American burying beetle, and bald eagle. Comments about the drafts, as well as conservation approaches, were incorporated into the final Species Data Collection Forms for these three species.

The Forest Service held three collaborative learning workshops during October and November 2003 in which the public was invited to develop themes for the revision alternatives. A Fish and Wildlife Service employee (Sarena Selbo) attended the Athens workshop and participated in the development of themes.

The Forest Service and Fish and Wildlife Service conducted their annual coordination meeting on January 6, 2004, at which time the preliminary management areas and alternatives were displayed.

The range of alternatives was approved by the Regional Forester on February 5, 2004. The Forest Service met with the Fish and Wildlife Service on March 23, 2004 to describe in detail alternatives for the revised Forest Plan.

The Forest Service requested an updated list of species to include in the Forest Plan revision and biological evaluation on February 25, 2004. The Fish and Wildlife Service responded on March 24, 2004 with a list of nine federally endangered or threatened plants and animals that should be addressed in the revision. In addition, the Fish and Wildlife Service recommended that the Forest Service address the cerulean warbler, sheepnose mussel, and rayed bean mussel in the revision of the Forest Plan. On April 14, 2004, the Forest Service informed the Fish and Wildlife Service that the rayed bean mussel is found outside the WNF proclamation boundary in the Scioto Brush drainage, and that no NFS lands or any lands within the WNF proclamation boundary drain into this watershed. The Fish and Wildlife Service responded via email that no direct, indirect, or cumulative effects are expected to the rayed bean mussel from management actions on the WNF. The Fish and Wildlife Service informed the Forest Service on June 21, 2004 that the agency was working on a candidate assessment for the eastern hellbender, and they recommended the Forest Service consider this species in the revision. The Forest Service responded on June 22, 2004 that the eastern hellbender is one the WNF RFSS and was included in the species viability evaluation process, and would be included in the revision.

On March 1, 2004, the Forest Service made a request to reinstate formal consultation to modify the incidental take statement in the 2001 programmatic Biological Opinion for the Forest Plan. The Fish and Wildlife Service amended the 2001 Biological Opinion to encapsulate the effects of the 2003 ice storm and other unanticipated forest health improvements on the WNF on March 8, 2004.

Several informal reviews of the draft Forest-wide direction occurred between the Forest Service and Fish and Wildlife Service during April-June 2004.

The Consultation Agreement was amended on May 17, 2004 to reflect new employee contacts and a revised timeline for the Forest Plan revision (Modification 1).

The draft biological evaluation for the Forest Plan revision was developed by the Forest Service and reviewed by the U. S. Fish and Wildlife Service between June and November 2004.

The Consultation Agreement was amended on April 18, 2005 to reflect a revised timeline for the Forest Plan revision (Modification 2).

The Forest Service requested an updated list of federally listed or proposed species to address in the biological assessment on July 7, 2005. The Fish and Wildlife Service responded on July 11, 2005 that the species list was the same as that noted in the March 24, 2004 letter received from the Fish and Wildlife Service. The Fish and Wildlife noted in their July 11, 2005 response that the biological assessment would not have to include the sheepsnose mussel or the cerulean warbler (as noted in the March 24, 2004 letter) as these species have not been proposed for listing at this time.

A population of running buffalo clover was found on the Ironton Ranger District in June 2005, and verified by botanical experts in August 2005. The Fish and Wildlife Service was notified of the finding on August 9, 2005. The location and description of the site was provided to the Fish and Wildlife Service on August 15, 2005.

The Forest Service and Fish and Wildlife Service met informally on August 16, 2005 to discuss effects of the Selected Alternative on federally listed species, as well as clarifications of Revised Forest Plan standards and guidelines.

A Biological Assessment was prepared to disclose the effects of the Selected Alternative (Alternative E<sub>mod</sub>) on the nine federally listed species. It was completed in August 2005.

---

## Species Evaluated

### Federally Listed Species

The Fish and Wildlife Service identified nine federally listed plant and animal species as occurring within or near the WNF proclamation boundary that should be addressed in this Biological Assessment (A. Zimmerman, pers. comm.). Of these nine species, only three are known to occur within the WNF proclamation boundary (Table 8). The effects of the Selected Alternative on these nine species are displayed in the following sections of this Biological Assessment.

**Table 8. Federally listed species occurring within or near the WNF.**

Species	Documented on the WNF	Status	Recovery Plan Date
Northern Monkshood ( <i>Aconitum noveboracense</i> )	No	Threatened	1983
Running Buffalo Clover ( <i>Trifolium stoloniferum</i> )	Yes	Endangered	1989; 2005 Agency Draft
Small Whorled Pogonia ( <i>Isotria medeoloides</i> )	No	Threatened	1992 (1 <sup>st</sup> Revision)
Virginia Spiraea ( <i>Spiraea virginiana</i> )	No	Threatened	1992
Fanshell ( <i>Cyprogenia stegaria</i> )	No	Endangered	1991
Pink Mucket Pearly Mussel ( <i>Lampsilis abrupta (=orbiculata)</i> )	No	Endangered	1985
American Burying Beetle ( <i>Nicrophorus americanus</i> )	No	Endangered	1991
Bald Eagle ( <i>Haliaeetus leucocephalus</i> )	Yes	Threatened	1983
Indiana Bat ( <i>Myotis sodalis</i> )	Yes	Endangered	1983; 1999 Agency Draft

## Overview of the Effects Analysis

This analysis of effects is programmatic in that it addresses only the effects of the Selected Alternative, which includes revised Forest Plan direction (Forest-wide goals, objectives, standards and guidelines and Management Area desired future conditions, objectives, standards and guidelines) on the nine federally listed species. In addition, the programmatic effects analysis addresses the projected management activities which could occur in the first decade of revised Forest Plan implementation; these management activities are displayed in Table 7.

All management actions proposed under the Selected Alternative would be subject to second level, site-specific analysis once they were authorized with a Record of Decision.

The projected land allocations and management activities that would occur as a result of implementing the Selected Alternative are displayed in Table 6 and Table 7 of this Biological Assessment. It is important to note that one aspect of an activity may have a beneficial effect on one or more species, while other aspects of the same activity could have a potentially adverse effect on one or more species. These effects will be displayed individually, and then summarized in a table at the end of each species analysis.

Because Alternative E<sub>mod</sub> falls within the range of the previously analyzed Alternatives A-F, the effects disclosed for Alternatives A-F in the Biological Evaluation (DEIS, Appendix F) will be similar for Alternative

$E_{mod}$ . For all species, direct and indirect effects could occur on NFS lands or could occur off-site onto other ownerships. The area where these direct and indirect effects occur for all nine species is called the action area (Figure 1; Table 4). For purposes of the Selected Alternative, the action area is defined as all lands inside the WNF proclamation boundary and within one mile to the outside of the WNF proclamation boundary. In addition, the action area will also include all lands within one mile of the edge of those NFS lands located outside the WNF proclamation boundary.

The extent of the action area was chosen because (1) direct effects of projected management activities on the nine species would primarily occur on NFS lands; and (2) certain indirect effects on the nine species could occur off-site and onto non-NFS lands. Of the potential direct and indirect effects that could occur to the nine species, smoke from prescribed fire and sediment transport from upland areas into streams are likely to travel the farthest from NFS lands. According to the WNF fire manager and Region 9 air quality specialist, smoke dissipates into the air column and detectable levels are minimal at a distance of one mile from the fire. Sediment originating on NFS lands and entering an aquatic system is likely to be deposited a certain distance downstream, depending on velocity and mean particle size (Hjulström, 1939 *in* Ritter et al., 1995). Based on channel morphology and velocity of streams on the WNF, sediment particles would be expected to be deposited within one mile of the origination point under normal flow conditions.

Cumulative effects, as defined for the National Environmental Policy Act, are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. For terrestrial species, the cumulative effects area will coincide with the action area described above. For aquatic species, the cumulative effects analysis area will include the 31, 5<sup>th</sup> level watersheds that contain the WNF proclamation boundary.

## Federally Listed Terrestrial Animal Species

Three terrestrial animal species, the Indiana bat, bald eagle and American burying beetle, are currently listed by the Fish and Wildlife Service as occurring in or near the WNF.

### Indiana Bat

#### Status of the Species

#### Species Description

##### Rangewide

The Indiana bat was listed as an endangered species on March 11, 1967 by the Fish and Wildlife Service. It has been found in 27 states throughout much of the eastern United States (USFWS 1999). More specifically, NatureServe (2004) describes its range as going from eastern Oklahoma, north to Iowa, Wisconsin, and Michigan, east to New England and south to western North Carolina, Virginia, and northern Alabama.

Northern populations migrate south to Alabama, Tennessee, Kentucky, Indiana, Missouri, and West Virginia for winter (NatureServe 2004). According to the Fish and Wildlife Service (1999), more than 85% of the range wide population occupies nine Priority I hibernacula (i.e., hibernation sites with a recorded population >30,000 bats since 1960), although two of these currently have extremely low numbers of bats. Indiana, Kentucky, and Missouri each contain three Priority I hibernacula. The most important



**Common Name:** Indiana bat  
**Scientific Name:** *Myotis sodalis*  
**Family:** Vespertilionidae  
**Group:** Mammals  
**Historic Range:** Eastern and Midwestern U.S.A  
**Population To Which Status Applies:** Entire Range  
**Current Status:** Endangered  
**Date First Listed:** March 11, 1967  
**Critical Habitat:** 11 caves and 2 mines in IL, IN, KY, MO, TN, and WV  
**Special Rules:** NA  
**Lead Region:** Great Lakes-Big Rivers Region (3)  
**Current Range:** AL, AR, GA, IA, IL, IN, KS, KY, MD, MI, MO, MS, NC, NJ, NY, OH, OK, PA, SC, TN, VA, VT, WV

*Source: Fish and Wildlife Service*

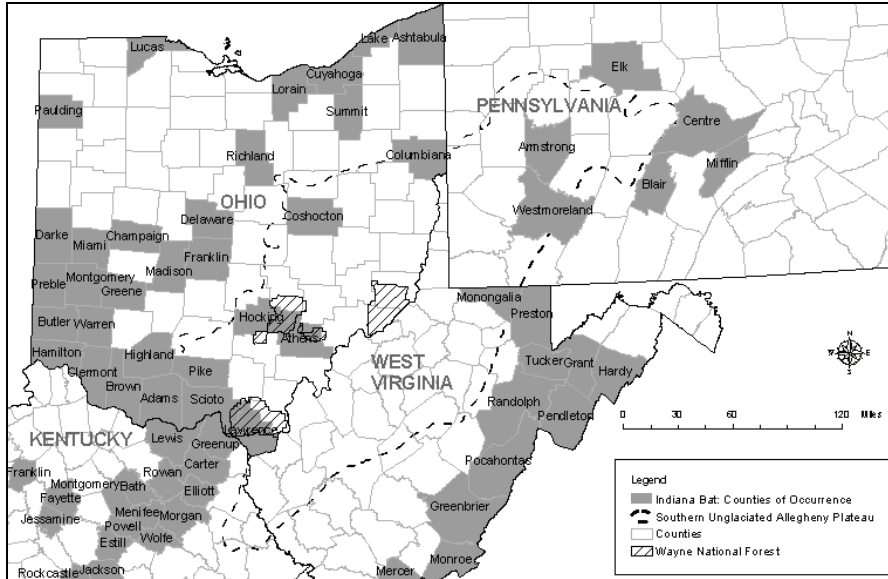
hibernating caves are: Bat Wing and Twin Domes caves (Indiana); Bat, Hundred Dome, and Dixon caves (Kentucky); and Bat Cave, Great Scott Cave, and Pilot Knob Mine (Missouri). Pilot Knob Mine is the largest colony. Priority Two hibernacula (recorded population >500 but <30,000 bats since 1960) are known from the aforementioned states, in addition to Arkansas, Illinois, New York, Ohio, Tennessee, Virginia, and West Virginia. Priority Three hibernacula with recorded populations of <500 bats or records of single hibernating individuals have been reported in 17 states (Alabama, Connecticut, Florida, Georgia, Iowa, Maryland, Massachusetts, Michigan, Mississippi, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Vermont, and Wisconsin).

### **Species Range in Ohio**

Brack et al. (2002) suggested that the Indiana bat is not likely to be equally distributed across its range; rather, areas of bat abundance are associated with optimal summer and winter temperature conditions. Maternity colonies of Indiana bats are most common in southern Iowa, southern Michigan, the northern two-thirds of Missouri, the southern two-thirds of Indiana and Illinois, and the western edge of Ohio (USFWS, 1999; Gardner and Cook, 2002). Brack et al. (2002) found that summer temperatures in the eastern part of the bat's range are different than where most individuals are found. For example, Pennsylvania and West Virginia have slightly cooler average temperatures than the central Midwestern states where higher Indiana bat populations occur.

Experts believe the Indiana bat is widely distributed throughout the forested regions of the Southern Unglaciaded Allegheny Plateau; however its occurrence has only been verified in a percentage of the counties within this area (Figure 2). Surveys have not been conducted in all counties. Where surveys have been conducted, sampling can be limited by topography, sampling gear, and the evasiveness of the species.

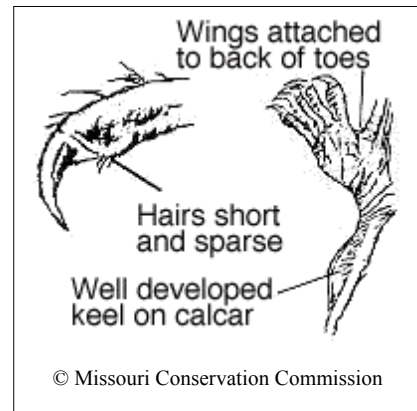
In Ohio, the Indiana bat has been recorded from 31 of Ohio's 88 counties either during the summer or winter (Figure 2). A Priority II Hibernaculum is located in Preble County, and Priority III Hibernacula are found in Adams, Brown, Highland, Hocking, and Lawrence counties (USFWS, 1999; Ewing, 2003a).



**Figure 2. Known county occurrences of the Indiana bat in the Southern Unglaciaded Allegheny Plateau. (Source: ODNR, 2003a; S. Selbo (pers. comm.); Western Pennsylvania Conservancy (R. Evans, pers. comm.); and BCI (2001)).**

**Life History**

The Indiana bat is a medium-sized bat, closely resembling the little brown bat (*Myotis lucifugus*) but differing somewhat in coloration. Its fur is a dull grayish chestnut rather than bronze, with the basal portion of the hairs of the back dull lead colored. This bat’s underparts are pinkish to cinnamon. The ear and wing membranes are blackish-brown. The calcar (heel of the foot) is keeled. Its body length is about 2 inches, and its wingspan is approximately 9.5-10.5 inches. The Indiana bat’s hind feet are smaller and have shorter toe hairs than those of the little brown bat. During hibernation Indiana bats congregate in more densely packed clusters than other bats in its range.



**Diet**

Female Indiana bats primarily feed on soft-bodied insects, including true flies (Diptera) and caddisflies (Trichoptera), followed by moths (Lepidoptera) and beetles (Coleoptera), less frequently. Females tend to feed on the highest percentage of Diptera during lactation, but on Trichoptera during pregnancy and the transition between pregnancy and lactation. Diets of male bats consist more heavily of Lepidoptera and Coleoptera (Kurta and Whitaker, 1998). In the northern part of its range,

aquatic insects make up a large portion of the diet (Murray and Kurta, 2002).

### **Fall Swarming and Mating**

From late-August to mid-October, prior to entering hibernacula, large numbers of Indiana bats fly in and out of cave or mine openings from dusk till dawn in a behavior called swarming. Swarming usually lasts for several weeks and mating occurs toward the end of this period. Male Indiana bats tend to be active for a longer period of time than females during swarming and will enter the hibernacula later than females (USFWS, 1999). Adult females store sperm through the winter, thus delaying fertilization until early May. Individuals relocate to summer roosts during April and May; however, males and females usually leave the hibernaculum at different times. Females begin grouping into maternity colonies by mid-May and give birth to a single pup between late-June and early-July (Easterla and Watkins, 1969; Humphrey et al., 1977). Temperature and relative humidity are important factors in the selection of hibernation sites. During the early autumn, Indiana bats roost in warm sections of caves and move down a temperature gradient as temperatures decrease. In mid-winter, Indiana bats tend to roost in portions of the cave where temperatures are cool. Long-term data suggest an ideal temperature range for suitable hibernacula is between 37°-43°F (USFWS, 1999). A recent study of highly populated hibernacula documented a temperature range of 37°-45°C (Tuttle and Kennedy, 2002). Relative humidity in Indiana bat hibernacula tends to be high, ranging from 66 to 95 percent (Barbour and Davis, 1969).

### **Female Maternity Colony and Summer Roosting Habitat**

Upon emergence from the hibernacula in the spring, females seek suitable habitat for maternity colonies (USFWS, 1999). These colonies are typically located under the sloughing bark of live, dead, and partially dead trees in upland and lowland forest (Cope et al., 1974; Humphrey et al., 1977; Gardner et al., 1991). Colony trees are usually large-diameter, standing dead trees (snags) with direct exposure to sunlight. The warmer temperature from sunlight exposure expedites development of fetal and juvenile young (Racey, 1982). A maternity roost may contain up to 100 adult females and their pups.

Roost trees often provide suitable habitat as a maternity roost for only a short period of time. Roost trees are ephemeral in nature; suitable trees fall to the ground or lose important structural characteristic such as exfoliating bark (Gardner et al., 1991; Britzke et al., 2003). Dead trees retain their bark for only a certain period of time (about 2-8 years). Once all bark has fallen off a tree, it is considered unsuitable to Indiana bats for roosting. Gardner et al. (1991) found that 31% of occupied Indiana bat roost sites were unavailable the summer following their discovery; 33% of the remaining occupied roost sites were unavailable by the second summer.

However, researchers have documented that female Indiana bats are often faithful to their summer maternity grounds, and will use roost trees in consecutive years, if the trees remain suitable (Gardner et al., 1991; Callahan et al., 1997; Kurta and Murray 2002). For unknown reasons, Indiana bats require many roost trees to fulfill their needs during the summer (Callahan et al., 1997). In Michigan, Indiana bats used two to four different roost trees during the course of one season (Kurta and Williams, 1992). In Missouri, each colony used between 10 and 20 roost trees, which were not widely dispersed (all fell within a circle ranging in diameter from 0.5 to 1 mile) (Miller et al., 2002).

It is unknown how many roosts are critical to the survival of the colony, but the temporary nature of the roost trees dictates that several must be available in an area if the colony is to return to the same area annually and raise their young successfully. Two important factors associated with roost trees is their ability to protect individuals from the elements, and to provide thermal regulation of each bat's environment. Maternity colonies have at least one primary roost, which is generally located in an opening or at the edge of a forest stand (USFWS, 1999). Maternity colonies also use multiple alternative roosts, which may be located in the open or in the interior of forest stands (USFWS, 1999). In Missouri, use of dead trees in the forest interior increased in response to unusually warm weather (i.e., shading provided a cooler thermal environment), and use of live trees and snags in interior forest increased during periods of precipitation (Miller et al., 2002). Maternity colonies in North Carolina and Tennessee used roosts located above the surrounding canopy (Britzke et al., 2003).

Indiana bats have been found roosting in several species of trees, and it appears that they choose roost trees based on their structural composition, instead of solely on species. Therefore, it is difficult to determine if one species of tree is more important than others. However, twelve tree species have been listed in the Habitat Suitability Index Model as primary species (Class I trees) (Rommé et al., 1995). These trees include silver maple (*Acer saccharinum*), shagbark hickory (*Carya ovata*), shellbark hickory (*C. laciniosa*), bitternut hickory (*C. cordiformis*), green ash (*Fraxinus pennsylvanica*), white ash (*F. americana*), eastern cottonwood (*Populus deltoides*), red oak (*Quercus rubra*), post oak (*Q. stellata*), white oak (*Q. alba*), slippery elm (*Ulmus rubra*), and American elm (*Ulmus americana*). These tree species are favored by Indiana bats because as these trees age, their bark will slough. In addition, Indiana bats use sugar maple (*A. saccharum*), shingle oak (*Q. imbricaria*), and sassafras (*Sassafras albidum*), which are listed as Class II trees (Rommé et al., 1995). The Class II trees are those species believed to be less important, but that still have the necessary characteristics to be used as roosts.

During a fall survey in Kentucky in 1994 and 1995, female Indiana bats roosted singly in sourwood (*Oxydendrum arboreum*) and pignut hickory (*Carya glabra*) trees. The roost trees were between 6 and 10 inches in diameter and contained bark cover between 54 and 70 percent. Females tended to roost within 0.75 miles of the hibernaculum, whereas males roosted anywhere from 0.95 to 2.35 miles from the hibernaculum. Both males and females were found to use 2 to 3 roost trees for 2 to 3 days at a time (Kiser and Elliott, 1996). Britzke et al. (2003) documented the use of conifers by maternity colonies in the mountains of Tennessee and North Carolina.

### **Male Roosting Habitat**

Some adult males use mature forests around and near their hibernacula for roosting and foraging from spring through fall. However, some male bats have been found to leave the hibernaculum area completely (USFWS, 1999). Researchers have also documented male Indiana bats returning to the same habitat in subsequent years (USFWS, 1999).

Roost trees in Kentucky are primarily dead snags on upper slopes or ridgetops; however, live shagbark hickory and pignut hickory trees have also been recorded as roost trees. Male Indiana bats have been found to roost singly during autumn in scarlet oak (*Quercus coccinea*), Virginia pine (*Pinus virginiana*), red maple (*Acer rubrum*), shagbark hickory, and red oak. These trees ranged in diameter from 4.6 to 26 inches and had bark coverage ranging from 1 to 100 percent. However, the majority of roost trees had bark coverage of at least 60 percent (Kiser and Elliott, 1996).

During a 1999 summer radio telemetry survey on the WNF, males were found roosting in American elm, red maple, shagbark hickory, and sugar maple trees, all of which were dead. The average dbh of these trees was 11.8 inches and the average length of time each tree was used was 2.3 days (Schultes, 2002). In 2000, two male Indiana bats were found roosting in dead American elm, red maple, black oak (*Quercus velutina*), white oak, pignut hickory and shagbark hickory. The average dbh of these trees was 11.9 inches and the average length of time each tree was used was 1.9 days (Schultes, 2002).

MacGregor et al. (1999) reported male Indiana bats were roosting, during the autumn pre-hibernation period, in forest stands that were harvested by the two-age timber harvesting methods 0-5 years prior to the study. Harvesting followed guidelines in the Daniel Boone National Forest Land and Resource Management Plan where 16 live trees/acre and a minimum of 2 snags/acre were to be retained.

Canopy cover around roost trees documented in different studies ranges from low to high. MacGregor et al. (1999) found canopy closure around autumn roost trees used by males ranged from 20 to 93% (mean = 80%) in a Kentucky study. Of the 70 roost trees located in their study, 27% were

located in fairly open canopy (<60% canopy cover); 24% were in an intermediate canopy coverage (60-80%); and 48% of the roost trees were found in areas with more than 80% canopy cover. A study on the WNF found roost trees used by male Indiana bats were more likely to be located in a canopy gap than in a shaded location (Schultes, 2002).

### **Foraging**

Foraging habitat for male and female Indiana bats in the core of its range is assumed to include forest habitats with open understories and canopy closures of 50 to 70 percent (Rommé et al., 1995). Other foraging habitat includes upland, bottomland, and riparian woodlands, as well as forest and cropland edges, fallow fields, and areas of impounded water (Kiser and Elliott, 1996). Other studies show that summer roosting and foraging areas, in parts of its range, can contain diverse cover types, including agricultural lands, residential areas, and open woodlands (Carter et al., 2002; Farmer et al., 2002; Miller et al., 2002; Sparks et al., 2004).

Females may use larger foraging areas than males during the summer. One study recorded a post-lactating female's foraging range as approximately 530 acres; males had an area of approximately 140 acres (Kiser and Elliott, 1996). New information from a Michigan study documented pregnant and lactating females traveling up to 2.6 miles from the day roost to foraging areas (Murray and Kurta 2004). However, Menzel et al (2005) found no significant difference in home range size for male or female bats during a study in Illinois, leading them to believe that the abundance of riparian and bottomland hardwood habitats in their study area allowed the individuals to meet their foraging requirements without having to travel a great distance.

Observations by Murray and Kurta (2004) indicated that female Indiana bats would not fly over open spaces between foraging areas on the northern edge of its range in Michigan, but instead appeared to follow wooded corridors described as a narrow fence line of mature trees. These foraging areas included lakes, ponds, an area that was 50% wooded and 50% open fields, woodlands, and forested wetlands. Menzel et al. (2005) found that Indiana bats foraged significantly closer to forest patches, roads, and riparian areas than agricultural lands or grasslands in a heavily fragmented area in Illinois. These data suggested that Indiana bats may use linear landscape features like narrow wooded patches, riparian corridors and roads as foraging habitat as well as traveling corridors in fragmented landscapes.

During summer months, some males remain near the hibernacula and forage along floodplain pastures, within dense forests, and on ridgetops. Male Indiana bats generally travel between 1.2 and 2.6 miles from their summer roosts to summer foraging areas (USFWS, 1999). A study in Kentucky indicated male Indiana bats have a minimum foraging area size

of about 400 acres and a high use area size of 115 acres (Kiser and Elliott, 1996).

During the fall, male bats were found to forage in upland, ridgetop forest, as well as valley and riparian forest areas (USFWS, 1999). Male Indiana bats tend to use larger foraging areas during autumn than in summer. However, female bats use even larger autumn foraging areas than males. During October, males were observed to be traveling between 0.89 and 1.5 miles to forage (Kiser and Elliott, 1996).

### General

Young females can mate in their first autumn and have offspring the following year. Males do not mature until their second year (USFWS, 1999).

A study done in Indiana found mortality between birth and weaning was about 8% (Humphrey et al., 1977). Humphrey and Cope (1977) reported the following survival information for an Indiana population: female survivorship (76% for ages 1-6 years; 66% for ages 6-10 years); male survivorship (70% for ages 1-6 years; 36% for ages 6-10 years). Humphrey and Cope (1977) reported maximum ages for banded females (15 years) and banded males (14 years) in an Indiana population.

### Population Dynamics

Winter census information for hibernating Indiana bat populations is compiled by the U. S. Fish and Wildlife Service (Table 9). Based on hibernacula surveys, the Indiana bat population is estimated to be about 458,332 individuals, as of 2005.

**Table 9. Rangewide Indiana bat winter population size estimates, 1960-2005.**

	1960/1970	1980	1990	2001	2003	2005
Indiana	160,300	155,200	163,500	173,076	183,332	206,609
Missouri	399,000	342,000	150,100	72,983	66,805	65,104
Illinois	14,800	14,800	14,900	19,328	35,030	44,343
Ohio	150	3,600	9,500	9,788	9,436	9,769
Michigan				20	20	20
Kentucky	248,100	102,200	78,700	47,918	41,498	63,339
Tennessee	20,100	20,100	16,400	10,172	8,900	9,971
Arkansas	15,000	15,000	4,500	2,476	2,124	2,067
Alabama	350	350	350	250	317	296
New York				29,642	32,923	41,702
Pennsylvania	700	700	400	702	853	746
West Virginia	1,500	1,200	6,500	9,744	9,741	12,677
Virginia	3,100	2,500	1,900	833	1,090	735
New Jersey					644	652
Vermont					175	297
Oklahoma					5	5
<b>Total</b>	<b>863,100</b>	<b>657,650</b>	<b>446,750</b>	<b>376,932</b>	<b>392,893</b>	<b>458,332</b>

(Data for 1960-1990 from Clawson 2002; data for 2001-2005 from A. King, pers. comm.).

## Status and Distribution

The Indiana bat population has decreased since winter censuses were initiated in 1960; however a slight increase in its rangewide population size has occurred over recent years. The Fish and Wildlife Service reported that winter populations appeared to have increased or remained stable in most state's hibernacula resulting in a 16.7% overall increase above the 2003 population estimates (A. King, pers. comm.). Some of this increase may be explained by an increased effort by biologists to identify previously unknown hibernacula.

Since 1990, the Ohio winter population has remained stable to slightly increasing. However, Indiana bats within the Priority III hibernaculum on the WNF increased from about 150 individuals in 1999, to an estimated 200 individuals in 2003, to an estimated 333 individuals in 2005 (Schultes, 2003; 2005).

## Threats to the Species

### Rangewide

The causes for the population decline of the Indiana bat have not yet been definitively determined. However, the documented and suspected reasons for decline include disturbance and vandalism; improper cave gates and structures; natural hazards; microclimate changes; adverse land use practices; and chemical contamination.

Human disturbance of hibernating bats led to a decline in Indiana bat populations from the 1960s to the 1980s (USFWS, 1983b; 1999). Disturbance from recreational cavers and researchers entering hibernacula can cause bats to expend crucial fat reserves before they are able to forage in the spring. A hibernating bat can use up as much as 68 days of fat supply in a single disturbance event (Thomas et al., 1990 in USFWS, 1999). The Fish and Wildlife Service (1999) described an example of how human disturbance has led to direct mortality of bats. In 1960, three youths entered a hibernaculum in Kentucky and killed about 10,000 bats by tearing them from the ceiling and trampling or stoning them to death. Indiana bats have also been killed in their hibernacula by shotgun blasts.

Changes in the microclimate of a cave or mine can affect temperature and moisture level, thereby affecting suitability of the hibernaculum or affecting bat physiology (Richter et al., 1993; USFWS, 1999; Tuttle and Kennedy, 2002). Blockage of entry points can alter airflow in a cave or mine. This poses serious consequences when a hibernaculum is on the warm edge of the species hibernating tolerance, or has less stable temperatures. In northern areas, changes in airflow could lead to areas of the mine or cave being too cold for the bat. In either case, changes in airflow and the microclimate could force individuals to use less optimal

locations in the hibernaculum. This could leave them vulnerable to predation, freezing, or exhaustion of fat reserves.

Improper gates have either rendered hibernacula unavailable to the Indiana bat, or have altered air flow causing hibernacula temperatures to be too high for bats to retain fat reserves through the winter (USFWS, 1999). Cave entrances essential to proper cooling of key hibernating sites must be identified and protected from inadvertent closures, including those that may occur naturally (Tuttle and Kennedy, 2002).

Natural hazards including flooding, freezing during severe winters, and ceiling collapse have caused the loss of Indiana bats (USFWS, 1999). Indiana bats have been drowned by flooding of caves or mines, either by river flooding or changes in subsurface and surface hydrology. Severe weather can affect bats roosting in summer or autumn habitat. There has been a documented occurrence of strong winds and hail stripping bark from a tree, forcing the bats to move to another roost (USFWS, 1999).

The Fish and Wildlife Service (1999) stated that land use practices, fire suppression, and agricultural development have reduced available roosting and foraging habitat, as well as reduced the abundance of insect prey across the species range. Ongoing research and monitoring is helping to enhance the understanding of habitat use and characteristics. When done properly, experts consider forestry practices to be compatible with Indiana bat conservation; however, silvicultural methods need to maintain structural features important for roosting and foraging, such as snags, small openings, and edge habitats (BCI, 2001). Other studies are showing that summer roosting and foraging areas, in parts of its range, contain diverse cover types, including agricultural lands, residential areas, and open woodlands (Carter et al., 2002; Farmer et al., 2002; Miller et al., 2002).

Very little information is available about Indiana bat predation. Sparks et al. (2003) observed Indiana bats being flushed from their roost by foraging woodpeckers. The woodpeckers did not pursue the bats, but the authors suggest that Indiana bats flushed from their roosts during daylight areas could be more susceptible to other predators (e.g., birds). Sparks et al. (2003) witnessed a raccoon actively trying to capture some evening bats, and speculated that interactions between tree-roosting bats and other forest vertebrates could occur.

Bioaccumulation of environmental contaminants is suspected as a potential factor in the decline of the Indiana bat (USFWS, 1999). Organochlorine insecticides became widely used after World War II; they are neurotoxic synthetic chemicals, many of which are resistant to metabolism in mammals (O'Shea and Clark, 2002). Organochlorine insecticides may have resulted in chronic mortality of Indiana bats (O'Shea and Clark, 2002). For example, guano collected from an Indiana

bat roost in Indiana in the 1970s had concentrations of dieldrin comparable to the levels found in colonies of gray bats that suffered mortality from dieldrin poisoning (O’Shea and Clark, 2002). Schmidt et al. (2002) measured levels of Polycyclic Aromatic Hydrocarbons (PAH) and organochlorine pesticides in surrogate bat species to ascertain potential effects to the Indiana bat. At low concentrations, these chemicals cause cancer and cellular mutations in mammals, and may affect reproductive success by reducing viability of gametes or offspring. In this Missouri study at Fort Leonard Wood, all red bats and eastern pipistrelles had detectable concentrations of DDE, heptachlor epoxide and PAHs, and many had measurable amounts of dieldrin.

Wind power facilities located on wooded ridges pose a newer threat to bats in general. An estimated 48 bats per wind turbine were killed at the Mountaineer wind farm in West Virginia (Tuttle, 2005). A Bats and Wind Energy Cooperative has been launched to conduct research on mortality causes and to develop solutions to prevent or minimize fatalities at wind farms.

#### Action Area

Of the rangewide threats to the Indiana bat and its habitat, the Forest Service has control over activities that affect known or potential hibernacula, and foraging and roosting habitat on the WNF. These threats will be specifically addressed in the evaluation of effects for the Selected Alternative.

## Environmental Baseline

### Status of Species in Action Area

#### Species Range

The action area is within the range of the Indiana bat, but the action area is located slightly to the east of the core of its range. The Indiana bat is present year round on the WNF. The following inventory and monitoring efforts have been conducted on the WNF to determine the presence of the species.

- 1979** Mine surveys and mist netting conducted in 1979 and 1980 did not record the Indiana bat on the WNF (Bookhout and Lacki, 1981).
- 1997** Mist net surveys were conducted in July on the Athens Unit (20 sites) and on the Ironton Ranger District (20 sites) (Kiser and Bryan, 1997). Four lactating female Indiana bats were captured along the Hocking River in the Haydenville area on the Athens Unit. This was the first evidence that maternity roost(s) occurred in or near the WNF on the Athens Unit. One male Indiana bat was captured in the Shawnee area of the Athens Unit. One male was captured in the Five Forks area on the Ironton Ranger District.

- 1998** Mist net surveys were conducted during the summer at 11 sites in the Bluegrass Ridge area of the Ironton Ranger District, but failed to capture Indiana bats (Kiser et al., 1998).

A passive survey was conducted at a mine opening on the Ironton Ranger District in September, and a harp trap survey was conducted at the same location in October (L. Andrews, pers. comm.). One male Indiana bat was captured, indicating that Indiana bats may have been using the mine for hibernation.

- 1999** Wintering Indiana bats were confirmed when an abandoned limestone mine was entered and approximately 150 Indiana bats were found. This mine has since been designated as a Priority III hibernaculum.

Mist net surveys were conducted in June and July on the Athens Unit (19 sites) and the Ironton Ranger District (18 sites) (Kiser et al., 1999). One adult male Indiana bat was captured in the Dorr Run area on the Athens Unit. Biologists captured what they thought was a pregnant Indiana bat in the Dorr Run area, however genetic study determined it to be a little brown bat. Five Indiana bats (three adult males, one young-of-year male, and one post-lactating female) were captured in the Bear Run area on the Ironton Ranger District. This survey provided the first indication of reproduction occurring on the Ironton Ranger District.

Six of the Indiana bats captured during the mist net surveys (four adult males, one juvenile male, and one post-lactating female) were fitted with radio-transmitters, and three were successfully tracked to collect more information about their summer roost tree use (Schultes, 2002).

- 2000** Abandoned limestone mines near the Priority III hibernaculum were entered in February, but no Indiana bats were found.

Mist net surveys were conducted in June and July on the Athens Unit (25 sites) and the Ironton Ranger District (26 sites) (Kiser et al., 2000; Schultes, 2002). Two adult male Indiana bats were captured, one on the Athens Unit (Dorr Run area) and one on the Ironton Ranger District (Bear Run area). One additional adult male was captured on privately-owned land adjacent to the Dorr Run area of the Athens Unit.

Three of the adult male Indiana bats captured during the mist net surveys were fitted with radio-transmitters and tracked to collect more information about their summer roost tree use (Schultes, 2002).

In September during a fall-swarming survey, a female Indiana bat was captured at the entrance to an abandoned underground coal

mine in the Dorr Run area (Athens Unit) (Brack and Little, 2001).

**2001** The Priority III hibernaculum was closed to the public with the installation of a bat-friendly gate.

**2002** Fall swarming surveys in September resulted in the capture of a male Indiana bat in the Snake Hollow area of the Athens Unit (L. Andrews, pers. comm.). The individual was captured in a mist net that was set at the entrance to an abandoned underground coal mine.

**2003** A follow-up February survey of the Priority III hibernaculum found approximately 200 Indiana bats inside the mine (Schultes, 2003).

Two abandoned limestone mines in the Bear Run area on the Ironton Ranger District were closed to the public with bat-friendly gates.

**2004** The “Brushy Mine”, an abandoned limestone mine, was surveyed in February. Illegal off-highway vehicles had been driving into the mine, posing a threat to human safety, as well as to any bats inhabiting the mine. No Indiana bats were observed in the mine, however other species were documented. A mist net survey was conducted at the Brushy Mine in June. Bats were captured, but no Indiana bats were netted. A bat-friendly gate was installed at the mine in June, after the mist net survey, to protect the bats from human disturbance.

Mist net surveys were conducted in June and July on the Marietta Unit (37 sites) and the Ironton Ranger District (13 sites). No Indiana bats were captured (Meade, 2004).

Relative humidity and temperature data loggers were installed in the Priority III hibernaculum in September to monitor microclimate trends over time.

In late-September, an adult female Indiana bat was captured at an entrance to an abandoned underground coal mine in Monkey Hollow (Athens Unit) during a fall-swarming survey (L. Andrews, pers. comm.).

**2005** A follow-up February survey of the Priority III hibernaculum found approximately 333 Indiana bats inside the mine (Schultes, 2005).

The temperature and relative humidity data loggers in the Priority III hibernaculum were downloaded and reset in August 2005. Data have not been analyzed to date.

Fall swarming surveys are planned to occur in September 2005 at specific open mine portals on the Athens Unit.

Numerous nights of mist netting have been completed over the years to ascertain the species distribution across the WNF. To date, these survey efforts suggest its distribution across the area may not be scattered or random, but instead focused in at least two areas of the action area (Figures 3-5). One area is located on the Ironton Ranger District where past limestone mining and quarrying occurred, along with some underground coal mining. This area, nicknamed the Bear Run area, contains the Priority III hibernaculum. The second area is in the southwest part of the Athens Unit in an area heavily impacted by underground clay and coal mining. Both of these areas have reforested since the peak mining era, and possibly offer both winter and summer habitat for the Indiana bat.

### **Suitable Habitat in the Action Area**

#### **Winter Habitat**

On the WNF, one abandoned limestone mine serves as a Priority III winter hibernaculum for Indiana bats. Numerous mines are located on Federal and non-Federal lands in the Athens Unit and the Ironton Ranger District as a result of past underground coal and limestone mining, however the majority of limestone mines are found in the Ironton Ranger District. These limestone mines may provide additional hibernacula for Indiana bats; however, surveys have not yet confirmed this. Characteristics of mines that may become Indiana bat hibernacula in the future include a large, unobstructed opening, air movement, and no signs of flooding such as sticks and debris at or near the ceiling of the mine.

Less is known in general, about the use of abandoned coal mines as bat hibernacula. Biologists continue to conduct fall swarming surveys, and Indiana bats have been captured at portals leading to abandoned underground coal mines. Entry into underground coal mines is not permitted because of safety concerns; however, biologists believe Indiana bats may be using these mines as hibernacula. The majority of these mines were abandoned in the mid-1900s as the coal ran out; therefore, an assumption can be made that Indiana bats are likely expanding their winter distribution into the WNF by using some of these mines.

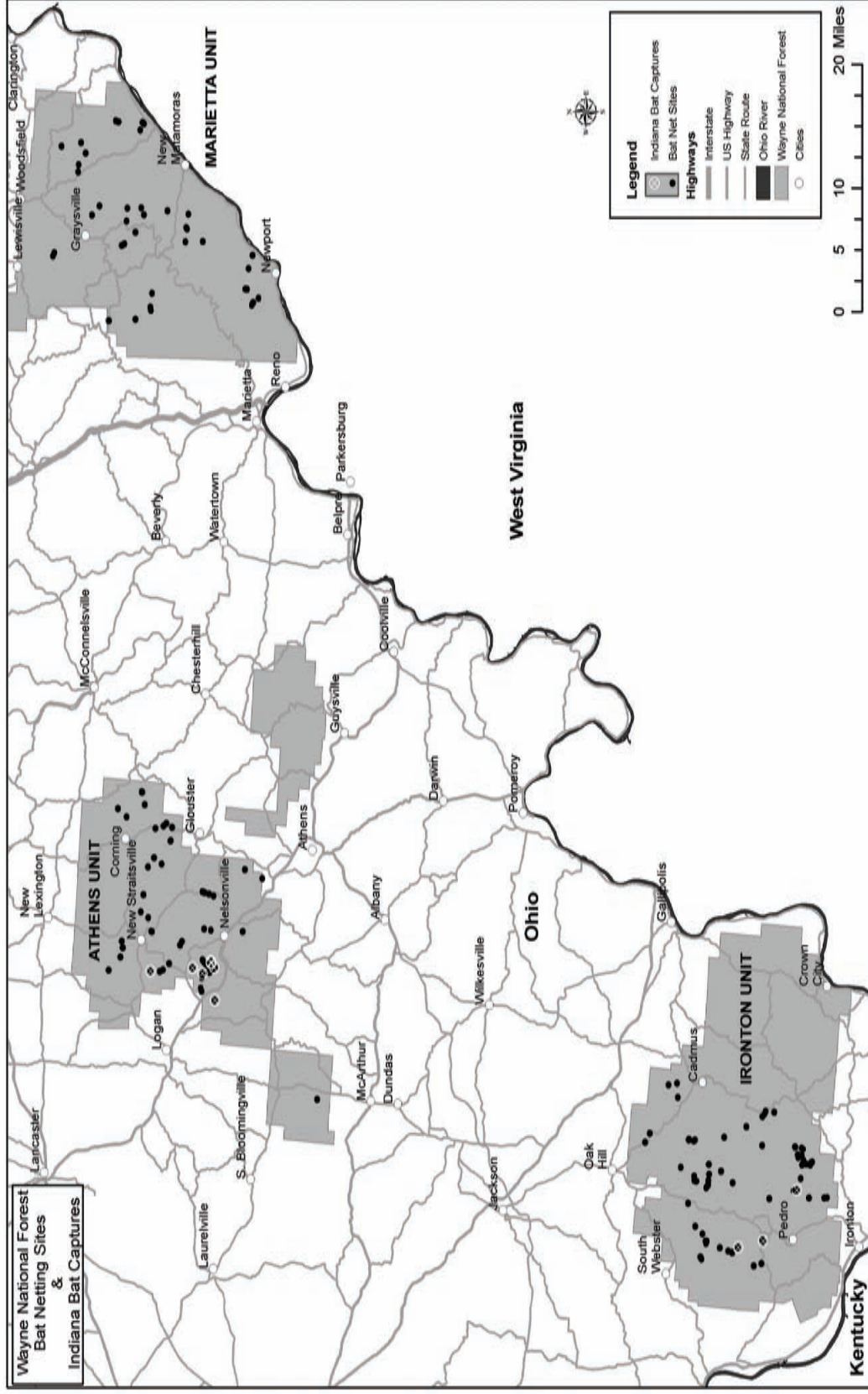
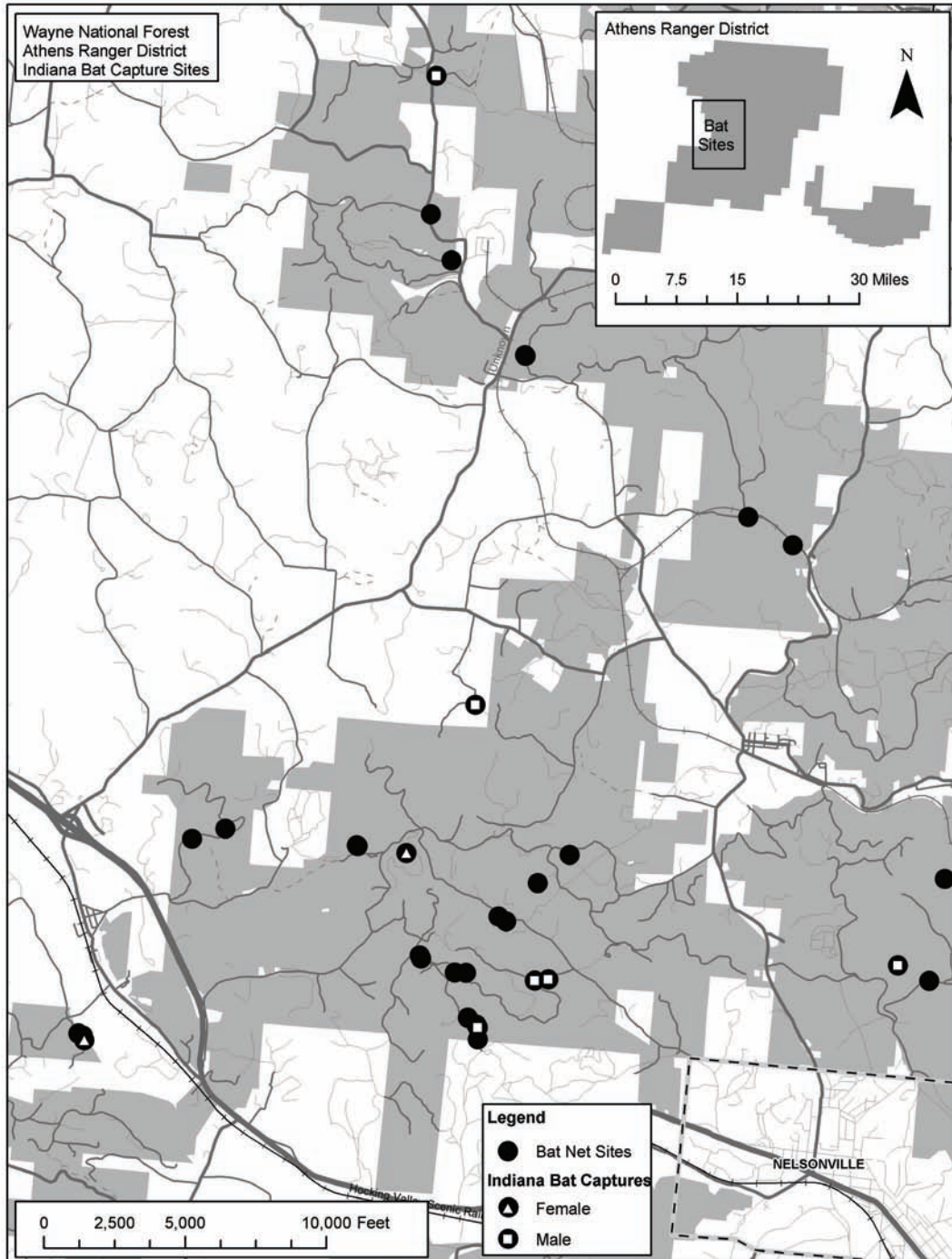


Figure 3. Bat netting sites in the Wayne National Forest, 1997-2004.

This page intentionally left blank.



**Figure 4. Locations of Indiana bat capture sites on the Athens Unit, 1997-2004.**

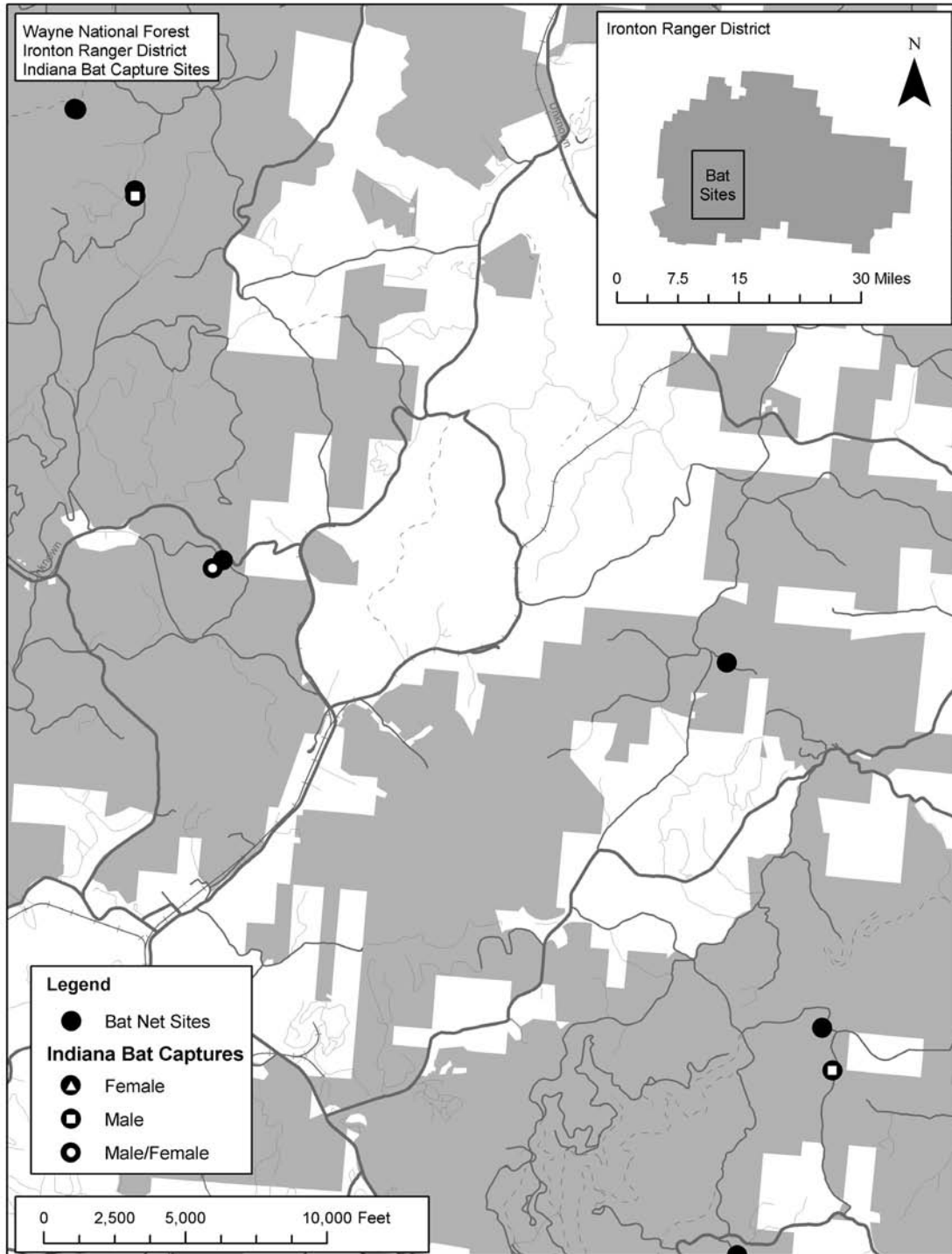
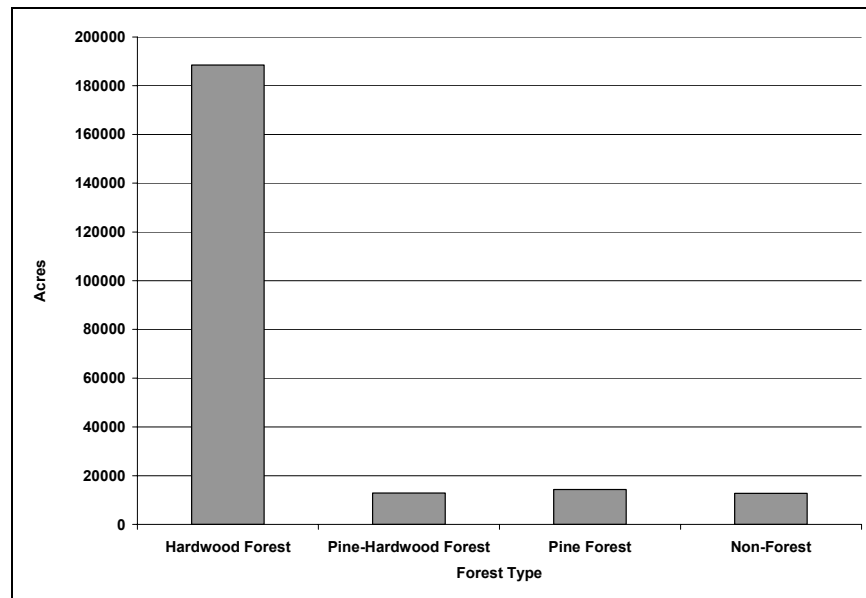


Figure 5. Locations of Indiana bat capture sites on the Ironton Ranger District, 1997-2004.

### Summer Habitat

Female and male Indiana bats use the WNF during the summer, and likely use non-Federal lands in the action area. Maternity colonies have not been found on NFS lands during telemetry surveys conducted on the WNF. However, lactating and post-lactating females have been captured during summer surveys, which suggest the presence of at least one maternity colony on or within the vicinity of the WNF. Adult males have been captured and radio-tracked to summer roosts within and/or near the WNF.

The majority of recorded Indiana bat roost trees are hardwood species; however, individuals have also been found roosting in pine species (Rommé et al., 1995; Britzke et al., 2003). Ninety-four percent of the WNF is forested, and 93% of these forested lands are comprised of hardwood or hardwood-pine forest communities (Figure 6). Seventy-nine percent of the action area is forested (LandSat, 1994).



**Figure 6. Distribution of general forest types on NFS lands.**

While individual Indiana bats will use smaller diameter trees for roosts, the larger diameter trees (> 8 inches dbh) provide more optimal habitat for maternity colonies. Although dependant on site capability, trees generally increase in diameter as they age. As trees age, they are also more likely to begin exhibiting characteristics of known Indiana bat roost trees, such as broken tops, cavities and areas of sloughing bark.

The tree species found in the hardwood and hardwood-pine communities on the WNF reach physiological maturity at different ages (P. Perry, pers. comm.). For example, scarlet oak, red maple, sassafras, shortleaf pine, and Virginia pine reach physiological maturity as early as 70 years of age,

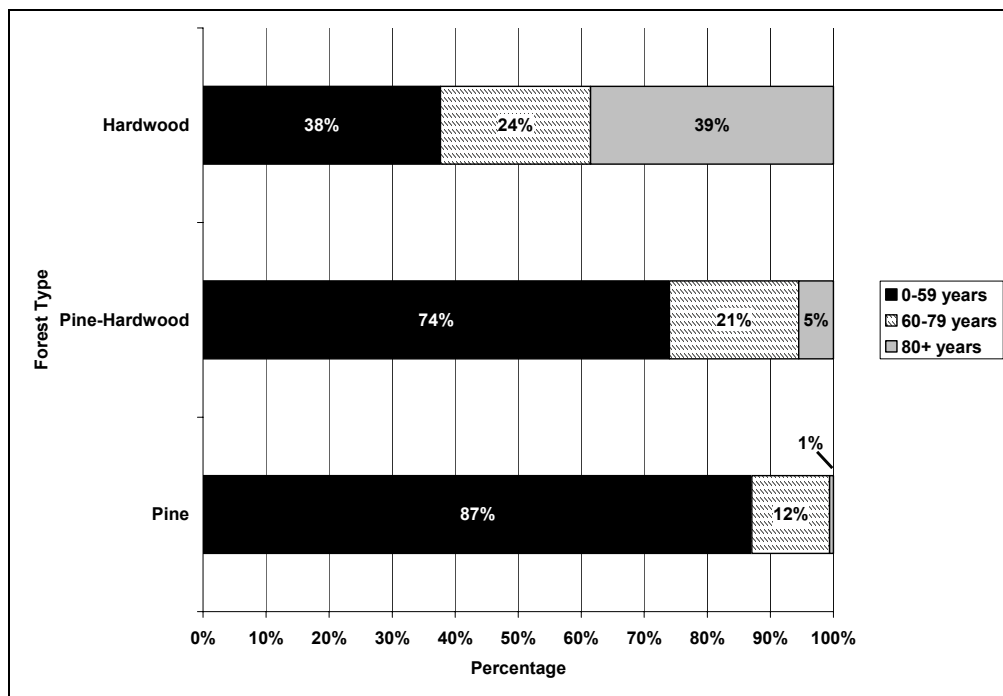
whereas hickory, sugar maple, and white oak are longer-lived species that may not reach physiological maturity until after 120 years or more. A general assumption can be made, based on the physical maturity of trees and experiences in the field by WNF foresters and biologists, that hardwood stands greater than 80 years old, and pine or pine-hardwood stands greater than 60 years old, contain larger trees with suitable roost characteristics.

An analysis of vegetation data for NFS land showed that nearly 40% of all hardwood stands were greater than 80 years old, with another 25% about to recruit into this older age class from the 60-80 year old classes; (Table 10; Figure 7). Pine and pine-hardwood communities are generally younger in age, but 38% of these communities were greater than 60 years old; almost 45% of the pine and pine-hardwood communities are between 40 and 60 years of age and are about to recruit into the older age class.

**Table 10. Acres of forest types by age class on NFS lands\*.**

Age (years)	Pine	Pine - Hardwood	Oak - Hickory	Yellow Poplar	Lowland Hardwood	Maple-Beech	Upland Hardwood	Total
0-59	12,467	9,512	22,250	6,956	6,793	1,329	33,673	92,980
60-79	1,769	2,636	23,613	4,483	1,225	1,118	14,475	49,319
80+	85	705	61,674	1,476	440	1,832	7,176	73,388
<b>Total</b>	<b>14,321</b>	<b>12,853</b>	<b>107,537</b>	<b>12,915</b>	<b>8,458</b>	<b>4,279</b>	<b>55,324</b>	<b>215,687</b>

\*Data do not include approximately 9,300 acres of NFS lands where a silvicultural examination is yet to be conducted.



**Figure 7. Comparison of general forest communities by age classes.**

There has been an increasing trend for the amount of older hardwood stands on the WNF since 1985 (Table 11). Hardwood stands greater than 80 years old increased by almost 5% during the time period when the 1988 Forest Plan was being developed.

**Table 11. Comparison of mature hardwood forest age classes in 1985 and in 2003 on NFS lands (Ewing 2003a).**

Habitat Component	1985 (%)	2003 (%)	Percent Change (1985-2003)
Hardwood-Mast Producing			
(40-79 years)	33.0	35.8	+2.8
(80-99 years)	18.0	15.9	-2.1
(100+ years)	8.7	15.7	+7.0

In February 2003, a severe ice storm occurred in southern Ohio and northern Kentucky, including portions of the Ironton Ranger District. In its aftermath, approximately 132,675 forested acres within the Ironton Ranger District boundary were affected. Approximately 71,650 acres were affected on NFS lands. Individual or groups of trees were broken or toppled in these areas, with the severity depending generally on elevation and aspect. This natural disturbance resulted in an increase in potentially suitable Indiana bat roost trees across the western two-thirds of the Ironton Ranger District.

Indiana bats have been captured during their nightly foraging activities on the WNF. In their Habitat Suitability Index model, Rommé et al. (1995) assumed optimal foraging habitat for Indiana bats to include forest habitats with open understories and canopy closures of 50 to 70 percent; however, the species has been observed foraging in a variety of other habitats. Based on written accounts from early settlers and travelers in the Ohio Valley, forests were park-like with large, widely spaced overstory trees with relatively little undergrowth of woody vegetation. An analysis of the structure, composition, and condition of overstory trees in research plots located in southeastern Ohio suggests that today's forest is denser than that reported for old growth oak-hickory forests and for presettlement forests (Sutherland et al., 2003; Yaussy et al., 2003).

### Water Sources

Aquatic habitat is important to the Indiana bat because it provides drinking opportunities and the production of desirable insect prey. The percent composition of ponds and lakes increased by 0.1 percent between 1985 and 2003. While the Forest Service only constructed 7 new acres of ponds and lakes during this time period, it purchased over 200 acres of

waterbodies through its land acquisition program (Ewing, 2003a). Numerous small lakes have been acquired through purchases of extensive tracts of mine lands. Some of these lakes are coal mine strip pits, limestone quarry ponds, or reclaimed coal mine impoundments.

The percent composition of wetlands increased by 0.18 percent between 1985 and 2003 (Ewing, 2003b). The Forest Service acquired several bottomland fields along Pine Creek, Symmes Creek, Monday Creek, Little Muskingum River and the Hocking River between 1988 and 2003. In cooperation with partners, 103 acres of previously tilled and ditched floodplain wetlands have been restored or enhanced since 1994.

Intermittent and perennial streams that provide habitat for aquatic insect production are numerous within the Action Area. Of the 200 miles of perennial stream that is in contact with NFS lands, 11 percent of those miles met Ohio water quality standards in 1998. About 41 percent of those miles were impaired and 48 percent had not been inventoried. Impairment of streams in this area is due to agriculture and abandoned mine lands (Ohio EPA, 2004). Watershed improvement activities targeting acid mine drainage is helping to improve downstream aquatic production areas. Private lands programs run through the Natural Resources Conservation Service are helping to reduce nutrient and sediment runoff into streams.

## Factors Affecting Species Environment

### Ongoing Non-Federal Actions

About 130,000 acres of New Page and Escanaba Timber Lands (i.e., used to be Mead Westvaco) are scattered across southern Ohio, and a paper mill is located in Chillicothe, Ohio. There are about 5,700 acres of New Page/Escanaba lands in the action area, the primary purpose of which is to ensure a long-term supply of fiber for the paper mill. On lands managed for hardwoods, New Page/Escanaba is testing ways to increase the oak component on the lands it will be harvesting, but no operational procedures are in place. The company is increasing the pine component on its lands with a target of approximately 23 percent of the corporate lands in pine. They are also encouraging private land owners to plant pine. Road construction and reconstruction occur in association with the timber harvesting.

About 25,450 acres of state-owned property is located within the action area. These properties include at least a portion of various state forests (Dean and Zaleski), wildlife management areas (Crown City, Trimble, and Waterloo), and state parks (Strouds Run, Burr Oak, and Jackson Lake). State forests and wildlife areas are generally managed for game and nongame species. To manage these areas, some timber is harvested and some silvicultural work may be conducted (e.g., prescribed fire). In 2003, the Ohio Division of Wildlife completed its *Indiana Bat Management*

*Strategy*, and its guidance is incorporated into forest management on state properties (ODNR, 2003a). In state parks, vegetation management occurs only in and around recreation facilities for public safety and scenery. Most of the lands in the state park system will continue to grow older.

The Nature Conservancy has recently acquired some land within the Ironton Ranger District. The organization would like to see the land added to the Wayne National Forest in the future, but for now has entered into a partnership agreement with the Ohio Division of Wildlife to cooperate in management of wildlife populations on their property. About half of their land consists of open reclaimed coal mine land, while the other half consists of hardwoods. At this time, the Nature Conservancy is not actively managing this property, with the exception of trying to reduce trash dumping.

Other private lands in and around the WNF is managed for a wide variety of purposes. Some timber harvesting is occurring on private lands, and these primarily involve high grading. Forest land is being cleared for new home sites and associated improvements. For example, the Pine Creek Watershed Assessment showed an increase in urbanization of rural areas around Wheelersburg, Ohio that has occurred in recent times (USDA Forest Service, 2001). The same is occurring around other areas of the WNF.

There are no known tribal actions ongoing within the action area.

#### **Ongoing Federal Actions**

FHA - The Federal Highways Administration completed consultation and a Final EIS on the Nelsonville Bypass. Construction is not expected to start until 2007 on the 8.5 mile bypass. According to the Biological Opinion for this project, a 768 acre linear corridor could be impacted, including all staging, waste, and borrow areas, and ancillary connector roads. About 275 acres (or 50%) of this disturbance could occur on NFS lands. Project engineers will likely make design refinements to further reduce disturbance.

APHIS - The emerald ash borer is an exotic pest that has been introduced to the United States, and an infestation was recently reported north of Columbus, Ohio. This insect has the potential to affect the composition of thousands of acres of forest land in the Midwest; the current treatment is to cut down all ash trees within a certain distance of an infected tree. Green ash is considered a Class I Indiana bat preferred roost tree. Ash trees are scattered in stands on NFS lands, but are not a predominant species. The USDA (APHIS) is working on an EIS and programmatic Biological Assessment for treatment of emerald ash borer infestations.

A Final EIS was issued for gypsy moth management in 1995. Mating disruption is an ongoing effort on the Wayne National Forest where

pheromone flakes are aerially applied over targeted forest areas. Gypsy moth outbreaks have the potential to defoliate trees (oaks especially) and can kill them. While additional dead trees could be beneficial to the Indiana bat, a large and long-lasting outbreak could alter forest composition and preferred roost tree species availability.

USFWS - The U. S. Fish and Wildlife manages the Ohio River Islands National Wildlife Refuge. Six islands within the action area are in the refuge system (Williamson, Wells, Grandview, Grape/Bat, Middle, and Broadback). The Fish and Wildlife Service has developed a management plan for the refuge, and it contains activities that are beneficial to the Indiana bat. These include the reforestation of bottomland hardwoods and wetlands, creating snag habitat, and conducting summer mist net surveys. Implementing the management plan is an ongoing effort.

Forest Service - Since receiving the 2001 Programmatic Biological Opinion, as amended in 2004, from the Fish and Wildlife Service for the 1988 WNF Land and Resource Management Plan, the Forest Service and Fish and Wildlife Service have implemented a tiered consultation approach. The Forest Service has tracked management activities that have the potential to affect the Indiana bat through permanent loss of habitat or alteration of habitat.

Since 2001, a total of 1455.5 acres of potentially suitable Indiana bat habitat has been altered, while 21.08 acres of potentially suitable Indiana bat habitat has been permanently lost (Table 12). Some projects that have gone through this consultation process have not been implemented to date (August 2005). For example, projects that could result in the loss of 74.46 acres of potentially suitable habitat have been planned, but projects amounting to only 21.08 acres have been implemented on the ground. Similarly, projects that could alter 7,739.95 acres of potentially suitable habitat have been planned, but only 1,455.50 acres have been affected on the ground.

While some of these accomplishments are categorized as “alteration of habitat”, the prescribed fire and the Bluegrass/Markin Fork timber harvest projects were considered beneficial to the Indiana bat since the understory was opened up with fire and the canopy opened up through single-tree selection harvesting. The Beech Grove pine thinning project, which is ongoing is another example where forest habitat is being altered, but the result will be beneficial to the Indiana bat. In this case, dense pine communities are thinned to allow hardwoods to regenerate.

**Table 12. Potentially suitable Indiana bat summer habitat affected on the WNF, October 2001 - August 2005.**

Type and Amount of Incidental Take Allowed in BO* through September 30, 2006	Amount of incidental take accounted for upon completion of the NEPA and FWS concurrence processes, October 2001-August 2005	Actual amount of incidental take (i.e., potentially suitable Indiana bat habitat affected on-the-ground), October 2001-August 2005
<b>Permanent Loss of Habitat (acres)</b>		
Coal Strip Mining (2,100 acres)	0	0
Road Construction (94 acres)	48.86	12.88
Trail Construction (160 acres)	11.75	2.45
Oil/Gas Well Development (25 acres)	10.35	2.95
Special Use Permits (125 acres)	3.55	2.80
<b>Total (2,504 acres)</b>	<b>74.46 Acres</b> (3% of Incidental Take)	<b>21.08 acres</b> (0.8% of Incidental Take)
<b>Alteration of Habitat (acres)</b>		
Timber Harvest (7,365 acres)	2,415	136
Timber Stand Improvement (2,500 acres)	0	0
Prescribed Fire (9,527 acres)	5,260	1,282
Creation of Wildlife Openings (352 acres)	4.50	0
Closing Underground Mine Entrances (250 acres)	60.45	37.50
Hazard Tree Removal (125 trees)	20	20
<b>Total (19,994 acres/125 trees)</b>	<b>7,739.95 Acres</b> (39% of Incidental Take)  <b>20 Hazard Trees</b> (16% of Incidental Take)	<b>1,455.50 acres</b> (7% of Incidental Take)  <b>20 Hazard Trees</b> (16% of Incidental Take)

\*As amended in 2004 (USFWS, 2004)

## Direct and Indirect Effects of the Selected Alternative

### Activities with No Effect

Some management activities projected to occur in the first decade would have no effect on the Indiana bat or its habitat. These activities do not affect or reduce winter or summer habitat, nor are they likely to disturb individuals.

- Grape vine control
- Site prep for native pine
- Spot treatment of stump sprouts and NNIS with herbicides
- Control of NNIS with mechanical or biological methods
- Maintenance of permanent forest openings
- Special use permits allowing hay production and grazing on existing openland

### Activities Likely to Not Adversely Affect: Beneficial Effects

Mature forest habitat will be maintained over the short-term (next ten years) and the long-term (next 100 years) in Alternative E<sub>mod</sub>. The structure and composition of mature forest will differ based on whether it results from natural succession, uneven-aged management, even-aged management, or from Historic Forest prescriptions.

#### Natural Succession

The FOF and FOFM management areas were developed, in part, for species that depend on larger and older forest communities. Scientists do not know how the current influx of red maple in the woodlands will affect long-term forest animal community composition, but concerns have been raised about the possible decline of oaks. Natural succession would also be allowed to occur on lands that are defined as unsuitable for vegetation management. As an example, these may include land-locked tracts or steep areas, or management areas categorized as not suitable for timber production.

For purposes of this effects analysis, forest stands that are in areas projected to undergo natural succession will be assumed to have older forest characteristics within 100 years. They would possess forest trees of great age (typically 150-200 years old in southeast Ohio), diversity of canopy layers, gaps in the canopy, large woody debris on the forest floor, and a component of standing dead and dying trees (McCarthy, 1995). These characteristics may be favorable for the Indiana bat. The difference between a managed uneven-aged forest and one undergoing natural succession is that trees within the natural succession prescriptions will continue to grow older until they die, and then will become snags and coarse woody debris on the forest floor. Most trees in uneven-aged management prescriptions will likely be harvested and removed from the stand at some point in their life cycle, with the exception of hickory trees and those trees identified for retention to ensure long-term Indiana bat roosting habitat.

An estimated 76,610 acres would undergo natural succession with implementation of Alternative E<sub>mod</sub>. This includes the 52,694 acres of management areas that would be categorized as not suitable for timber production (CA, DR, FOF, FOFMA, SA, RNA, and TRL) and about 23,916 acres that are found in management areas that allow timber production, but are not suited for harvesting projects (e.g., land is too steep, not accessible). Alternative E<sub>mod</sub> would result in a slightly greater amount of lands that would undergo natural succession than Alternative E because an area of Future Old Forest was added to the Ironton Unit.

#### Historic Forest Management Prescriptions

The HF and HFO management areas are expected to provide mature forest habitat dominated by oak and hickory species. The prescription for the HF

and HFO management areas calls primarily for the use of uneven-aged vegetation management combined with prescribed fire to create forest communities with more open understory conditions and which are dominated by oak and hickory species. This forest structure would be similar to that which occurred in the late-1700s and early-1800s (Hutchinson et al., 2003). Based on the Indiana bat habitat suitability model (Rommé et al., 1995), the open to semi-open character of the forest stands may be optimal for Indiana bats. In addition to a high abundance of oak and hickory species, the trees would be widely spaced and the understory would be relatively open. The HF and HFO management areas were placed on the landscape in or near the two areas on the WNF with Indiana bat captures.

At this time, there are no forest stands that exhibit the structure and composition desired for the HF and HFO management areas in the future. During the first decade of implementation, up to 7,398 acres of NFS land could be improved for Indiana bat roosting and foraging using the historic forest prescriptions. Over the long-term, implementation of Alternative E<sub>mod</sub> could result in up to 41,650 acres of mature forest resulting from HF and HFO prescriptions.

### **Uneven-aged Management**

Implementation of uneven-aged management methods could provide structural habitat conditions favorable to the Indiana bat because each entry opens gaps in the canopy and has the potential to improve foraging habitat. Uneven-aged forest stands are those which have three or more age classes of trees. When using uneven-aged timber harvest methods, every entry into the stand results in the formation of a new tree age class. For example, a forest stand may consist of only one tree age class because it originated from an even-aged timber harvest 60 or more years ago. The new growth resulting from the first single-tree selection or group selection harvest creates a second tree age class. The second entry, which may happen at least every third decade creates a third age class of trees, and so on over time. It will take several decades to achieve a truly uneven-aged condition

Opening the canopy directly benefits the Indiana bat because it increases the degree of exposure of suitable maternity roost trees to solar radiation, thereby providing improved thermal conditions for raising young during a wide range of weather conditions. Male Indiana bats may also benefit from an uneven-aged management regime that creates gaps in the canopy. A radio telemetry study on the WNF found roost trees used by male Indiana bats were more likely to be located in a canopy gap than in a shaded location (Schultes, 2002). Opening the canopy with the use of uneven-aged harvest methods may also improve foraging habitat for the Indiana bat. It forages among the tree canopy; foraging habitat declines as

canopy cover approaches 100%, but is assumed to be optimal when canopy cover is between 50-70% (Rommé et al., 1995).

In the long-term, the abundance of oak-hickory in forest communities treated with uneven-aged methods is likely to decline, which is not favorable for the Indiana bat because oak-hickory species possess exfoliating bark. It is possible that in the long-term, uneven-aged management without other silvicultural tools (e.g., prescribed fire, herbicides) may result in forest stands that have denser understories than that desired by the Indiana bat.

These habitat improvements would be emphasized in the DCF and DCFO management areas, but would also occur to a lesser degree across the planning landscape in the FSM, FSMO, GFM, and RC management areas. Uneven-aged management may optimize the forest structure for this species, especially as the first entries are made into the stands. During the first decade, up to 7,157 acres of NFS land could be treated with uneven-aged management prescriptions (i.e., likely 70% group selection and 30% single tree selection). After a period of 100 years, about 66,360 acres of the WNF would be managed by uneven-aged methods; some stands may have had only one entry while others may have had as many as three entries.

### **Even-aged Management Prescriptions**

Today's forest communities were primarily derived from forest communities that were harvested with even-aged management techniques in the past century. Even-aged vegetation management may have both short-term adverse effects and long-term beneficial effects on the Indiana bat and its habitat. The adverse effects are disclosed in the following section, but in terms of beneficial effects, even-aged management is used to regenerate oak and hickory species. Fifty percent of all Class I Indiana bat roost trees are comprised of oak and hickory species, therefore maintaining mixed oak communities across the landscape would have long-term benefits to this species. Oaks and hickories are considered to be shade intolerant, meaning that they require sunlight to successfully sprout and mature. Even-aged management removes a major part of the canopy which allows sunlight to reach the forest floor and encourage sprouting and growth of oak-hickory.

Currently there are 73,388 acres of mature hardwood forest (> 80 years old) on NFS lands. These mature forest acres originated in the late 1800's and early 1900s as the iron furnace era came to a close, and farms were being abandoned. In other words, today's mature forests originated from even-aged events.

Even-aged management could occur on approximately 52,450 acres of NFS lands, based on management area prescriptions and habitat composition objectives. Over the next decade, up to 1,725 acres of mature

hardwood forest habitat could be treated with even-aged management techniques, or about 3 percent of these acres. Over time, age classes of forest stands in management areas that allow even-aged prescriptions will become regulated to the 120 year rotation scheme. When true regulation occurs, about 32% of these forest stands would be 60-99 years and 20% would be greater than 120 years. In 100 years, it is estimated that 6,453 acres would be at least 80 years of age, or about 12% of the acres where even-aged management could occur. A 120-year rotation was chosen to ensure mature forest habitat would be available, as well as diverse mast crops.

While it will take more than 100 years to achieve regulation, it is clear that implementing even-aged timber management techniques will provide mature forest habitat both now and in the future. Even-aged management is allowed in the DCF, DCFO, FSM, GFM, and RC management areas, and therefore mature forest resulting from even-aged methods will be well distributed across the landscape of the WNF.

### Mature Forest Summary

The estimated amounts of mature forest resulting from natural succession, Historic Forest prescriptions, uneven-aged management, and even-aged management are shown in Table 13. Currently, about 31% of the forest stands on the WNF are mature and offer potentially suitable Indiana bat habitat. Mature forest habitat on the WNF would likely increase by more than 119,000 acres after 100 years of implementation of the Selected Alternative. About 81.2% of the WNF would be covered by mature forest habitat that varies in both structure and species composition. The Selected Alternative ensures that potentially suitable Indiana bat habitat is available and well-distributed across the WNF, both now and into the future.

**Table 13. Summary of mature forest habitat trends for each alternative.**

		Estimated Acreage of Mature Forest Habitat Produced after 100 Years of Implementing the Four Mature Forest Conservation Approaches					
Alternative	Current Acreage of Mature Hardwood Forest Habitat	(a) Natural Succession	(b) Historic Forest	(c) Managed Uneven-aged Management	(d) Even-aged Management (80+ years)	Total*	Change from Current Levels
E <sub>mod</sub>	73,388	76,610	41,650	66,358	8,740	193,358	+119,970

\* A small percentage of the Wayne National Forest (<1%) that is comprised of water or non-forest was not included in estimates of future mature forest habitat for this analysis.

Other management activities included in Alternative E<sub>mod</sub> may benefit the Indiana bat and its habitat. Please refer to Table 7 for the upper limits of these management activities that may occur over the first decade.

- **Reforestation** would eventually create roosting and foraging habitats for the Indiana bat as the trees mature.
- **Crop tree release** often involves the girdling of small-diameter trees (i.e., less than 6 inches dbh) to open the canopy for neighboring trees; girdling could create additional snags for roosting.
- **Construction of waterholes, ponds, and lakes and restoration of wetlands** creates drinking water sources for Indiana bats as well as habitat for insect breeding, its food source.
- **Land exchange and acquisition** creates larger, contiguous areas of public ownership and thus reduces potential disturbance to roosting or hibernating Indiana bats from activities on private lands.
- The construction and maintenance of recreation **trails** may provide a travel corridor for foraging bats. Biologists often set mist nets across a trail when surveying an area for Indiana bats, especially if a water source is nearby. These trail corridors vary from 5-10 feet in width and maintain a forested canopy when the trail occurs in a forested setting.
- **Riparian and aquatic habitat restoration** includes activities that decrease the input of sediment and acid mine drainage into streams, as well as direct improvements such as placement of large woody debris and reconstruction of the natural dimension, pattern, and profile of streams. All of these activities result in improved aquatic habitat which may lead to increased insect production (Indiana bat food source) and improved drinking water sources.
- **Stabilization of disturbed areas**, including such sites as abandoned mine lands and orphan or depleted oil and gas wells, returns areas to an herbaceous or forested cover.
- **Road decommissioning** eliminates unneeded stream crossings (potential site for sediment introduction into streams) and it reverts sites to a forested condition.
- **Installation of bat-friendly gates** protects individuals from human disturbance and maintains suitable microclimate parameters.

### Activities Likely to Not Adversely Affect: Insignificant Effects

Some management activities may result in a potential impact to the Indiana bat and its habitat, but the impact would not reach the scale where take would occur. Established Forest-wide standards and guidelines minimize the scale of the potential impact to a point where it cannot be detected.

#### Disturbance of Winter Habitat

Human disturbance and modifications of hibernacula has been attributed to the rangewide decline of the Indiana bat population. Inappropriate barriers can limit access or can modify temperature or humidity in the hibernacula. Past underground mining has left many open mine portals on NFS lands. One underground limestone mine on the Ironton Ranger District has been categorized as a Priority III hibernaculum and has been protected through the installation of a bat-friendly gate.

Management activities that promote human activity in proximity to open portals that lead to mines with suitable winter habitat characteristics could lead to disturbance of these sites. Alternative E<sub>mod</sub> incorporates measures to protect known hibernacula.

- A Forest-wide objective (5.1.1a) calls for the installation of bat-friendly gates on hibernacula discovered on NFS lands to prevent unauthorized human entry.
- An established Forest-wide standard (TES-1) deters human access to areas surrounding known hibernacula by closing or relocating trails that lead to or pass within easy viewing distance of the site.
- Forest-wide standard (TES-2) prohibits new road and trail construction and surface occupancy for exploration or development of federally owned minerals within one-quarter mile of known hibernacula.
- Prescribed fire burn plans are to specify weather conditions that would prevent smoke dispersal into known hibernacula (TES-4).

Alternative E<sub>mod</sub> incorporates the same measures to protect known fall swarming sites associated with underground coal mines. Use of these openings may indicate the presence of hibernacula. Surveys to verify the presence of wintering Indiana bats in these underground coal mines cannot be accomplished for safety reasons, but guidance has been incorporated into Alternative E<sub>mod</sub> to minimize disturbance of these sites.

- Within a quarter-mile of any known fall swarming site where hibernating Indiana bats cannot be verified for mine safety reasons, guidance calls for the reduction or elimination of human disturbance (TES-3).

### Activities Likely to Not Adversely Affect: Discountable Effects

Some activities have discountable effects on potentially suitable habitat, which are effects that are extremely unlikely to occur. Land exchange is a primarily beneficial activity because it aids in consolidation of NFS lands, which provides more opportunity for landscape level forest management. There could be a situation where a tract of land with potentially suitable Indiana bat habitat is proposed for exchange. Biologists would be involved in the review of all land exchange proposals, and evidence of suitable habitat would be noted and brought to the attention of Forest Service managers. While it is possible suitable roost trees could be exchanged, the probability is low that known maternity roosts, known hibernacula or known swarming sites would be exchanged.

### Activities Likely to Adversely Affect

There are some activities, or components of activities, projected to occur within the first decade that could negatively impact Indiana bats. The following activities may include the need to fell one or more trees to accomplish the activity. Numerous species of trees have been identified as possible roost trees because of their structural characteristics (i.e., exfoliating or sloughing bark). Established Forest-wide standards minimize the potential for removal of current suitable roost trees (TES-10), and facilitate the maintenance of future roost tree availability (TES-12) in forest stands being treated with any timber harvesting methods. There is a possibility, however slight, that individuals could be roosting in an undetected roost tree, and the removal of the tree during the non-hibernation season could result in the accidental take of one or more individuals.

Each of the following activities also have the potential to modify Indiana bat foraging habitat, either for a short period of time or permanently.

#### Permanent Roads and Trails

Silvicultural prescriptions for uneven-aged and even-aged management require multiple entries into the same stand to attain, and then maintain, the desired future habitat conditions. The road system in areas treated with uneven-aged management methods is generally larger than that needed in areas treated with even-aged management methods. While some road construction may be necessary in both situations, existing roads can be reconstructed and used in the future, keeping the road system footprint basically the same over time. In other words, permanent road construction would likely decrease over time, while road reconstruction would increase over time.

To bring roads up to the appropriate standard, trees are removed from the road bed and drainage structures are repaired or improved during reconstruction. Some of these reconstructed roads may be gated and

closed to vehicle use, or may be converted to recreational trails until they are needed once again to conduct timber harvesting or other management activities.

This road and trail construction acreage might appear substantial if it was to occur all in one contiguous block, however each road and trail project is typically small, linear and would only remove a small portion of an otherwise forested landscape (Table 14).

Established Forest-wide standards protect current suitable roosting habitat, but permanent road and trail construction or road reconstruction could result in the loss of future roost trees or maternity colony trees.

Road and trail construction and road reconstruction activities could also affect the Indiana bat by reducing the amount of foraging habitat. These activities will result in narrow and linear corridors through the forest, but forest canopy cover over the road or trail surface should not be affected. For example, the greatest majority of permanent roads constructed or reconstructed would have a clearing width of 22 feet, with a road surface of 12 feet. Only access roads to recreation facilities or administrative sites have two lanes and have a clearing width of 30 feet and a surface width of 20 feet. Few access roads are likely to be needed. A clearing width of 10 feet is used for OHV, mountain bike and horse trails but the actual tread width is less than 50 inches. A five foot width is cleared for hiking trails, but the tread width is 24 inches.

Past mist net surveys on the WNF have shown that Indiana bats will use recreational trails as flight corridors while foraging, especially where water sources are located nearby or on the trail itself. Kiser and Elliot (1996) documented individuals roosting within 160 feet of narrow, one-lane dirt roads and suggested they may use road corridors for travel ways. The likelihood of this occurring is greater if forest canopy is maintained over the road corridor. Menzel et al. (2005) found Indiana bats foraging along roads in a relatively high frequency, and the authors suggested that the roads create a vertical foraging edge that can possibly reduce the energetic demands associated with flight, and may provide landscape orienting clues.

**Table 14. Acres of permanent road and trail construction, and road reconstruction during the first decade.**

Management Activity	Alternative E <sub>mod</sub>
Permanent Road Construction	74
Permanent Road Reconstruction	318
OHV Trail construction	150
Hiking Trail Construction	18
Horse Trail Construction	61
Mountain Bike Trail Construction	36
<b>Total</b>	<b>657</b>
<b>Percent of NFS Lands</b>	<b>0.28</b>

### Temporary Roads, Skid Trails and Log Landings

Temporary roads are necessary to accomplish various projects. These roads are constructed to the minimum standard necessary to accomplish the tasks at hand and ensure safety of workers. The clearing width can be as wide as 22 feet, with a surface width of at least 10 feet. The road is revegetated and after a period of a few years, trees are likely to be present again. The same is true for skid trails and log landings used in timber harvesting operations. These three activities could temporarily alter suitable foraging habitat but could also create conditions beneficial for foraging individuals (Table 15). The temporary roads and skid trails are narrow and linear in shape and the forest canopy is retained, which could make them suitable travel corridors especially if a water source is located nearby. A log landing is small in size, but may create a gap in the canopy. All three activities would open the canopy and understory, thereby moving localized conditions closer to optimal foraging habitat conditions.

**Table 15. Acreages of NFS lands projected to be affected by temporary roads, skid trails and log landings.**

Management Activity	Alternative E <sub>mod</sub>
Temporary Road Construction (acres)	146
Skid Trails and Landings (acres)	740
<b>Total (acres)</b>	<b>886</b>
<b>Percent of NFS Lands</b>	<b>0.37</b>

### Timber Harvesting

Timber harvesting is a tool used to achieve desired future terrestrial and riparian habitat conditions, and to maintain a component of oak-hickory in the landscape. It can improve short-term and long-term foraging habitat for the Indiana bat, but at the same time, it can alter the condition of forest

stands to where optimal foraging conditions are reduced for a period of time.

Uneven-aged methods can open the canopy to a desired level to improve foraging. An uneven-aged stand has trees of three or more distinct age classes, either intimately mixed or in small groups. Single-tree selection is the act of harvesting single trees to achieve and maintain a specific diameter distribution. Group selection is a method of tree regeneration in which the objective is to create an uneven-aged stand by regenerating parts of the stand by cutting small “groups”. Each group can be up to 2 acres in size. An established Forest-wide standard (TES-8) directs the Forest Service to maintain at least 60% canopy cover in all hardwood cutting units treated with uneven-aged methods to promote quality foraging habitat.

Trees that do not grow as fast as the others become weakened and increasingly less competitive for sunlight, water, nutrients, and/or space. Harvesting some trees in a stand that has been regenerated by even-aged methods reduces the density of trees on the site, and encourages healthier and larger individual trees. Pre-commercial thinning (i.e., occurs when a stand is about 20-30 years old) and commercial thinning (i.e., occurs when a stand is around 50 years old) are used to decrease stem density in forest stands that have been treated with even-aged methods in the past. Foraging habitat is likely limited in stands treated with these methods because of the high density of trees.

Even-aged management is beneficial for a variety of shrub and early forest species, and is a primary tool used to regenerate oak and hickory. The majority of forest stands that exist on the WNF today originated from even-aged timber harvests beginning as far back as the late-1800s. As stated above, certain oak and hickory species provide important roosting habitat for the Indiana bat. Even-aged stands generally have one age class, although two age classes can be found in some two-layered natural or managed stands. These stands generally have a well-developed canopy with a regular top at a uniform height. Different even-aged methods include:

- **Clearcut** - the stand overstory is generally removed in one harvest
- **Clearcutting with reserves** - a clearcutting method in which varying numbers of reserve trees are left standing to attain goals other than regeneration. The overstory trees that would be retained, called reserve trees, may be small or large trees, or combinations of small and large trees, retained for future growth; certain species components; current or future den trees; future sources of snags or coarse woody debris; or some level of visual quality
- **Shelterwood** - the cutting of most of the trees, but leaving those needed to produce seedlings

- **Two-aged system** - regenerates a timber stand and maintains two age classes. Optimal foraging habitat may be reduced with even-aged methods, but the effect is not permanent. As the stand regenerates and matures, it would once again provide optimal foraging habitat for the Indiana bat.

Even-aged timber harvests would generally range from 2-30 acres in size, however the harvest sizes could vary among the management areas. For example, harvest areas may be about 2 to 20 acres in size in DCF and DCFO management areas to ensure optimal habitat is available for early successional species, while maintaining suitability for mature forest birds during the post-breeding season (Ewing, 2003c, 2003d; Vitz, 2003). An established Forest-wide standard (TES-7) directs the Forest Service to retain forested flight corridors within and between stands treated with even-aged methods. Existing suitable roost trees, as well as trees left for future roost recruitment in the treated stand, would receive added solar heating from the open condition of the stand, something beneficial to females and young.

Table 16 summarizes projected timber harvesting levels for the first decade for the Selected Alternative.

Timber harvest, especially even-aged management methods, could temporarily reduce optimal foraging habitat conditions (up to 50 years). Shelterwood, two-age and clearcut with reserves would retain more trees on the site than a clearcut. MacGregor et al. (1999) reported male Indiana bats were roosting, during the autumn pre-hibernation period, in forest stands that were harvested by the two-age timber harvesting methods 0-5 years prior to the study. Even-aged management would be concentrated in the FSM and FSMO management areas, although small amounts could occur in the GFM, RC, and DCF management areas.

Alternative  $E_{mod}$  incorporates even-aged management prescriptions that encourage oak regeneration and it also incorporates Historic Forest prescriptions to create forest communities with more open understory conditions and which are dominated by oak and hickory species. Based on an analysis of projected acres of even-aged and Historic Forest treatments that could occur over the next 100 years (based on SPECTRUM model results), there would likely be a declining trend in oak-hickory on NFS lands with the implementation of Alternative  $E_{mod}$ , but this trend would be not be as severe as in the no action alternative.

Oak and hickory trees would likely remain scattered across the WNF as individuals, or found in small groups on ridges and southwest facing slopes. Extensive oak and hickory communities would also be concentrated on the landscape where the HF and HFO management areas are located.

**Table 16. Projected levels of timber harvest during the first decade.**

Management Activity	Alternative E <sub>mod</sub>
Historic Forest Prescriptions	7,398
Uneven-aged Hardwood and Mixed Hardwood Timber Harvest (acres)	7,158
Thinning (acres)	1,460
Even-aged Hardwood Harvest (acres)	1,725
Even-aged Pine Harvest (acres)	200
<b>Total Harvested</b>	<b>17,941</b>
<b>Percent of NFS Lands Treated</b>	<b>7.5</b>
<b>Percent of Action Area Treated</b>	<b>1.6</b>

### Crop Tree Release

Crop tree release is a release treatment performed during the sapling stage to free selected trees from competition of overtopping trees of comparable age (or woody vines and shrubs), and to favor the trees that are needed to meet wildlife habitat or other management objectives. This method involves the felling or girdling of individual trees (less than 6 inches dbh) to improve growing conditions for certain tree species. The forest canopy is left intact. Trees that are felled are not removed from the stand.

Crop tree release is performed in a young, dense stand that is not likely to possess Indiana bat foraging habitat. Trees cut or girdled are smaller-diameter trees, but SFW-TES-10 would be applied to ensure protection of any existing trees that possess Indiana bat roosting habitat. Alternative E<sub>mod</sub> has incorporated a Forest-wide guideline (VEG-16) that encourages the girdling, rather than felling, of any trees that could provide some quality snag habitat. Still, there is a possibility, albeit extremely small, that an unknown Indiana bat could be roosting in a tree that is cut as part of a crop release project.

### Prescribed Fire

While prescribed fire can be a beneficial tool to aid in the regeneration of oak-hickory and to open up the understory for improved foraging habitat, prescribed fire may have direct and indirect effects on the species.

Fire, heat or smoke could directly affect roosting individuals. Indiana bats leave their hibernacula by mid-April and begin to travel to their summer habitat, but the timing could be earlier or later depending on weather. Females become pregnant and give birth to their single pup during early summer. The female can only carry the pup for a short period of time, after which time the pup must remain at the maternity roost until it can fly on its own. It is during this time period is when smoke and heat could have the greatest negative effect on these immobile individuals (i.e., early summer through late-summer).

Indiana bats are insectivores. Prescribed fire can create vegetation conditions favorable for increased insect production or activity. Yet, the abundance of organisms in the leaf litter and upper soil layers can be reduced in sites treated with prescribed fire, although they recolonize the

area as it revegetates (Boerner, 2000). Recolonization of the site by insects may be in part due to changes in the plant community after a prescribed fire. Hutchinson and Sutherland (2000) reported that long-term studies of forest communities subjected to prescribed fire show the understory vegetation response can be variable, but for the most part small increases in plant species richness or diversity occurs in the central hardwoods region. A shift in plant species composition may occur in the understory due to the reduction in leaf litter and exposure of mineral soil.

Carter et al. (2000) reported that fires that cause overstory mortality can create canopy gaps which can allow for more effective foraging. They also noted that depending on fire intensity, tree species susceptibility, and tree canopy position, roosting cavities can be created. However, snags serving as bat roosts could be consumed in the fire.

The primary prescribed fire season generally occurs during the late-winter and early spring, often times ending by mid-April when the forest vegetation begins to leaf out. Depending on environmental conditions, a minimal amount of prescribed fire could occur as late as the end of April. However, the “spring green-up” that occurs by mid-April limits the use of fire. The secondary prescribed fire season runs from fall and through the winter if weather conditions are appropriate. However, secondary season prescribed fires could be conducted as early as late-summer if weather permits.

Prescribed fire activities also include construction of firelines. Both hand lines and dozer lines are used as fire breaks. Hand lines are narrow segments where firefighters use rakes, leaf blowers and ATV mowers to remove fuels. Dozer lines are constructed on old, existing roads. Hazard trees represent the biggest danger to firefighter safety, so hazard trees are felled along firelines. Some of these trees could provide current or future roosting habitat.

The use of prescribed fire is projected to increase from current levels during the first decade. A total of 69,819 acres could be burned within the first decade, but because some of the same acres of land could be burned twice, the actual affected area on the ground is less (Table 17).

More or less than a quarter of the WNF could be treated during the first decade, which averages to about 5,000-7,000 acres or 2-3 percent of NFS lands annually. Prescribed fire would occur across the planning area in management areas that allow treatment of habitat with fire, rather than being concentrated in one area.

Prescribed fire can improve Indiana bat habitat, but could adversely affect individuals if conducted when individuals are less mobile (i.e., hibernating and generally during birth until pups are strong enough to fly on their own to avoid smoke and heat). An established Forest-wide standard (TES-4) requires that all prescribed fire burn plans specify weather conditions that

would prevent smoke dispersal into known hibernacula, which is especially important during spring burns when individuals are preparing to leave the hibernacula and during fall burns when individuals may be involved in fall swarming. Another established Forest-wide standard prohibits the use of prescribed fire during the secondary fire season until after August 15<sup>th</sup> to provide time for juveniles to strengthen their flying skills and to account for possible late birth events resulting from colder spring weather (TES-11).

**Table 17. Acreages of prescribed fire that may occur during the first decade.**

Primary Purpose	Alternative E <sub>mod</sub>
Non-native Invasive Species Control	200
Maintenance of Grassland and Herbaceous – Shrub Habitat*	1,500
Oak Regeneration	46,215
Hazardous Fuels Reduction	21,904
<b>Cumulative Total (acres)</b>	<b>69,819</b>
<b>Total Acres Affected</b>	<b>62,467</b>
<b>Percentage of NFS Lands Affected**</b>	<b>26.2</b>
<b>Percentage of Action Area Affected**</b>	<b>5.6</b>

\*Some acres treated for oak regeneration would be treated twice in the first decade.

\*\*Some of the same acres of NFS lands are projected to be treated with prescribed fire more than once during the first decade. Figures in this row reflect the percentage of NFS lands treated with fire, rather than the cumulative acreage figures reported above.

### Development of Permanent Forest Openings

A small percentage of the WNF is comprised of relatively small openings in the forest (generally 1-5 acres in size), or on the periphery of larger tracts of forested land. Some of these open areas contain rare plant or insect populations, while others serve as foraging areas for various mammals and birds. The herbaceous and shrubby mix of vegetation offers an array of soft mast and insects for these animals. Trees present in and at the edge of openings could provide suitable roosting habitat to Indiana bats because of the increased sunlight. Indiana bats could find the edge of these openings beneficial for insect foraging (Sparks et al., 2004). Up to 500 acres of openings could be created during the first decade.

While forest openings were historically developed by removing trees within forested areas, today Forest Service managers rely primarily on the designation of existing open land on acquired properties to serve as permanent forest openings. Similarly, development of agreements with utility companies would continue to be pursued to manage utility corridors as quality permanent forest openings. While it could occur, the probability is low that forested area would be converted to a permanent forested opening. For example, log landings have been designated as openings after a timber harvest was completed, and then maintained.

### **Energy Minerals Development – Oil and Gas Resources**

About 121 acres of NFS land could be affected by the construction of access roads, well pads, and tank batteries. The development of access roads, well pads, and tank batteries could result in the removal of suitable roost trees or alter foraging habitat.

The removal of trees for facilities associated with the well are permanently converted to non-forest cover, however forest canopy cover is generally maintained over the access roads and pipelines. Small openings in the canopy may result from the development of the well pad and tank battery. The removal of trees for these activities may provide flight corridors for foraging and may open the canopy to a level preferred by the Indiana bat.

Construction of access roads and well pads could result in the removal of current and future suitable roost trees. All activities on federal oil and gas leases are subject to certain stipulations, and operations cannot proceed otherwise. These stipulations (based on laws, regulations, and executive orders) are provisions that modify standard lease rights and are attached to, and made part of, a new lease. They provide for greater protection of identified resources, as well as mitigation of negative effects. A No Surface Occupancy stipulation prohibits the use or occupancy of the land surface for oil and gas exploration and development to protect desired values, and it has been placed on NFS lands within one-quarter mile of known Indiana bat hibernacula (MIN-9). A Controlled Surface Use stipulation identifies specific areas on the ground where operations can or cannot occur on federal leases and it has been placed on NFS lands within riparian areas and wetlands (MIN-10). A Controlled Surface Use stipulation prohibits the cutting of snags (trees with less than 10% live canopy), shagbark or shellbark hickories, or trees that are hollow and/or have major splits or broken tops, except during the Indiana bat hibernation season (September 15 to April 15) (Revised Forest Plan, Appendix H). If such trees are a safety hazard, they may be cut anytime they pose an imminent threat to human safety, but if cut in the non-hibernation season the Forest Service biologist must be notified in advance. This stipulation applies only to trees over six inches in diameter

An important difference in the administration of reserved or outstanding rights is that the exercise of those rights is not a privilege but a legal right owned by a private party. Private mineral owners are free to develop reserved or outstanding minerals on NFS lands in accordance with valid existing rights, severance deed rights, State and federal laws, the Secretary of Agriculture's Rules and Regulations (for reserved mineral rights only) and an approved plan of operations. For reserved mineral rights, the Forest Service will approve an operation permit where required by the Secretary of Agriculture's Rules and Regulations (1937, 1947 and 1963 rules). Even when a permit is not specifically required (1911 rules), the operator must still develop and submit a plan of operation for review by the Forest Service.

For outstanding minerals, a minerals operation plan will be negotiated. In the process of reviewing the plan of operation for reserved rights, or when negotiating the terms and conditions of a plan of operation for outstanding minerals, the Forest Service will request a voluntary adherence to Forest Plan standards and guidelines that protect Indiana bats and their habitat. It is possible that suitable roost trees could be removed during the non-hibernation season during the development of oil and gas resources on NFS lands with reserved or outstanding rights. There is a possibility, however low, that one or more Indiana bats could be directly harmed if such trees were occupied and removed during the non-hibernation season.

Runoff from production wells could contaminate nearby aquatic resources, which may be used by the Indiana bat for drinking or feeding. Brine spills could occur during oil and gas well development; however the operator is required to construct berms around the wells to contain any spills. The brine is required to be removed by tank truck.

### **Energy Minerals Development – Surface Mining**

Activities associated with surface mining could remove current suitable roost trees and trees that could recruit into future roost trees in potentially large areas. If currently suitable roost trees are removed during the non-hibernation season (April 15 to September 15), one or more Indiana bats could be directly harmed. Foraging habitat could be permanently converted to non-forest cover for an undetermined period of time.

Reclamation of a surface mine site to forest cover is not guaranteed since the character of the soil is changed and compaction occurs during the mining and reclamation process. At best, foraging and roosting habitat would be lost for several decades.

The Surface Mining Control and Reclamation Act of 1977, as amended, prohibits surface mining of coal on any federal lands within the boundaries of any National Forest east of the 100<sup>th</sup> meridian (located in central Texas) subject to valid existing rights and certain exceptions. Therefore, as a general rule, deposits of coal underlying NFS lands may be mined only by underground methods.

The Forest Service has recently approved a Plan of Operation for a coal exploration drilling program in the Corning, Ohio area on private minerals on the Athens Unit. The initial phase will result in approximately 33 holes being drilled with another 60 to 80 test holes planned over the next couple of years. Some of the test holes will be drilled in an area that would be designated as a FOF management. If exploration results are encouraging, a prospecting permit to drill about 95 acres of Federal coal may be requested from the BLM, which in turn could lead to an application to lease Federal coal. An additional 245 acres may also be involved in the same operation when the minerals (including coal) revert back to the United States in 2010. The long-term plans of the coal company are to underground mine an extensive area east and north of Corning, much of which will be under

WNF. The company is currently working on its plan of operation, and has unofficially proposed to use about 25 acres of WNF surface for storing about 600,000 cubic yards of overburden from their underground operations, as well as a haul road, a conveyor belt, and a sediment pond. At last report, they were in the process of writing an EA with the intent of applying for a compatibility determination from OSM. They have alternatively talked about storing the overburden on private land, but are still proposing the road, conveyor belt, and the sediment pond on National Forest System lands. Should OSM, through ODNR (in consultation with the Forest Service), allow the storage of the overburden, it would affect 23 acres for a period of 20 to 30 years. The haul road would affect about 0.37 acre (1000 feet long - 16 feet wide), the conveyor belt would affect less than 0.01 acre (four 3' x 6' piers within a span of 1000 feet), and the sediment pond would affect about 1 acre.

On the Ironton District, one company holds valid existing rights to strip mine coal on approximately 1,200 acres of land. The company is planning to conduct coal exploration drilling to determine the quality and quantity of the coal with the possibility of strip-mining in the future. Because of legal problems, it is unclear at this point if the company will actually proceed with the coal operations in the next ten years. If they do, it will severely disturb approximately 1,200 acres of NFS lands located north of the Bear Run area, which appears to be an important area for the Indiana bat on the Ironton Ranger District.

#### **Hazardous Fuels Reduction – Mechanical Methods**

The increased density of forests, combined with fire suppression and natural disturbances like the 2003 ice storm, have led to an increase of woody material on the forest floor. Experts who study fire behavior suggest this increased amount of material could pose a wildfire risk to human health and safety, and therefore projections for 10,181 acres of mechanical fuels reduction could occur in the first decade. Reducing the risk of wildfire not only benefits wildlife in general, it would benefit the Indiana bat. An uncontrolled wildfire burns hotter and could occur at any time of the year depending on environmental conditions.

Treatment of hazardous fuels is expected to occur primarily in pine stands where fuels appear to be greater than other areas on the WNF. The work involves the lopping and scattering of smaller woody material on the ground. However, it is possible that a leaning or standing tree would be felled and bucked up or removed, either as part of the fuels reduction work or to protect workers from a potential hazard tree. There is a possibility, however slight, that individuals could be roosting in such a tree, and if removed during the non-hibernation season one or more Indiana bats could be unintentionally harmed.

### **Utility Corridors**

The removal of current or future suitable Indiana bat roosting or foraging habitat could occur with the construction of utility corridors. Utility companies apply for a special use permit to construct corridors for transmission of water, electricity, or other utilities to private lands across NFS lands. Requests for special use permits for these activities occur periodically, and no long-term utility corridor plans are available from the utility companies. Development of privately-owned inholdings is generally the driver for such construction projects.

Utility corridors are linear, and vary in width. Many are generally narrow in width and are placed in road right-of-ways. Some traverse the forest, but are generally narrow enough to where forest canopy cover can be maintained over the corridor. A few corridors could be larger transmission lines where a linear canopy gap occurs through the forest. The Forest Service estimates about 50 acres of NFS lands could be impacted during the first decade.

### **Construction of Administrative or Recreation Sites and Parking Lots**

The removal of current or future potentially suitable Indiana bat roosting or foraging habitat could occur with the construction of administrative or recreation sites. Such sites are usually kept in a park-like setting and are generally small (about 5 acres each). About 50 acres of NFS lands could be converted to administrative or recreation sites during the first decade. About 10 acres could be converted to small roadside parking areas. The effect of these activities would be the same as described for roads, trails, and oil and gas well developments.

### **Closure of Open Mine Portals and Subsidence and AMD Treatment**

In places, the thin limestone cap is collapsing into underground mine chambers. These subsidence are not only a public safety concern, they are points where surface water can enter underground chambers and recharge acid mine drainage. Some entrances to old mines remain open, and also pose a public safety concern. In both cases, the Forest Service projects to close a portion (i.e., up to 155) of the hundreds of subsidence and open portals that exist currently. Closing them could involve backfilling or installation of bat-friendly gates. Bat-friendly gates are usually installed when a biologist determines there could be potentially suitable habitat in the mine and acid mine drainage recharge is not a factor.

In addition to the potential for the need to remove one or more trees to access these sites, closure of such mine features could adversely affect the Indiana bat if they are used as hibernacula. Closure could eliminate a hibernaculum or could modify the microclimate of a larger underground complex making it no longer suitable for individuals. Mine safety regulations do not allow for the survey of such open mine features to check for hibernating individuals. To minimize the potential for adverse

effects, an established Forest-wide standard (TES-5) calls for the surveys for bat presence during the fall swarming period to assess whether bats are indeed using the feature.

Remediation of AMD is beneficial for the Indiana bat, however during construction of source treatments, some trees may need to be removed.

### **Hazard Tree Removal**

An activity that is common to all management activities conducted on the WNF is the management of hazard trees. These trees sometimes possess Indiana bat roost tree characteristics. Protection of the public and Forest Service workers, contractors, partners and volunteers is of great importance. Periodically, a hazard tree will be present within a work site and will need to be removed to ensure safety.

The Forest Service estimates that up to 2,550 hazard trees with potential Indiana bat roost habitat may be removed during the first decade to ensure human safety based on trends for recent years. The Forest Service has a record of trying to plan ahead and remove such trees prior to the non-hibernation season, but there is a chance that these trees will not be noticed during the hibernation period. For example, only 20 hazard trees that had Indiana bat tree characteristics have been removed from work sites during the non-hibernation season between September 2001 and August 2005. Therefore, the majority of these hazard trees would be removed during late-fall through winter when the Indiana bat is hibernating.

The Forest Service is careful in implementing its hazard tree program; however it must follow Forest Service directives. These directives require that trees, with a crown that is greater than 50% dead, be removed from developed recreation sites. These directives also require such trees to be removed at dispersed recreation concentration points. These areas include trail intersections or sign information areas. Along trail corridors, trees that are leaning over the trail are removed. In the event a hazard tree needs to be removed from a high human use area (i.e., recreation-associated area) during the non-hibernation season, an emergence survey would be conducted at the hazard tree prior to its removal (TES-10).

The largest number of hazard tree removals may occur on the Ironton Ranger District because the 2003 ice storm affected thousands of acres of forest, and individual trees that were affected are still dying and falling along trails and roads and in recreation areas. This figure may seem high, but a broad analysis of WNF vegetation data shows that on the average, a mature stand has about 15 trees with current Indiana bat roost tree characteristics (K. Flegel, pers. comm.). If that figure was expanded out to the more than 73,000 acres of mature forest on NFS lands, at least 1.1 million trees are likely to exist that possess current Indiana bat roosting habitat. This figure is likely conservative since it does not take into

account the number of trees affected by the 2003 ice storm or what is present on non-NFS lands.

### **Hickory Tree Removal**

Many roost trees with optimal roost characteristics are dead or dying, but living shellbark and shagbark hickories trees are especially important because they offer optimal roost characteristics for decades. Hickory trees also provide benefits to many other wildlife species.

Alternative E<sub>mod</sub> recognizes the importance of these trees as potential roost sites by incorporating a Forest-wide guideline to retain all shellbark and shagbark hickories (TES-9). This differs from existing direction in the 1988 Forest Plan, as amended, that allows the removal of shagbark and shellbark hickory trees during the hibernation season. During the implementation of the projected management activities, many of which would result in long-term benefits to the Indiana bat and its habitat, some hickory trees may need to be removed to enable the project to proceed without causing adverse effects to other resources important to the Indiana bat. Removal of such trees would be done during the hibernation season, when possible.

As an example, a shagbark hickory may be located on an old road that needs to be reconstructed to conduct habitat improvements for the Indiana bat or other plant or animal species. Avoidance of the hickory tree could result in the need to construct a new road, or may cause engineers to have to cut into unstable hillsides. Removal of the hickory would result in less soil disturbance or potential soil erosion, thereby benefiting water quality and potential Indiana bat drinking and feeding sources.

According to WNF timber markers and Forest Inventory and Assessment data, shagbark and shellbark hickory trees are usually scattered about in most stands that occur on drier sites, sometimes single or in small groups (M. Freidhof, pers. comm.). An analysis using data from current management projects and expertise from WNF forestry technicians, up to 1,141 shagbark and shellbark hickory trees greater than 6 inches dbh (i.e., suitable roost size for individuals) may need to be removed over the first decade to avoid long-term resource effects.

### **Summary of Direct and Indirect Effects**

Alternative E<sub>mod</sub> includes management activities that could benefit the Indiana bat, but others that may cause potentially adverse effects to the Indiana bat, either from the permanent loss of habitat or the alteration of habitat for a period of time (Table 18).

**Table 18. Estimates for management activities that could result in the permanent loss or alteration of Indiana bat habitat on NFS lands during the first decade.**

	<b>Alternative E<sub>mod</sub> (acres)</b>
<b>Permanent Loss of Habitat</b>	
Permanent Road Construction - Reconstruction	392
Recreation Trails	265
Recreation Facilities & Parking Lots	60
Surface Mining	1,250
Oil & Gas Well Development	121
<b>Total Loss of Habitat</b>	<b>2,088</b>
<b>Percent NFS lands affected</b>	<b>0.87</b>
<b>Percent action area affected</b>	<b>0.19</b>
<b>Alteration of Habitat</b>	
Timber Harvest	17,941
Crop Tree Release	2,113
Prescribed Fire	69,819
Temporary Roads, Skid Trails and Log Landings	886
Hazardous Fuels Reduction – Mechanical Methods	10,181
Development of Permanent Openings	500
Utility Corridor Development	50
Closure of Mine Features	232
AMD Treatments	270
<b>Total Alteration of Habitat</b>	<b>101,992</b>
<b>Percent NFS lands affected</b>	<b>42.8</b>
<b>Percent action area affected</b>	<b>9.2</b>
Hazard Tree Removal	2,550
Hickory Tree Removal	1,142

Over the first decade of Forest Plan implementation, it is estimated that 2,088 acres of potentially suitable Indiana bat habitat could be permanently lost (Table 18). However, these activities would result in the permanent loss of less than 1% of potentially suitable habitat on the WNF and in the action area.

- Forest-wide standards are in place to minimize the potential for removal of any currently suitable roost tree. Measures are also in place to ensure trees are available to recruit into roost trees out into the future.
- Approximately 657 acres would be affected by construction of permanent roads, trails, and reconstruction of roads. Habitat impacts should be minimal since the acreage of individual projects would be generally small and spread out across the landscape. Reconstruction acreages are limited to existing road footprints and

would not add to the on-the-ground acreage affected. The forest canopy is generally intact after the construction or reconstruction of these transportation features, and they could actually provide travel corridors or could open up the canopy to a more optimal level for foraging.

- Development of oil and gas wells converts forest land into non-forest land, but leaves a similar mark on the landscape as do roads and trails. Access roads could serve as travel corridors and the small gaps in the canopy created by the well pad could improve localized forest canopy conditions to a range more suitable for Indiana bat foraging.
- Construction of recreation facilities are generally small in scope, and result in a park-like or savannah-like setting. An established Forest-wide guideline encourages the retention of larger mast-producing trees when developing campgrounds to enhance wildlife viewing opportunities (REC-11). These could provide roost habitat since they would be located in a more open setting. Indiana bats have been found foraging in open areas and forested areas with less than 50% canopy, so it is possible they could use such areas for foraging.
- Surface mining activities projected could result in the largest potential loss of habitat during the first decade, about 57 percent of all acres affected by activities that could result in the permanent loss of habitat. As described above, the potential for the 1,200 acre surface mine at the Ironton Ranger District to occur is not certain.

Over the first decade of Forest Plan implementation, it is estimated that 101,992 acres of potentially suitable Indiana bat habitat could be altered (Table 18). These activities would alter 42.8 percent of NFS lands and 9.2 percent of the action area, however many of the activities could actually improve Indiana bat roosting and foraging habitat over the short-term or long-term (or both). This acreage may seem substantial, but consider the following:

- When done properly, experts consider forestry practices to be compatible with Indiana bat conservation; however, silvicultural methods need to maintain structural features important for roosting and foraging, such as snags, small openings, and edge habitats (BCI, 2001). Forest-wide standards are in place to minimize the potential for removal of any currently suitable roost tree. Measures are also in place to ensure trees are available to recruit into roost trees out into the future. In addition, shagbark and shellbark hickories are retained, unless removal is needed to ensure long-term resource protection important to the Indiana bat.

- Uneven-aged timber harvest, Historic Forest prescriptions, thinning, crop tree release and prescribed fire are designed to improve foraging habitat for the Indiana bat, both for the short-term and the long-term. About 87,950 acres could be affected by these activities, but could result in improved foraging habitat conditions. These types of activities are distributed across the National Forest and across the first decade, so these activities would not be directed at one particular spot or be conducted in a short amount of time.
- Maintenance of oak and hickory on the landscape is important for a variety of wildlife species, but the structural characteristics these trees have makes their maintenance in the landscape important for long-term Indiana bat roosting habitat. Even-aged management, while it reduces foraging habitat for a period of time (i.e., not permanently), plays a role in regenerating oak species and their retention in the landscape over time. Even-aged management is focused within the FSM, FSMO, and GFM management areas, but could occur in small amounts in other management areas.
- Forest openings are small, and development of these areas should have a minimal effect on foraging habitat. They are generally developed from areas already in an open condition, and are kept to the periphery of large tracts of interior forest (WLF-5). These sites may provide foraging opportunities for the Indiana bat (Sparks et al., 2004). Researchers are discovering that foraging habitats may include upland, bottomland, and riparian woodlands, as well as forest and cropland edges, fallow fields, agricultural lands, residential areas and areas of impounded water (Kiser and Elliott, 1996; Carter et al., 2002; Farmer et al., 2002; Miller et al., 2002; Murray and Kurta, 2004).
- Utility corridors are narrow and linear. Those located in road right-of-ways would not change the condition existing along a road. Those that occur through forest areas remain in some vegetated condition, thereby providing a potential foraging site, albeit less optimal than areas with forest canopy.
- Approximately 886 acres could be affected by construction of temporary roads, skid trails, and log landings. Habitat impacts should be minimal since the acreage of individual projects would be generally small and spread out across the landscape. The forest canopy is generally intact after construction, and the area is revegetated and allowed to return to forest after the project is completed. These features could provide travel corridors or could open up the canopy to a more optimal level for foraging.
- Treatment of hazardous fuels by mechanical means does not alter foraging habitat since treatment is primarily confined to fallen

trees and woody debris. Most of the treatments would be emphasized in pine stands. It is considered an activity which could alter habitat because there is a potential for removal of an undetermined roost tree. However, as stated above, this potential is minimized by established conservation measures integrated into Alternative E<sub>mod</sub>.

- The total acreage of potentially suitable Indiana bat habitat that may be altered could actually affect less acres on-the-ground when activities are implemented. For example, the effects analysis pointed out that some acres of prescribed fire would actually occur on the same patch of ground (Table 17). As another example, an uneven-aged timber harvest may account for 50 acres. Some of the temporary roads, landings and all of the skid trails would occur on the same acres as the actual harvest. Project-level analysis would identify actual disturbance acreages.

### Cumulative Effects of the Selected Alternative

The WNF plays a role in the recovery of the Indiana bat, albeit possibly a smaller role than other National Forests and public/private ownerships within the species range. A Priority III hibernaculum and known fall swarming sites indicate that winter habitat is present on the WNF. As of 2005, at least 333 individuals were known to be hibernating on the WNF. A large part of the WNF has been surveyed for the presence of the Indiana bat, but surveys completed to date suggest that two areas in the action area are especially important. The southwestern part of the Athens Unit (an area bounded by Haydenville – Dorr Run – Snake Hollow – Monkey Hollow) and the Bear Run area of the Ironton Ranger District include fall swarming sites or a known hibernaculum, and known foraging habitat. Lactating or post-lactating females have been captured in both areas, indicating maternity colonies may be in or near these two areas.

Cumulative effects were analyzed within the 1,108,199 acre action area (see *Location and Ecological Setting of the Proposed Action* for a description of the action area) rather than the WNF proclamation boundary because:

- a. The action area contains all anticipated direct and indirect effects of implementing Alternative E<sub>mod</sub>;
- b. Smoke generated from prescribed fire activities (potential direct effect on roosting bats) is likely to travel the farthest off-site from NFS lands. Smoke dissipates into the air column and detectable levels are minimal at a distance of one-mile from the fire (K. Moore and A. Acheson, pers. comm.). Therefore, if a prescribed fire was conducted on NFS lands on the edge of the WNF proclamation boundary, the additional mile should be adequate to

encompass direct and indirect effects for this species.

- c. The action area is large enough to contain the summer foraging range of any local individual bats using the WNF. Males and females will travel variable distances from roosts to forage, with some documented as traveling over 2.5 miles to forage. If the southwestern part of the Athens Unit and the Bear Run area of the Ironton Ranger District are assumed especially important to this species, the cumulative effects analysis area is more than large enough to incorporate a typical foraging range around these areas.

### **Winter Habitat**

Winter habitat is limited in the action area since karst systems (limestone caves) do not occur here. An abandoned underground limestone mine is being used by the species, and mist netting indicates that individuals are using some underground coal mines in the Monkey Hollow, Snake Hollow, and Dorr Run areas of the WNF during fall swarming. Due to safety regulations, biologists cannot access these coal mines to verify if they are being used as winter hibernacula.

Underground mining occurred in portions of the action area in the past, primarily on the Athens Unit and on the western half of the Ironton Unit. An abandoned mine inventory conducted by the Forest Service resulted in the location of 1,467 underground mine portals and 220 subsidences on NFS lands in the Pine Creek and Monday Creek watersheds, about half of which are open. Not all of these openings lead to suitable winter habitat, but the Forest Service evaluates portals for human safety hazards and for use by bats. Where the two overlap, the Forest Service evaluates the portal for gating. To date, 8 open portals have been gated on NFS lands, and 20 open subsidences have been closed.

It is unknown how many open coal mine portals or subsidences are on private lands, but the figure is probably less than that for NFS lands. Most abandoned mine lands in the Monday Creek watershed are on NFS lands and about half are on NFS lands in the Pine Creek watershed. Open mine portals on private lands are not regulated. Some people modify them, while others leave them alone. The Ohio Division of Mineral Resources has a reclamation program to help landowners alleviate health and safety threats from open portals. To date, this agency has closed or gated 382 mine entries statewide. The Division assesses each opening as to its potential for providing winter habitat, and gates opening if it may be present. This program would likely continue into the future if the abandoned mine program is reauthorized.

In the next few years, the Federal Highway Administration will begin construction of a bypass around Nelsonville, Ohio. There are numerous mines in the area, including one about 600 feet from the future disturbance area where an Indiana bat was captured. Blasting near the mine could

cause the mine to collapse which could kill or trap hibernating bats, and vibrations generated from the use of equipment and blasting could cause bats to awaken during hibernation thus decreasing their fitness (USFWS, 2005a). Monitoring will be conducted at this portal during construction, and because monitoring would detect immediate threats to the mine, the Fish and Wildlife Service does not anticipate the blasting would approach a level which could cause the mine or portal to collapse. In addition, the Fish and Wildlife Service did not believe the noise from construction would pose a detectable response from hibernating bats based on several studies that have been done to assess the effects of noise on Indiana bats (USFWS, 2005a).

Using a cumulative effects analysis time period of ten years (i.e., typical Forest Plan cycle), as many as 555 mine openings could be closed in the action area. The Division of Mineral Resources could possibly close about 370 openings (based on their 2004 accomplishments). The Forest Service may close 155 portals and subsidences on NFS lands (i.e., same amount for the no action alternative and for Alternative E<sub>mod</sub>). In addition, 20-30 mine openings may be gated on the WNF.

There should be no adverse cumulative effects on potentially suitable winter habitat from Forest Service actions because conservation measures have been incorporated into Alternative E<sub>mod</sub> to remove the risk of affecting winter habitat. These measures include Forest-wide direction that encourages pre-gating and post-gating mist net surveys at mines where bat-friendly gates are installed (GFW-TES-6), and fall swarming surveys at any mine openings that may be backfilled (SWF-TES-5).

The Forest Service has also included measures to limit as much as possible the potential for disturbance of individuals at known hibernacula and known fall swarming sites (see Forest-wide standards and guidelines SFW-TES-1 through SFW-TES-4).

### **Summer Habitat**

Land use activities fall into two categories – they either alter suitable Indiana bat habitat for a period of time until it once again is suitable, or they result in the permanent loss of habitat. Cumulative effects of these activities will be discussed separately.

Analysis of cumulative effects that may alter summer habitat proceeded from the current forest age class and composition, through the next 50 years. This timeframe was chosen because of all direct and indirect effects that could affect summer habitat, even-aged timber harvesting could alter foraging and roosting habitat for up to 50 years. At about this time, stands are beginning to open up and trees are growing larger in diameter, both of which may offer foraging and roosting habitat once again. Cumulative effects of activities that could result in the permanent loss of habitat will be addressed over a ten year period for two reasons:

(1) the transportation system needed to manage forest resources should be mostly in place after a period of ten years, and (2) activity levels on private lands after this period are difficult to estimate.

### **Alteration of Summer Habitat**

#### **Past**

Mature forest with canopy gaps and open understories is important to this species, both during the summer and during the swarming period; however forest structure has changed over time. Researchers believe that the action area was primarily forested, but about 10 percent of the area was disturbed each decade by weather-related events or by forest pests and diseases (Runkle, 1982). These disturbances ranged in size from canopy gaps to larger blowdowns, and were scattered across the landscape. In the central hardwood forest, the climate warmed and became drier 5,000 to 8,000 years ago, and an increase in fire occurred. Native American people utilized fire to clear forest from around their camps, clear brush for improved hunting and for better visibility for protection against enemy attacks (Fralish, 2004). The action area was a mosaic of early-, mid-, and late-successional forest habitats.

As European immigrants moved into the action area in the late-1700s, the forest was cleared for home sites, agriculture, lumber and mining. By 1940, only about 15% of the forest cover was still present in Ohio, and this trend was likely similar for the action area (Ohio Division of Forestry, 2004). Active fire suppression began in the 1920s.

#### **Present**

Today, the Ohio Division of Forestry estimates that almost 30% of Ohio is now covered by forest once again, and the trend is similar for areas of Kentucky and West Virginia within the Southern Unglaciated Allegheny Plateau (Ewing, 2003a). An estimated 79 percent of the lands within the action area are forested today, based on Landsat TM (1994).

While forest cover has increased, it has a different structure and composition than what occurred here before Europeans first started moving into the area. Based on written accounts of early settlers and travelers in the Ohio Valley, forests were described as being park-like with large, widely spaced overstory trees and relatively little undergrowth of woody vegetation. Chestnut-oak forests dominated the landscape until the early 1900s, but these changed to oak-hickory forests after the chestnut blight occurred. An analysis of the structure, composition and condition of overstory trees in research plots located in southeastern Ohio suggests that the today's forest is denser than that reported for old growth oak-hickory forests and for presettlement forests (Sutherland et al., 2003; Yaussy et al., 2003). Changes in disturbance patterns over the past 75 years have been suggested as reasons why an increase in shade tolerant species (e.g., red

maple) is occurring in greater abundance in the forest understory and midstory (Abrams, 1992; Abrams, 1998). There is no scientific information available at this time to know whether the increasing density of forest communities is a contributing factor to the Indiana bat's decline.

Forested lands within the action area are managed in a variety of ways, creating a mosaic of habitat conditions across the action area. National Forest System lands account for 21 percent of the action area and 94 percent of these are forested. Tables 2, 10, and 11, and Figures 6 and 7 provide detailed information about the current age class and species composition distributions of forest stands on NFS lands.

Based on knowledge gained by WNF field-going staff, about 50% of the private lands in the Ironton Unit have been logged over the past 20 years. About 95 percent of the treatments were considered high-grading or diameter-limit cutting. These private lands are now in various stages of regeneration, from sapling to pole sized trees. This scenario is most likely similar for the Athens and Marietta Units. These harvesting methods deliberately harvest mature trees and/or thin intermediate age classes, regenerating a new age class to replace the old. However, landowners frequently partially cut stands as a harvesting method without the deliberate effort to thin immature age classes or to regenerate a new crop. These partial cuttings often take the form of diameter-limit cuttings in which all trees of a specified diameter and larger are cut. A second type of partial cutting removes only the large, higher quality trees of sawtimber size, leaving an irregularly spaced residual stand without any particular balance or design. Both of these types of cuttings are undesirable because they "high grade" the woods. That is, the largest, best formed, and most valuable species are removed, leaving a forest stand of lower value and generally lower vigor (Pope et al., no date).

Please refer to the Environmental Baseline for the Indiana bat and the subsection titled, *Factors Affecting Species Environment*, for further descriptions of ongoing forest management activities on other ownerships or by other agencies in the action area.

### **Future**

Timber harvesting is likely to continue on New Page/Escañaba Timber lands. The forest lands are up for sale, but it is the company's intent to sell to a single entity that will maintain sustainable forest products for the Chillicothe Mill. It is not known exactly what stands of timber may be harvested during the next decade, but perhaps about 10 percent could be harvested, primarily with even-aged methods, each decade. This would equate to about 2,500 acres in a 50 year period.

A mixture of even-aged and uneven-aged timber harvests may occur on Dean and Zaleski State Forests. It is not known for certain how much harvesting could occur on these lands in the next 50 years, but for

purposes of this analysis, an assumption of 500 acres will be made. Very little of Zaleski is in the action area, and much harvesting has occurred at Dean State Forest over the past two years as a result of the 2003 ice storm.

For the most part, logging on private lands may decrease over the next 50 years due to immature age and poor accessibility of much of the remaining timber. If an assumption is made that timber harvesting on private lands decreases to one-third of past logging rates (i.e., ~8 percent per decade), then some type of harvest activity could occur on about 40% of private lands over the next 50 years. Similar to present times, high grading is expected to occur on the majority of private lands. This harvest method does not result in optimal foraging conditions for the Indiana bat, and tends to remove trees with future roost value.

Little to no prescribed fire or herbicide applications are used in combination with timber harvests on private or industrial timber lands.

Effects from potential gypsy moth and emerald ash borer infestations cannot be estimated; however it is possible that some parts of the action area could be affected in the next 50 years. A gypsy moth infestation could result in additional snags for roost habitat. An emerald ash borer infestation may result in the felling and removal of ash trees, which would reduce potential future roost trees.

The Forest Service would employ different timber harvest prescriptions in various management areas over the next 50 years. Of the treatments that could be implemented, immediate improvements to Indiana bat foraging and roosting habitat could occur on about 84,800 acres of NFS land.

- Uneven-aged harvest methods may be used on 45,300 acres over the next 50 years, of which some acres would be treated so the stands can progress towards a true uneven-aged stand. Single-tree and group selection methods are used to open up the canopies which can help warm roost trees and create canopy foraging gaps. This method does not promote regeneration of oak and hickory, so it is possible that the forest composition in these treated stands could move toward more shade tolerant species.
- Historic Forest prescriptions could be applied to about 33,900 acres in the next 50 years, of which some acres could be treated twice. The combination of thinning and prescribed fire (and possibly herbicides) would create open understories for foraging, and could improve environmental conditions around roost trees. This treatment encourages oak and hickory regeneration and the stands would be dominated by these species, thereby providing an abundance of future roost trees.
- Thinning may be done on 5,680 acres over the next 50 years. It decreases stem density in forest stands that have been treated with

even-aged methods in the past. Foraging habitat is likely limited in stands treated with these methods because of the high density of trees, so thinning can improve foraging habitat.

- Even-aged management (two-age, shelterwood, and clear cut) could occur on about 15,100 acres in the next 50 years. Even-aged management methods could temporarily reduce optimal foraging habitat conditions (up to 50 years). Shelterwood, two-age and clearcut with reserves would retain more trees on the site than a clearcut. MacGregor et al. (1999) reported male Indiana bats were roosting, during the autumn pre-hibernation period, in forest stands that were harvested by the two-age timber harvesting methods. The Forest-wide standards and guidelines (SFW-TES-10 and SFW-TES-12) require that trees with existing roosting characteristics be left during harvests, and at least 30 live trees per acre for roost tree recruitment be retained. While foraging habitat may be affected for as many as 50 years, some roosting habitat would be available to the species in areas treated with even-aged methods. Even-aged management on NFS lands could have short-term adverse effects on the availability of suitable habitat, but over time these stands would mature and once again become suitable.

In the next ten years, about 8 percent of forested non-Federal lands could be harvested, and about 17,941 acres of NFS lands - or 2 percent of the forested action area, could be harvested. Based on these future scenarios, it is possible that about 54 percent of the forested action area could be harvested in some manner over the next 50 years. Cumulatively, the timber harvesting on NFS lands during the 50 year time period would account for 11 percent of the harvesting, however 85 percent of these harvested acres could result in immediate and long-term foraging and roosting improvements for the Indiana bat. Only 1.7 percent of the action area would be affected by even-aged management treatments on NFS lands over these five decades, yet even those treatments could result in some foraging and roosting opportunities. Based on the habitat needs of this species, these timber harvesting strategies incorporated in Alternative E<sub>mod</sub> could have greater beneficial cumulative effects than that of the no action alternative.

Construction of utility corridors and temporary roads may occur to some degree on other ownerships, but are not likely to increase over current levels. Prescribed fire, temporary roads, creation of forest openings and reduction of hazardous fuels are projected to occur during the first decade and to some degree will likely occur out into future decades. These activities have short-term direct and indirect effects (i.e., less than a decade) that may be adverse, but can provide benefits to this species over the long-term.

Cumulative effects from implementing Alternative E<sub>mod</sub> would be mitigated through protective Forest-wide standards and guidelines and should not jeopardize the continued existence of the Indiana bat. These cumulative effects would also be reduced by the fact that these activities would be distributed spatially and temporally across the WNF in management areas that prescribe such activities. Some of these activities will be occurring on the same acres of land, thereby reducing the overall effects. Activities such as uneven-aged and even-aged timber harvest, prescribed fire, and hazardous fuels reduction may have short-term adverse cumulative effects, but in the long-term they may benefit the species. These activities would open dense understories and could reduce canopy cover to levels thought to be more optimal for Indiana bat foraging. Any adverse cumulative effects would be mitigated to the degree possible through protective Forest-wide standards and guidelines.

#### **Loss of Summer Habitat**

The action area is located in a very industrialized area with a high population. It is rich in mineral resources. Today, about 2 percent of the action area is comprised of roads, industrial sites and residential areas. Most of the industry is located along the Ohio River corridor, or along major transportation routes through the action area. Oil and gas wells are scattered within forest land, primarily in the Athens and Marietta Units. Some coal mining occurs today, primarily on the Athens Unit.

As people move away from urban centers, forest land is cleared for homes and other improvements. It is unknown how many total acres of suitable habitat could be permanently lost on private and other public lands within the proclamation boundary in the next ten years, but it is expected that some new oil and gas wells, roads, home sites, and industrial and commercial sites will be constructed in the planning area on these other ownerships. It's estimated that the number of people in the action area could increase by 8.5 percent by 2020 (DEIS, page 3-254).

The Federal Highways Administration completed consultation and a Final EIS on the Nelsonville Bypass. Construction is not expected to start until 2007 on the 8.5 mile bypass. According to the Biological Opinion for this project, a 768 acre linear corridor could be impacted, including all staging, waste, and borrow areas, and ancillary connector roads. About 275 acres (or 50%) of this disturbance could occur on NFS lands. Project engineers will likely make design refinements to further reduce disturbance.

Permanent road construction and reconstruction, trail construction, oil and gas development and surface coal mining are the activities in the Selected Alternative which could result in the loss of Indiana bat habitat over the first decade (i.e., 2,088 acres). Alternative E<sub>mod</sub> could result in the loss of 157 more acres than would the no action alternative. This loss equates to less than 0.2 percent of the action area. These activities are expected to occur as small projects that are distributed across the planning area.

A possible surface coal mine, which would be located north of the Bear Run area on the Ironton Ranger District, accounts for 57 percent of the NFS lands that could be permanently converted to non-forest habitat for many decades. The area has not been surveyed for the presence of Indiana bats, but it is located just north of where individuals have been captured. The Forest Service has no authority over private mineral rights; however it can use the project level planning process to consider how Forest Service management activities might influence short-term and long-term available habitat in this part of the Ironton Ranger District.

### Determination of Effect and Rationale

Table 19 presents a summary of the effects of Alternative E<sub>mod</sub> on the Indiana bat and its habitat that may occur in the planning area.

A **Likely to Adversely Affect** determination is made for the Indiana bat. The Indiana bat is present on the WNF year round. In addition to the known Priority III hibernaculum and fall swarming sites, there may be additional winter habitat as well as summer habitat that is currently unknown. Implementation of management activities that require the removal of trees may accidentally cause direct take through the removal of an undetermined roost tree during the non-hibernation season. Although the potential for this take is extremely small considering the large amounts of available roost trees in the planning area and the established Forest-wide standards and guidelines, the possibility still exists. Removal of trees can also alter foraging habitat.

Although roosting and foraging habitat may be affected, adverse impacts from Alternative E<sub>mod</sub> are not likely to impede recovery of this species. The Forest Service has incorporated both proactive conservation actions as well as protective measures into the Selected Alternative to aid in the recovery of this species:

1. The Selected Alternative incorporates conservation approaches or measures to proactively protect and conserve Indiana bat habitat.
  - A Conservation Plan for Federally Listed Species was developed and included in the revised Forest Plan (see Appendix 1 of this Biological Assessment). This Conservation Plan summarizes the strategy the Forest Service will use during revised Forest Plan implementation to aid in the recovery of this species. The WNF Conservation Plan addresses the 1983 Indiana bat recovery plan objectives (USFWS, 1983a): (1) prevent disturbance to important hibernacula; (2) maintain, protect, and restore foraging and nursery habitat; (3) monitor population trends; (4) public education; and (5) research needs; and addresses the 1999 Agency Draft Recovery Plan objectives (USFWS, 1999): (1) conduct research necessary for the survival and recovery of the Indiana bat; (2) obtain

information on population distribution, status and trends; (3) protect and maintain Indiana bat populations; (4) provide information and technical assistance outreach; and (5) coordinate and implement the conservation and recovery of the Indiana bat.

- As a conservation approach, Alternative E<sub>mod</sub> incorporates habitat management tools to provide a diversity of mature forest habitats, which may be favorable to the Indiana bat (Table 13). Over 81 percent of NFS lands would be covered by mature forest in 100 years, a net increase of 119,000 acres. This forest would possess a more diversified structure and composition than what the no action alternative prescribes.
  - The Selected Alternative proactively addresses the importance of oak and hickory species to the Indiana bat by incorporating a Historic Forest management prescription. Through thinning and the use of prescribed fire and/or herbicides, the structure of the resulting forest would be more open and it would be dominated by oak and hickories, preferred trees for roosting. This management area was placed near the two areas of importance for this species (Bear Run area and southwestern part of Athens Unit).
  - The importance of protecting winter habitat and existing summer roost trees, and providing a plentiful supply of future roost trees is recognized in the Selected Alternative. A Forest-wide goal (5.1.1) was incorporated that guides the Forest Service to retain or develop Indiana bat roosting and foraging habitat and protect all known Indiana bat hibernacula. A Forest-wide objective (5.1.1a) ensures proactive management of any additional Indiana bat hibernacula discovered on NFS land.
2. The Selected Alternative incorporates various activities that may adversely affect the Indiana bat (see table below). However, those activities that could result in the loss of habitat would affect less than 1 percent of NFS lands. About 42 percent of the WNF could be affected by activities that may have short-term adverse effects, but long-term beneficial effects. These short-term adverse effects are minimized by Forest-wide standards and guidelines:
- Forest-wide standards and guidelines in Section 5 – Endangered, Threatened and Sensitive Species (SFW-TES-1 through GFW-TES-14) apply directly to the Indiana bat (see Appendix 1).
  - Section 2-Watershed Health addresses how to stabilize disturbed areas, which promotes healthy aquatic habitats. This ensures long-term aquatic insect production and drinking supplies.
  - Section 3 –Aquatic and Riparian Resources provides guidance on the use of filterstrips, road-stream crossings, pipeline-stream crossings, removal of material from streams, and guidance on the

restoration of riparian corridors, wetlands, springs, and ponds. This ensures long-term aquatic insect production and drinking supplies.

- Section 4 – Wildlife and Plants includes guidance on prescribed burning in mosaic patterns and creation of upland waterholes. Both of these are included to address insect production for the Indiana bat.
- Section 6 – Vegetation includes guidance on girdling trees during crop tree release to create future snags (GFW-VEG-16).
- Section 10 – Minerals includes a standard to enact a no surface occupancy stipulation in areas within one-quarter mile of Indian bat hibernacula

Projected management activities during the first decade	Alternative E <sub>mod</sub> (acres)
<b>Permanent Loss of Habitat</b>	
Permanent Road Construction - Reconstruction	392
Recreation Trails	265
Recreation Facilities & Parking Lots	60
Surface Mining	1,250
Oil & Gas Well Development	121
<b>Total Loss of Habitat</b>	<b>2,088</b>
<b>Percent NFS lands affected</b>	<b>0.87</b>
<b>Percent action area affected</b>	<b>0.19</b>
<b>Alteration of Habitat</b>	
Timber Harvest	17,941
Crop Tree Release	2,113
Prescribed Fire	69,819
Temporary Roads, Skid Trails and Log Landings	886
Hazardous Fuels Reduction – Mechanical Methods	10,181
Development of Permanent Openings	500
Utility Corridor Development	50
Closure of Mine Features	232
AMD Treatments	270
<b>Total Alteration of Habitat</b>	<b>101,992</b>
<b>Percent NFS lands affected</b>	<b>42.8</b>
<b>Percent action area affected</b>	<b>9.2</b>
Hazard Tree Removal	2,550
Hickory Tree Removal	1,142

3. Activities which may directly or indirectly affect the Indiana bat and its habitat would likely be distributed across the landscape and over time. Second-level project analysis would occur and at that time, any additional protective measures needed to minimize or eliminate adverse effects would be identified.

**Table 19. Summary of effects determinations for the Indiana bat.**

<b>Projected Management Activity</b>	<b>Alternative E<sub>mod</sub></b>
<b>Vegetation Management</b>	
Even-aged Hardwood Timber Harvest	A
Even-aged Pine Timber Harvest	A
Uneven-aged Timber Harvest	A
Thinning	A
Crop Tree Release	A
Grape Vine Control	N
Site Prep for Native Pine	N
Reforestation	B
Prescribed Fire	A
Herbicide Application	N
Development of Permanent Forest Openings	A
Maintenance of Permanent Forest Openings	N
Control of Non-Native Invasive Species-Mechanical	N
Control of Non-Native Invasive Species-Biological	N
Wetland Restoration & Enhancement	B
Waterhole Construction	B
Fishing Pond/Lake Construction	B
Restoration & Improvement of Aquatic/Riparian Habitat (Lentic)	B
Restoration & Improvement of Aquatic/Riparian Habitat (Lotic)	B
Installation of Bat-Friendly Gates on Mines	B
<b>Recreation Management</b>	
OHV Trail Construction	A
Hiking Trail Construction	A
Horse Trail Construction	A
Mountain Bike Trail Construction	A
Recreation Facility & Parking Lot Construction	A
<b>Transportation Management</b>	
Temporary Road Construction	A
Permanent Road Construction	A
Permanent Road Reconstruction	A
Road Decommissioning	B
Disturbance related to Timber (Skid Trails, Landings)	A
<b>Energy Minerals Management</b>	
Surface Coal Mining Activities	A
Reclamation of Depleted or Orphan Wells	B
Oil & Gas Well Development	A
<b>Special Uses Management</b>	
Utility Corridor Development & Maintenance	A
Agricultural Crop Production & Grazing	N
<b>Watershed Management</b>	
Treatment of AMD	B
Surface Mine Reclamation	B
Closure of Open Mine Portal/Subsidence	A
Stabilization of Disturbed Areas	B
<b>Fire Management</b>	
Reduction of Hazardous Fuels - Mechanical	A
<b>Lands Acquisition Management</b>	
Land Acquisition	B
Land Exchange	D
<b>N</b> = No Effect; <b>B</b> = Not Likely to Adversely Affect, Beneficial Effects; <b>I</b> = Not Likely to Adversely Affect, Insignificant Effects; <b>D</b> = Not Likely to Adversely Affect, Discountable Effects; <b>A</b> = Likely to Adversely Affect	

## Bald Eagle

### Status of the Species

#### Species Description

##### Rangewide

The bald eagle was listed as an endangered species in most of the United States in 1978, (it was listed as threatened in five states). Because of population losses to pesticide pollution, hunting, and habitat destruction, a recovery program was launched to



restore it to non-endangered status. Bald eagles have recovered due to the implementation of Fish and Wildlife Service programs. They were downlisted to threatened status in 1995 and were proposed for delisting in July of 1999. They would continue to be protected under the Bald and Golden Eagle Protection Act of 1962, as amended, the Migratory Bird Treaty Act of 1918 and the Lacey Act of 1900, if delisted.

##### Species Range in Ohio

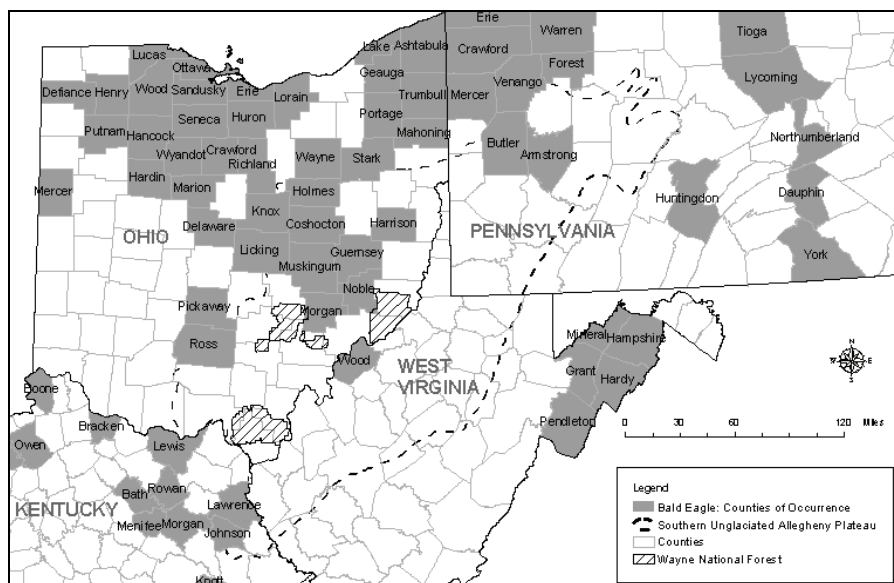
The bald eagle's numbers in Ohio have grown significantly. In 1979, there were four known nesting pairs in Ohio. As of 2004, there were 108 nests (a modern day record) that started incubation and there were 74 nests with confirmed live young (ODNR, 2004a; 2005). Twenty-one new pairs were confirmed in Ohio - 3 in Sandusky County, 2 each in Ashtabula, Erie, Ross, and Wyandot, and 1 each in Hardin, Harrison, Huron, Knox, Muskingum, Ottawa, Pickaway, Putnam,

**Common Name:** Bald eagle  
**Scientific Name:** *Haliaeetus leucocephalus*  
**Family:** Accipitridae  
**Group:** Birds  
**Historic Range:** North America south to northern Mexico  
**Population to Which Status Applies:** U.S.A., conterminous (lower 48) States.  
**Current Status:** Threatened, Proposed for De-listing  
**Date First Listed:** March 11, 1967  
**Critical Habitat:** NA  
**Special Rules:** 17.41(a)  
**Recovery Plan?** Yes  
**Lead Region:** Great Lakes-Big Rivers Region (3)  
**Current Range:** AL, AR, AZ, CA, CO, CT, DC, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY

Source: Fish and Wildlife Service

Richland, and Seneca counties. See Figure 8 for a county distribution of nesting bald eagles in Ohio, as of 2004. Preliminary results for 2005 indicate that there may have been 85 successful bald eagle nests in Ohio (ODNR, 2005).

Although generally concentrated along western Lake Erie, wintering bald eagles were sighted in 2003 around the mouth of the Sandusky River, as well as the Kokosing, Scioto, and Muskingum rivers. Clermont, Scioto, and Gallia counties along the Ohio River were the southern-most locations of eagle sightings. A preliminary total of 352 bald eagles were observed during the midwinter bald eagle surveys, including 271 mature bald eagles and 81 immature eagles (birds less than 5 years old). In 2002, 304 bald eagles were identified during the mid-winter survey, a group composed of 167 mature and 137 immature birds. In 2004, 127 eaglets fledged from a record 108 nests (ODNR, 2005)



**Figure 8. County occurrences of the bald eagle in the Southern Unglaciaded Allegheny Plateau, 2004.**

### Life History

The bald eagle is a large, long-lived bird of prey that occurs only in North America. The adults have brown bodies with white heads and tails. The young are all brown, and can be distinguished from young golden eagles by their lower bare legs (golden eagles have feathered legs all the way to their feet). They do not take on the coloring of the adults or reach sexual maturity until age four.

In Ohio, the female lays one to three eggs, approximately 36 hours apart, in mid-February to late March. Both she and her mate spend time on the

nest incubating. This process usually lasts 35 days, with the young hatching in late March through early May. The eaglets will stay in the nest 10 to 12 weeks and both parents share the feeding responsibilities. The eaglet(s) begin limb hopping as they strengthen their wings. The fledging process continues for four to eight weeks; all the while the eaglets slowly broaden their range from the nest, but continue to depend on their parents for food. The young birds generally become independent at 17 to 20 weeks of age and will disperse from Ohio in November or December (ODNR, 2003b).

Many bald eagles do not breed for the first time until they are 5 to 6 years of age or older (NatureServe, 2004). The time period before sexual maturity is a time of significant mortality, and many eagles do not reach two years of age. After the first couple of years, chances for survival improve, and eagles are thought to live up to thirty years (USFWS, 1983b).

The bulk of the bald eagle's diet is fish; however they will also feed on waterfowl, small mammals, and carrion, especially in winter (USFWS, 1983b).

It is believed that eagles mate for life, but there is little documentation to substantiate this claim. In the event that the mates are separated, new mates likely are found. Pairs of eagles usually raise one to two young per season, originating from one to three eggs. The entire breeding cycle from initial breeding activity to fledging is about six months.

When the nesting period is over, the wintering period begins. At this time, the eagles generally leave their nest site for more protected locales with abundant food supplies. According to the 1981 eagle count done by the National Wildlife Federation, during the months between November and March bald eagles make their way into all of the contiguous 48 states. As with their nests, the eagles revisit many of the same wintering sites. The sites are chosen for their shelter from the wind to reduce energy use. The wintering population of eagles is split between large groups that congregate at recurring communal sites, and those that have smaller gatherings. Both the large and small wintering meeting and roosting sites are equally important to the survival of the species. In addition to shelter from the weather, roost sites provide isolation from humans. When human disturbance of a night roost occurs, eagles may abandon the location (USFWS, 1983b).

### Population Dynamics

Survival of individual bald eagles, particularly those in their first year of life, depends heavily on conditions they encounter during the wintering period. In previous studies, it was thought that their reproduction rate was the most important dynamic for the preservation of the species, but it is

now believed that their survival rate may play a more crucial role. It appears likely that eagle populations may be more successful with lower reproduction rates and higher survival rates, than vice versa (USFWS, 1983b).

A 1963 National Audubon Society survey reported an average of 0.59 young produced per active nest, whereas in 1994 the average number of young produced per occupied territory was 1.17 (USFWS, 1995). The number of occupied breeding territories has increased by 462% since 1974, and since then the species is doubling its breeding population every 6 to 7 years (USFWS, 1995).

### Status and Distribution

Because of population losses to pesticide pollution, hunting, and habitat destruction, a recovery program was launched to restore it to non-endangered status. In the early 1960s, there were fewer than 450 nesting pairs of bald eagles in the lower 48 states. Efforts at captive rearing and restocking wild populations in specific areas of the country, hacking, habitat protection, and banning of DDT, bald eagle populations increased to 6,471 nesting pairs in 2000 in the lower 48 states (USFWS, no date).

### Rangewide Threats

The use of DDT as a pesticide from 1940 through the 1960's caused the drastic decline in the bald eagle. Consumption of DDT contaminated prey resulted in eggshell thinning and nesting failures. With the banning of DDT and strong enforcement of recovery measures, the eagle has successfully recovered.

Destruction and degradation of habitat is a major threat to the species. Their habit of returning to the same nesting and winter roosting sites, as well as their tendency to congregate makes each site of great importance to the entire population of bald eagles. Habitat degradation occurs as a result of direct cutting of trees for shoreline development, human disturbance associated with recreational use of shorelines and waterways, and contamination of waterways from point source and non-point sources of pollution (USFWS, 1995). In the Chesapeake Bay Recovery Region, Buehler et al. (1991 in USFWS, 1995) found that feeding and resting use of the Chesapeake Bay shoreline was directly related to the distance of development from the shoreline. Eagles avoided shorelines with nearby pedestrian or boat traffic. In the Great Plains Recovery Region, wintering areas have been lost through development of riparian areas for recreational, agricultural, and urban uses (USFWS, 1995). Cottonwood regeneration is affected by grazing and water level fluctuations of impoundments.

Disease is a factor in some bald eagle deaths. Avian cholera, avian pox, aspergillosis, tuberculosis, and botulism may affect individual eagles, but

are not considered to be a significant threat to the population (USFWS, 1995). The Mexican chicken bug, when abundant, is known to kill young in the southwestern region (USFWS, 1995). According to the National Wildlife Health Center in Wisconsin, only 2.7% of bald eagles submitted to the Center between 1985 and 1990 died from infectious disease (USFWS, 1995).

Even though the widespread elimination of DDT and reduction of other pesticides has been greatly successful, other contaminants exist on a localized level. They can affect the survival and reproductive success and health of bald eagles. The abundance and quality of prey may be seriously affected by environmental contamination. While compounds implicated in reduced reproductive rates and direct mortality are no longer used, contaminants continue to be a major problem in some areas. (USFWS, 1995). Lifetime exposure to contaminants may limit an eagle's reproductive capabilities, alter their behavior and foraging abilities, and increase their susceptibility to diseases and other stresses (USFWS, 1995).

The Fish and Wildlife Service (1995) reports that eagle productivity is being depressed by PCBs and DDE, mostly in the coastal areas of Lakes Michigan and Huron. DDE residue concentrations have dropped in Lake Superior eagle eggs to a level considered to be the "no effect concentration" (4 ppm). Mercury poisoning is a concern in Maine and in the southeast (USFWS, 1995). High levels of mercury affect eagles with a variety of neurological problems where flight and other motor skills are altered, and reduce hatching rates of eggs.

Pesticides, in recent times, have not impacted the bald eagle population; however individual poisonings do occur (USFWS, 1995). Poisonings seem to occur indirectly through the eagle's prey. Carcasses baited with poison for target species like coyotes, may attract eagles. Crop insecticides may be taken up by prey species and result in eagle mortality (USFWS, 1995).

Shootings, disease, human disturbance, electrocution and vehicle collisions are also continuing threats to the eagle (USFWS, 2003a).

#### **Action Area Threats**

Of the rangewide threats described above, habitat degradation resulting from direct cutting of trees for shoreline development and contamination of waterways from point source and non-point sources of pollution are within the control of the Forest Service on NFS lands. If nesting or roosting were to occur within the planning area, the Forest Service could manage human disturbance associated with recreational use of shorelines and waterways on NFS lands

## Environmental Baseline

### Species Range in the Action Area

Bald eagles have been occasionally sighted on or near the WNF, mostly in the winter, along the Ohio River, around Burr Oak Lake and Lake Vesuvius, and in Hocking and Morgan counties. During summer months, bald eagles are sighted along the Ohio River near the Ironton and Marietta units. No nests have been found in the area. Thus, at this time, bald eagles on the WNF are probably migrating through or wintering here. The bald eagle is expanding its nesting range, however, and individuals initiated nesting in nearby Morgan and Noble counties in 2004 (ODNR, 2004b).

### Suitable Habitat within the Action Area

There are no known nesting sites in the action area.

### Nesting Requirements

Eagles select areas with low human disturbance, suitable forest structure, and abundant prey for nesting sites. Eagles usually nest near large bodies of water (within 0.5 miles), although they will occasionally nest in upland areas where there is good access to food. Bald eagles tend to return to the same breeding area, and often the same nest sites, each year. Although there are reports of nests on the ground or on cliff faces, the majority of eagles build their nests in supercanopy trees with large diameters and canopies (USFWS, 1983b). They construct the nests of sticks and add to them each year (USFWS, 1983b). Nesting almost never occurs farther than 1.8 miles from water (Gerrard and Bortolotti, 1988 in USFWS, 1995). Nest sites are usually in large trees along shorelines in relatively remote areas. The trees must be sturdy and open to support a nest that is often 6 to 9 feet across and more than 1 m thick (Bent, 1938 in USFWS 1995).

Suitable nest site characteristics are found in parts of the WNF, specifically along larger rivers such as the Hocking, or near reservoirs such as Burr Oak Lake, Timbre Ridge Lake, and Lake Vesuvius.

### Foraging Habitat

Eagles will forage along rivers, streams, lakes, and marshes. Suitable foraging habitat exists along the larger river systems and lakes in the WNF. Wetlands on the WNF are not managed to maintain populations of fish, therefore they offer limited foraging opportunities for the eagle.

### Roosting Habitat

Daytime roosts are usually located near foraging areas within 100 feet of shorelines and are used for eating, resting and hunting. Tall dead trees or mature trees with strong branches are the eagle's preference. During

winter, night roost trees are used by an individual bald eagle or group of eagles for protection from wind and harsh weather. These trees are also thought to aid in mate location and communication of food sources.

Night roosts most likely to be used include trees in ravines, on the leeward side of hills, or in other wind-protected areas (USFWS, 1983b). In relatively flat terrain where few trees are present, eagles usually roost in trees that are clumped or screened from the prevailing wind by other vegetation (USFWS, 1983b).

Suitable roosting habitat may be found with the WNF near larger watercourses or waterbodies.

### Factors Affecting Species Environment

The Ohio Division of Wildlife has an active monitoring program throughout the state. Mid-winter bald eagle surveys are conducted and reported on every year. Nesting attempts are monitored for success and reported on statewide.

The U. S. Fish and Wildlife Service manages several islands in the action area as part of the Ohio River Islands National Wildlife Refuge. The refuge's management plan includes programs such as bottomland hardwood restoration and wetland restoration, both of which would benefit the eagle. The agency conducts a 29 mile long mid-winter bald eagle survey in the willow Island pool annually.

Please refer to the *Factors Affecting Species Environment* for the Indiana bat for activities that are occurring which may affect forest habitat.

Within the action area, several groups have formed and are working to improve water quality of mine-impacted streams. These include the Monday Creek Restoration Project and the Little Raccoon Restoration Group. Their efforts will provide benefits to the eagle over the long-term as aquatic health is restored.

## Direct and Indirect Effects of the Selected Alternative

### Activities with No Effects

There are some activities that do not pose a risk of degrading habitat (direct cutting of trees for shoreline development) or contaminating waterways (from point source and non-point sources of pollution). These activities include:

- Crop tree release
- Grape vine control

- Herbicide application
- Development of permanent openings
- Maintenance of permanent openings using mechanical methods
- Control of non-native invasive species using herbicides, mechanical or biological methods
- Waterhole construction
- Fishing pond and lake construction (these sites are generally small in size)
- Installation of bat-friendly gates
- Reduction of hazardous fuels using mechanical methods
- Special use permits allowing hay production and grazing on existing openland

### Activities Not Likely to Adversely Affect - Beneficial Effects

The creation of the River Corridor MA was developed, in part, with the bald eagle in mind and should provide long-term direct benefits to this species as it expands its range in Ohio. The purpose of the River Corridor MA is to retain, restore and enhance the inherent ecological processes and functions associated with riverine systems.

The River Corridor MA is located on Symmes Creek, Hocking River, Little Muskingum River, and along the Ohio River on the Marietta Unit.

The creation of the Timbre Ridge Lake MA should also have direct benefits to this species. The desired future condition of this management area is to maintain the wooded character around this 100-acre lake, and maintain its water quality to encourage the maintenance of a self-sustaining bass-bluegill fishery. The management area would provide feeding opportunities as well as suitable roosting or nesting habitat.

Other management activities included in the Selected Alternative may benefit the bald eagle:

- Efforts to **restore riparian and aquatic habitats** on NFS lands should have long-term direct and indirect benefits to the bald eagle. The Selected Alternative include Forest-wide Goals 2.1 and 3.1 that strive (1) to restore water quality and soil productivity to improve health of watersheds impaired by past land use practices and mining activities, (2) to protect and improve riparian corridors to sustain ecological processes and functions, and (3) protect aquatic habitat from potential upland disturbances. These goals, in association with Forest-wide objectives 2.1(a-c) and 3.1(a-d)

should promote conditions that sustain food sources for the bald eagle, as well as roosting and nesting sites along rivers and large water bodies.

- **Reforestation** of newly acquired NFS lands, particularly those in floodplains of larger streams and rivers that were once farmed, will provide long-term benefits to the bald eagle. Riparian areas that are reforested will eventually mature and provide suitable roosting and nesting habitat.
- **Restoration of wetlands** provides a future foraging area.
- **Riparian and aquatic habitat restoration** includes activities that decrease the input of sediment and acid mine drainage into streams, as well as direct improvements such as placement of large woody debris and reconstruction of the natural dimension, pattern, and profile of streams. All of these activities result in improved aquatic habitat which may lead to increased fish production.
- **Stabilization of disturbed areas**, including such sites as abandoned mine lands and orphan or depleted oil and gas wells, returns areas to an herbaceous or forested cover.
- **Road decommissioning** eliminates unneeded stream crossings (potential site for sediment introduction into streams) and returns sites to a forested condition.
- The taxonomic experts involved in the species viability evaluation process noted that **land acquisition** along rivers is a key management strategy that will have long-term benefits for the species (Ewing, 2003e). It is possible that bald eagle nesting or roosting habitat could be acquired in the future, and it is possible that acquisition/exchange of lands could reduce disturbance to any future roosting or nesting bald eagles from activities on private lands.

### Activities Not Likely to Adversely Affect – Insignificant Effects

The following activities are expected to have insignificant effects on potentially suitable habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs.

Removal of trees is associated with several management activities (timber harvesting, road construction, road reconstruction, trail construction, parking lot construction, recreation facility construction, pond or lake construction, surface coal mining, oil and gas well development, and utility corridor development). The risk of removing suitable bald eagle roosting or nesting habitat is low. Alternative E<sub>mod</sub> includes a Forest-wide goal to protect bald eagle communal night roosts, daytime concentration areas, and occupied breeding territories (Goal 5.1.2) and a Forest-wide

objective to identify such areas by conducting mid-winter eagle searches (Objective 5.1.2a). In addition, established Forest-wide standards and guidelines protect any night roosts, nests or concentrations found during mid-winter searches and other field surveys (TES-16), protect super canopy trees (TES-18), and provide guidance on construction of roads, trails or facilities in riparian areas (ARR-4, ARR-5, and ARR-6).

When regenerating native pine, the forest floor must be opened to full sunlight and soil must be exposed so that native pine seeds can germinate and survive. In most cases, soil disturbances from logging or removal of leaf litter during prescribed fire will be enough to allow seeds to contact soil. However, in certain sites, it may be necessary to scarify the soil (**site prep for native pine**) to facilitate the appropriate environment for seed germination. The objective is to create small, scattered patches of exposed soil, but ground cover would remain on 75 percent or more of the treatment area. Filterstrips would minimize the potential for sediment introduction into streams from such activities (ARR-5 and 6).

Smoke from prescribed fires could cause eagles to temporarily flee their nesting or roosting areas. Prescribed fire activities are projected to increase above current levels. The likelihood of smoke affecting eagles is low because Alternative E<sub>mod</sub> incorporates conservation measures that prohibit prescribed fire within one-half mile of occupied bald eagle sites (TES-19). While no occupied bald eagle sites occur on NFS lands at present, the discovery of occupied roosts, concentrations or nests would require the Forest Service to follow protection guidelines outlined in the Northern States Bald Eagle Recovery Plan (TES-16).

The bald eagle is a scavenger, but fish makes up the majority of its diet. Many management activities integrated into the Selected Alternative have the potential to cause soil disturbance and could affect the eagle's forage base. Soil erosion can increase turbidity levels in lakes or streams, and can settle out onto stream substrates. Turbidity and sedimentation can, in turn, affect feeding and reproduction of aquatic organisms, including fish. The use of filterstrips (ARR-5) and soil stabilization methods (WSH-8) are established conservation measures integrated into Alternative E<sub>mod</sub> that reduce the potential for introduction of soil into water bodies. Filterstrips also reduce the risk for water quality degradation from nutrient enrichment resulting from potential runoff from agricultural or grazing permits.

### Activities Not Likely to Adversely Affect – Discountable Effects

Some activities have discountable effects on potentially suitable habitat, which are effects that are extremely unlikely to occur. Land exchange is a primarily beneficial activity because it helps consolidate NFS lands, which provides more opportunity for landscape level forest management. There could be a situation where a tract of land with suitable eagle habitat on it is

proposed for exchange. Biologists would be involved in the review of all land exchange proposals, and evidence of suitable habitat would be noted and brought to the attention of Forest Service managers. While it is possible that potentially suitable, but unoccupied roost trees could be exchanged, it is unlikely that occupied roost trees, nests or concentration areas would be exchanged.

### Cumulative Effects of the Selected Alternative

No nesting bald eagles are known to occur in the action area, but individuals have been observed during winter. The Wayne National Forest can play a role in the recovery of the bald eagle, especially as its population expands.

Cumulative effects were analyzed within the 1,108,199 acre action area (see *Location and Ecological Setting of the Proposed Action* for a description of the action area) rather than the WNF proclamation boundary because:

- a. The action area contains all anticipated direct and indirect effects of implementing Alternative E<sub>mod</sub>;
- b. Smoke generated from prescribed fire activities (potential direct effect on bald eagles) is likely to travel the farthest off-site from NFS lands. Smoke dissipates into the air column and detectable levels are minimal at a distance of one-mile from the fire (K. Moore and A. Acheson, pers. comm.). Therefore, if a prescribed fire was conducted on NFS lands on the edge of the WNF proclamation boundary, the additional mile should be adequate to encompass direct and indirect effects for this species.

Forest cover has increased across Ohio from about 15 percent in 1940 to almost 30 percent today (Ohio Division of Forestry, 2004). The trend is similar for the Southern Unglaciaded Allegheny Plateau (Ewing, 2003e). Almost 80 percent of the lands (public and private) within the action area are forested (Ohio Land Use Cover, based on Landsat TM 1994). Riparian corridors within the proclamation boundary are primarily forested (i.e., 72.5 percent) (National Landcover Database, 1992).

These reforestation trends have benefited the bald eagle by increasing roosting or nesting habitat, and have played a role in improved water quality conditions within the action area over time. Eagle populations continue to increase in Ohio and observations of eagles are occurring within counties containing NFS lands. In 2004, eagles were observed in Scioto and Gallia counties during mid-winter eagle searches (ODNR, 2004c).

Development of private lands along the Ohio River will likely continue in the future since it is considered a major transportation route for industry. Inland, within the WNF, riparian corridors on private lands could remain in their existing condition (i.e., forested or under agricultural production) or could be impacted by an increasing trend for development of private residences “out in the country”, although the impact would be minimal since floodplain development is discouraged by local zoning commissions. Effects of these possible activities on bald eagle foraging habitat may be reduced since any activities that could impact streams or wetlands would be regulated by the Ohio EPA and possibly the U. S. Army Corps of Engineers.

No adverse cumulative effects should occur as a result of implementing the Selected Alternative because of the protective Forest-wide standards and guidelines incorporated into it. Furthermore, the allocation of the RC and TRL management areas provide long-term cumulative benefits to the species.

### Determination of Effect and Rationale

Table 20 presents a summary of the effects of the Selected Alternative on the bald eagle and its habitat that may occur.

**A Not Likely to Adversely Affect** determination is made for the bald eagle. This determination is based on the following rationale:

1. The Selected Alternative incorporates conservation approaches or measures to proactively protect and conserve bald eagle habitat.
  - A Conservation Plan for Federally Listed Species was developed and included in the revised Forest Plan (see Appendix 1 of this Biological Assessment). This Conservation Plan summarizes the strategy the Forest Service will use during revised Forest Plan implementation to aid in the recovery of this species. The WNF Conservation Plan addresses the 1983 bald eagle recovery plan objectives: (1) determine current population and habitat status; (2) determine population and habitat needed to achieve recovery; (3) protect, enhance, and increase bald eagle populations and habitats; and (4) establish and maintain communication to coordinate and conduct recovery efforts.
  - As a conservation approach, Alternative E<sub>mod</sub> incorporates two management areas that should provide availability of nesting or roosting habitat for the long-term. The River Corridor and Timbre Ridge Lake management areas will provide forest cover adjacent to high quality aquatic systems.

- The Forest Service recognizes the importance of protecting nesting or roosting or concentration sites by incorporating Forest-wide Goal 5.1.2 into the Selected Alternative. In addition, a Forest-wide objective (5.1.2a) enables the Forest Service to cooperate in population monitoring efforts that aid in the recovery of this species.
2. Forest-wide standards and guidelines incorporated into the Selected Alternative prevent risks to individual eagles or their habitat. These include SFW-TES-15 through SFW-TES-20 (see Appendix 1). Other protective measures that benefit the bald eagle include:
- Section 2-Watershed Health addresses how to stabilize disturbed areas, which promotes healthy aquatic habitats. This ensures long-term forage.
  - Section 3 –Aquatic and Riparian Resources provides guidance on the use of filterstrips, road-stream crossings, pipeline-stream crossings, removal of material from streams, and guidance on the restoration of riparian corridors, wetlands, springs, and ponds. This ensures long-term forage.
  - Federal oil and gas lease-specific notifications and stipulations that aim to protect floodplains (Appendix H, Notification #2; Stipulation #15, #16), federally listed species and their habitat (Appendix H, Notification #3; Stipulation #12), steep slopes and unstable soils (Appendix H, Notification #4; Stipulations #8, #9, #17).

**Table 20. Summary of effects determinations for the bald eagle.**

<b>Projected Management Activity</b>	<b>Alternative E<sub>mod</sub></b>
<b>Vegetation Management</b>	
Even-aged Hardwood Timber Harvest	I
Even-aged Pine Timber Harvest	I
Uneven-aged Timber Harvest	I
Thinning	I
Crop Tree Release	N
Grape Vine Control	N
Site Prep for Native Pine	I
Reforestation	B
Prescribed Fire	I
Herbicide Application	N
Development of Permanent Forest Openings	N
Maintenance of Permanent Forest Openings	N
Control of Non-Native Invasive Species-Mechanical	N
Control of Non-Native Invasive Species-Biological	N
Wetland Restoration & Enhancement	B
Waterhole Construction	N
Fishing Pond/Lake Construction	I
Restoration & Improvement of Aquatic/Riparian Habitat (Lentic)	B
Restoration & Improvement of Aquatic/Riparian Habitat (Lotic)	B
Installation of Bat-Friendly Gates on Mines	N
<b>Recreation Management</b>	
OHV Trail Construction	I
Hiking Trail Construction	I
Horse Trail Construction	I
Mountain Bike Trail Construction	I
Recreation Facility & Parking Lot Construction	I
<b>Transportation Management</b>	
Temporary Road Construction	I
Permanent Road Construction	I
Permanent Road Reconstruction	I
Road Decommissioning	B
Disturbance related to Timber (Skid Trails, Landings)	I
<b>Energy Minerals Management</b>	
Surface Coal Mining Activities	I
Reclamation of Depleted or Orphan Wells	B
Oil & Gas Well Development	I
<b>Special Uses Management</b>	
Utility Corridor Development & Maintenance	I
Agricultural Crop Production & Grazing	N
<b>Watershed Management</b>	
Treatment of AMD	B
Surface Mine Reclamation	B
Closure of Open Mine Portal/Subsidence	B
Stabilization of Disturbed Areas	B
<b>Fire Management</b>	
Reduction of Hazardous Fuels - Mechanical	N
<b>Lands Acquisition Management</b>	
Land Acquisition	B
Land Exchange	D
<b>N</b> = No Effect; <b>B</b> = Not Likely to Adversely Affect, Beneficial Effects; <b>I</b> = Not Likely to Adversely Affect, Insignificant Effects; <b>D</b> = Not Likely to Adversely Affect, Discountable Effects; <b>A</b> = Likely to Adversely Affect	

## American Burying Beetle

### Status of the Species

#### Species Description

##### Rangewide

The American burying beetle was designated as Endangered in its entire range in 1989 (54 Fed. Reg. 29,652 (July 13, 1989)).



The historical range, since identified and described by Olivier in 1790, can be roughly described as most of temperate eastern North America. Records from the edge of its range demonstrate the large size of its historic range: Nova Scotia, Montana, Nebraska, Michigan, and Texas (USFWS, 1991a). More records exist from the Midwest and northeastern states than from the Appalachian, southern Atlantic and Gulf of Mexico coastal plain (USFWS, 1991a).

The historic range of the American burying beetles has decreased by over 90 percent. Historic records for the American burying beetle include 150 counties in 35 states in the eastern United States and southern Canada. Today, this species is known to occur in Arkansas, Massachusetts, Michigan, Nebraska, Ohio, Oklahoma, Rhode Island, South Dakota and Canada (Ontario).

**Common Name:** Beetle, American burying (=giant carrion)  
**Scientific Name:** *Nicrophorus americanus*  
**Groups:** Animals, Insects  
**Current Status:** Endangered  
**Lead Region:** 5  
**Date First Listed:** July 13, 1989  
**Critical Habitat:** None  
**Special Rules:** None  
**Recovery Priority:** 5C  
**Approved Recovery Plan?** Yes  
**Historic Range:** U.S.A. (eastern States south to FL, west to SD and TX), eastern Canada  
**This Status Likely To Occur In:** AR, MA, MI, NE, OH, RI, SD Canada (Ont.)

Source: Fish and Wildlife Service

The American burying beetle is the largest member of the group of beetles that breed and raise their larvae on carcasses of vertebrates (mammals and birds). It is 1 to 1.75 inches in size with a shiny black body and is the only one of the genus *Nicrophorus* with an orange-red marking on the first thoracic segment (pronotum). Each of the front wings (elytra) has two scalloped orange-red markings and the antennae are red-orange tipped. It is often covered with phoretic mites with which it shares a symbiotic relationship (USFWS, 1991a).

### **Species Range in Ohio**

The last known naturally-occurring collection was a single beetle near Old Man's Cave in Hocking County in 1974 (Horn, 1998). The Ohio Division of Wildlife and The Ohio State University initiated a reintroduction program in Ohio in July 1998 (ODNR, 2003c). A total of 85 pairs and 17 individual beetles were released from 1998-2000 at the Waterloo Wildlife Research Station (Horn, 1998; Horn and Keeney, 1999; Horn and Keeney, 2000). While no releases occurred during 2001 and 2002, intensive pitfall trapping surveys occurred to locate previously released beetles (Horn and Keeney, 2002). In 2002, a captive colony of beetles, representing only the second in the country was established at The Ohio State University. In July 2003, an additional 98 pairs of captively reared beetles were released (ODNR, 2003c). Seventy-eight adult pairs were released at the Waterloo Wildlife Research Station on 01 July 2004 and 125 larvae were found in 20 sampled burial sites on 14 July 2004 (S. Selbo, pers. comm.). Figure 9 displays the likely distribution of this species in Ohio (USFWS, 2004).

Reproduction has been documented after these releases. Five broods of 2<sup>nd</sup> and 3<sup>rd</sup> instar larvae were found on carcasses in fall 1998, and four broods were found in 1999 (Horn, 1998; Horn and Keeney, 1999). In addition, one freshly emerged adult female was recovered in September 1998 (Horn, 1998). Horn and Keeney (2000) trapped a single male about ½ mile northeast of the 1999-2000 release sites, and based on lack of tags it was likely an individual produced from a released pair.



words, some populations produce one brood, but others are capable of producing two broods prior to death. Laboratory and field studies have shown that brood size ranges up to about 30 individuals (USFWS, 1991a). Sex ratio studies in Arkansas, Oklahoma, and Nebraska documented that females slightly outnumber males (Lomolino et al., 1995; Creighton and Schnell, 1998; Bedick et al., 1999).

### Population Dynamics

NatureServe (2005) has given a global rank of G2G3 and a national rank of N2N3 to the American burying beetle: Imperiled to Vulnerable – uncertainty exists as to whether it is at high risk or moderate risk of extinction due to a restricted range. These ranks are based on the belief that there are more than 5 and possibly fewer than 20 extant populations.

### Status and Distribution

The American burying beetle has exhibited a dramatic range collapse in recent times, having been reduced to less than 10% of its original range and probably much less than 1% of its original occupied habitat (NatureServe, 2005).

A handful of captive colonies exist now, including ones at The Ohio State University and the St. Louis Zoo. A project was funded in 2005 to establish a propagation facility at The Wilds in Ohio.

### Rangewide Threats

There has been considerable controversy about the cause of the American burying beetle decline. It has been pointed out that the extirpation of the species in most areas preceded the widespread use of pesticides. An unknown disease vector specific to the American burying beetle cannot be totally ruled out, but no other species of the genus are affected. The lack of optimal sized carcasses for reproduction of the species is now seen as the primary cause for the species precipitous decline (USFWS, 1991a).

The prevailing theory for its decline is that because they are the largest species in the genus, and require the largest carcasses, they have been more adversely affected than other members of their genus by habitat fragmentation. As stated in the recovery plan, “fragmentation of large areas of natural habitat that historically supported high densities of indigenous species (exacerbated by the direct taking of birds and other vertebrates) may have been a contributing factor in the decline of *N. americanus* by changing the species composition and lowering the reproductive success of prey species required for optimum reproduction.” In locations where the American burying beetle has been extirpated or greatly reduced in population, other species of the genus *Nicrophorus* have increased. Bedick et al. (1999) reported that fierce competition

among *Nicrophorus* beetles occurs, as evidenced by injuries such as missing appendages. Kozol et al. (1988 in Bedick et al., 1999) found there were no *Nicrophorus* beetle competitors that won against the American burying beetle; however Bedick et al. (1999) theorizes that *N. carolinus* could prove to be a worthy adversary in prairie habitats on the western edge of its range.

It has been noted that some of the species that once probably provided important carcasses for the beetle are now rare. The passenger pigeon is extinct, and greater prairie chicken is much less common than they once were. Scavengers including dogs, cats, and coyotes always increase at forest edges and where civilization occurs and now competes with the American burying beetle for prey. A scavenger can also consume the beetle as the carcass is consumed (Ewing, 2003f).

With increasingly localized populations, the American burying beetle's genetic variability that is important for adapting to changing habitat would have been further reduced by genetic drift. Data resulting from Creighton and Schnell (1998) showed beetles move great distances, and they stated that this can have implications on reintroduction programs. Individuals could disperse from a release site and create a dilution effect, making it harder to establish a stable population.

Creighton and Schnell (1998) hypothesized that a number of factors could come into play to threaten population viability. They noted that Lomolino and Creighton (1996) found breeding success is greater in forested areas, but if large areas of forest were altered the breeding success could be lowered. They found in their study that beetles are capable of moving great distances in a short time to find food, but such movement could introduce them to other threats like predation, insecticides, insect traps and nocturnal light pollution, especially in more developed areas.

### **Action Area Threats**

The lack of optimal sized carcasses for reproduction of the species is now seen as the primary cause for the species precipitous decline. The Forest Service has control over the management of forest communities on NFS lands that provide habitat for prey species. Forest fragmentation is also a threat, in that scavengers including dogs, cats, and coyotes may increase at forest edges and where civilization occurs and now compete with the American burying beetle for prey. Loss of potentially suitable habitat resulting from compaction of soils, as well as insect traps, insecticides, and nocturnal light pollution may threaten the species.

## Environmental Baseline

### Status of Species in the Action Area

#### Species Range in the Action Area

The American burying beetle is not currently known to occur in the action area, although the Waterloo Wildlife Research Station reintroduction site is located in close proximity to the edge of the action area. Three pitfall trap surveys have been conducted on the Athens Unit (L. Andrews, pers. comm.). Surveys in Snake Hollow and in the Peabody reclaim area resulted in the capture of other burying beetle species, but no American burying beetles. Predators (i.e., most likely a raccoon) destroyed the bait in the Jobs Hollow survey area, so no beetles of any kind were captured.

The Forest Service is currently conducting an analysis for the reintroduction of the American burying beetle. Potential reintroduction sites were selected primarily by soil type and secondarily by understory condition. Loose soils and an open understory were identified as criteria for site selection. Two potential sites have been located in the Long Hollow and Wildcat Hollow areas of the Athens.

The Fish and Wildlife Service lists the counties of Athens, Hocking and Vinton as having occurrences or possible occurrences of the species. Portions of the Athens Unit of the WNF are found in these counties.

#### Suitable Habitat within the Action Area

American burying beetles have been found in pastures, pasture/forest transition areas, old fields, open woodland and forests, specifically oak-hickory forests, and grasslands (USFWS, 1991a). According to American burying beetle researchers at The Ohio State University, the beetles will concentrate in ravines and wooded areas, but also use oak parkland and savannah-like habitats. It may be more of a forest edge species than previously thought. They base this idea on experiences with beetle releases (i.e., the beetles head for openings once they are released) and the fact that American burying beetles were first collected when Ohio had forests with a more open condition. While just speculative, these experts consider that maturation of the forests of Ohio may have contributed to the species decline in this area. The Ohio beetle reintroduction sites at the Waterloo Wildlife Research Station are edge habitats with maintained openings (Ewing, 2003f). The beetle does prefer upland ridgetop areas versus riparian areas, since carrion found in the uplands are typically warmer and have a greater odor plume (Keeney, 2000).

While the American burying beetle forages in a variety of habitat types within its range, species experts suggest that suitable breeding habitat is more narrowly defined (USFWS, 1991a; Lomolino and Creighton, 1996). After studying the beetle in Oklahoma, Lomolino and Creighton (1996)

concluded that viable populations of the American burying beetle may be restricted to sites with deep, loose soils and a substantial layer of litter. With these microhabitat conditions, the beetle can quickly bury carcasses and avoid competition from other scavengers. Data from a study in Oklahoma and Arkansas suggest that the American burying beetle may be a generalist when it comes to finding carcasses, but may be more specific in selecting sites for carcass burial (Lomolino et al., 1995). Level topography, well-drained soils and a well-formed detritus layer are characteristics noted at American burying beetle sites (USFWS, 1991a).

Given the habitat preferences of the American burying beetle, suitable foraging habitat may exist throughout the WNF in each of the three units. The amount of suitable habitat for reproduction may be more limited because of past mining activities in the landscape, and because forest communities are denser than they were historically. The reintroduction sites at the Waterloo Wildlife Research Station are adjacent to the southern border of the Athens Unit. Since the American burying beetle has the capability to travel two to four miles on an average day and the known record for beetle travel is 10 miles within a 24-hour period, it is possible for the beetle to become established on the WNF as a result of efforts at Waterloo.

### Factors Affecting Species Environment

As described above, an ongoing American burying beetle reintroduction effort is occurring at the nearby Waterloo Wildlife Research Station.

Please refer to the *Factors Affecting Species Environment* for the Indiana bat for activities that are occurring which may affect forest habitat.

## Direct and Indirect Effects of the Selected Alternative

### Activities with No Effects

There are some activities projected to occur within Alternative E<sub>mod</sub> that would have no effect on American burying beetle habitat. These activities do not fragment the forest or alter forest communities:

- Grape vine control
- Herbicide application
- Control of non-native invasive species using herbicides, mechanical or biological methods
- Wetland restoration or enhancement
- Restoration and improvement of riparian and aquatic systems (lentic and lotic systems)
- Installation of bat-friendly gates

- Treatment of AMD
- Closure of open mine portals or subsidences
- Special use permits allowing hay production and grazing on existing openland

### Activities Not Likely to Adversely Affect - Beneficial Effects

Alternative E<sub>mod</sub> incorporates a Forest-wide Goal (5.1.3) that guides the Forest Service to cooperate in efforts to reintroduce the American burying beetle to NFS lands. At this time, the Forest Service is working with researchers at The Ohio State University to identify potential release sites on the Athens Unit. Reintroduction may occur during the first decade of this planning cycle.

The species appears to be a generalist when it comes to foraging because it has been found in open and forested habitats. The allocation of management areas in Alternative E<sub>mod</sub> will result in a diversity of forest communities with different structure and composition. Alternative E<sub>mod</sub> will ensure suitable foraging habitat is available and well-distributed for the American burying beetle.

It is one thing to have suitable foraging and breeding habitat, but another to have a supply of carcasses. American burying beetle experts stated that management of the WNF to promote a variety of early to late successional habitats benefits the wild turkey and ruffed grouse, and could therefore benefit the American burying beetle (Ewing, 2003f). The young of these two bird species represent optimal-sized carcass sources for breeding American burying beetles. A percentage of juvenile turkeys and grouse succumb to adverse environmental conditions in the spring and summer, which coincides with American burying beetle reproduction periods. A total of 54,580 acres of the WNF were allocated to the Forest and Shrubland Mosaic MA, a management area that was developed to optimize habitat conditions for early successional forest species, like the ruffed grouse.

A Forest-wide objective (11.2e) calls for the closure of at least 20 miles of illegal OHV trail. Such trails pose a direct and indirect threat to the American burying beetle because they compact soils.

Other management activities integrated in Alternative E<sub>mod</sub> may benefit the American burying beetle:

- **Prescribed fire** may have both adverse and beneficial effects on beetle habitat. As for beneficial effects, some animals may succumb to the fire and provide a carrion source for the beetle.

- **Stabilization of disturbed areas**, including such sites as abandoned mine lands and orphan or depleted oil and gas wells, returns areas to an herbaceous or forested cover.
- **Road decommissioning** could reduced compacted soils and revert sites to a vegetated condition.
- **Land exchange and acquisition** creates larger, contiguous areas of public ownership and provides more opportunity to manage forest communities for beetle prey sources.
- American burying beetle experts indicated that an open to semi-open forest may be more optimal for the beetle. **Uneven-aged timber harvesting, thinning, crop tree release, and Historic Forest management prescriptions** could result in short-term and long-term habitat improvements for the species.
- Beetles at the Waterloo Wildlife Research Station moved toward forest openings after they were released. **Development and maintenance of permanent forest openings** may benefit individuals, possibly during foraging.

### Activities Not Likely to Adversely Affect - Insignificant Effects

There are no known populations of the American burying beetle on the WNF. However, there may be undiscovered populations that could be impacted by activities that occur on NFS lands. The following activities are expected to have insignificant effects on potentially suitable habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs.

- Lomolino et al. (1995) studied carrion beetle populations in Oklahoma and Arkansas, and their data suggest that the American burying beetle will use a variety of habitats when foraging. However Lomolino and Creighton (1996) pointed out that they avoided clearcuts during that study. **Even-aged management** may reduce foraging and breeding habitat for a period of time until the forest becomes open once again (possibly about 50 years, when it is thinned for the second time). On the other hand, even-aged management is beneficial for production of prey species (i.e., turkey and grouse chicks).
- When regenerating native pine, the forest floor must be opened to full sunlight and soil must be exposed so that native pine seeds can germinate and survive. In most cases, soil disturbances from logging or removal of leaf litter during prescribed fire will be enough to allow seeds to contact soil. However, in certain sites, it may be necessary to scarify the soil (**site prep for native pine**) to facilitate the appropriate environment for seed germination. The

objective is to create small, scattered patches of exposed soil, but ground cover would remain on 75 percent or more of the treatment area. Soil disturbance would affect the litter layer, something that appears to be important for breeding. However, this action is likely to cause only insignificant effects because native pine are more likely to be present on dry sites where soils may not be deep and loose (i.e., deep and loose soils possibly associated with breeding sites).

- The USFWS (1991a) suggested that increased habitat fragmentation created more edge habitat, which would likely lead to more habitat for mammal and bird scavengers. These scavengers could directly compete for carrion with the beetle. **Roads and trails** could provide scavenger access to areas of the National Forest. Road and trail projects are not likely to be concentrated in one area, but rather spread out across the planning area. As suggested by researchers who study nest predation of bird species, the highly forested landscape, like the WNF may contribute to a lower abundance of predators. (Chalfoun et al., 2001; Stephens et al., 2003).
- **Construction of roads, trails, parking areas, recreation facilities, oil and gas wells, and log landings** compact the soil and eliminate potential areas for carcass burial.
- American burying beetles use grassland areas in the western part of its range, but grassland areas in the action area resulted from surface mining activities. **Surface mining** and the subsequent reclamation efforts often leave soils that are more compacted. These areas are likely to be less suitable for carcass burial.
- Construction of **utility corridors** could result in ground disturbance, especially if the utilities are buried. The corridor would be vegetated, and could provide foraging habitat.

Table 21 displays the management activities that could affect the availability of prey sources or burial sites.

Only a portion of these activities in Table 21 would likely occur on the Athens Unit, which is located within the range of the American burying beetle in Ohio. For example, the possible 1,200 acre surface mine would be located on the Ironton Ranger District. If the other projected activities were distributed evenly across the three units, about 641 acres of NFS lands on the Athens Unit may be affected by activities that affect the availability of prey sources or burial sites. This acreage is likely much smaller because all road and trail acreages were calculated using the clearing width rather than the surface or tread width. The areas along roads, within the clearing width, are generally not compacted.

**Table 21. Projected amounts of activities (for a ten year period) that could affect carrion sources or eliminate carcass burial habitat.**

	<b>Alternative E<sub>mod</sub></b>
Permanent Road Construction and Reconstruction (acres)	392
Temporary Roads, Skid Trails and Log Landings	886
Recreation Trails (acres)	265
Recreation Facility & Parking Lot Construction (acres)	60
Surface Mining (acres)	1,250
Oil & Gas Well Development (acres)	121
<b>Total acres affected</b>	<b>2,974</b>
<b>Percentage of NFS lands affected</b>	<b>1.25</b>
<b>Percentage of action area affected</b>	<b>0.27</b>

One study showed that the American burying beetle exhibited a strong preference for forested sites and avoided clearcuts (Lomolino and Creighton, 1996). Alternative E<sub>mod</sub> allows for 1,725 acres of hardwood and 200 acres of pine even-aged management during the first decade, which equates to only 0.8 percent of NFS lands, or 0.17 percent of the action area. All even-aged management methods would retain trees to ensure short-term and long-term Indiana bat habitat is available, and some methods may require more trees to be left in the stand than what is considered the minimum necessary for the Indiana bat. Therefore, some even-aged methods may result in an open stand condition, possibly favorable to the American burying beetle. These even-aged timber harvests may reduce habitat for a period of time, but habitat would once again become suitable for this species. Harvest areas would be distributed across the landscape, but would be generally be located in FSM and FSMO management areas during the first decade.

**Prescribed fire** would help to create an open under and midstory, which may be favorable to the American burying beetle. However, it may reduce the litter layer, something that beetle experts believe may be important in the reproduction cycle. Prescribed fire is likely to occur periodically and leaf fall during non-fire years would replenish the litter layer. Beetles become active when air temperatures are at least 60°F. Prescribed fire activities are likely to occur during times of the year when air temperatures are above the 60° F mark. If the beetle was present on NFS lands, fire could overtake individual beetles. However, beetles are very mobile and could fly away from the fire. No information was found in the literature on effects of fire to this species; however no impacts were found to occur to other species of burying beetle at an ongoing prescribed fire study in Vinton and Lawrence counties, Ohio (Ewing, 2003f). Projections for prescribed fire activities are displayed in Table 22.

The use of prescribed fire is projected to increase from current levels during the first decade. A total of 69,819 acres could be burned within the first ten years. More or less than a quarter of the WNF would be treated, which averages to about 5,000-7,000 acres or 2-3 percent of NFS lands annually. Prescribed fire may be used twice in the first decade to treat NFS lands in HF and HFO management areas.

**Table 22. Acreages of prescribed fire that may occur during the first decade.**

Primary Purpose	Alternative E <sub>mod</sub>
Non-native Invasive Species Control	200
Maintenance of Grassland and Herbaceous – Shrub Habitat*	1,500
Oak Regeneration	46,215
Hazardous Fuels Reduction	21,904
<b>Cumulative Total (acres)</b>	<b>69,819</b>
<b>Total Acres Affected</b>	<b>62,467</b>
<b>Percentage of NFS lands affected**</b>	<b>26.2</b>
<b>Percentage of action area affected</b>	<b>5.6</b>

\*Some acres treated for oak regeneration would be treated twice in the first decade.

\*\*Some of the same acres of NFS lands are projected to be treated with prescribed fire more than once during the first decade. Figures in this row reflect the percentage of NFS lands treated with fire, rather than the cumulative acreage figures reported above.

### Activities Not Likely to Adversely Affect - Discountable Effects

Some activities have discountable effects on potentially suitable habitat, which are effects that are extremely unlikely to occur. Efforts to slow the spread of gypsy moth are currently ongoing in parts of the planning area (i.e., the Ironton Ranger District). The insecticide B.t. is not currently used on NFS lands. There is a possibility it may be necessary in the future if a gypsy moth epidemic arose. B.t. is a biological insecticide that affects Lepidoptera (i.e., butterflies and moths), and would not be expected to harm the American burying beetle. If it was deemed necessary to use this insecticide, a site-specific analysis would be conducted and effects to resources, including the American burying beetle, would be identified.

American burying beetle experts suggest that lights and insect traps could affect individuals. Although no beetles have been found on NFS lands, it is possible that beetles from the Waterloo Wildlife Research Station release site could travel to NFS lands. Lights attract the beetle and although unlikely, individual beetles could succumb to predators feeding in the lighted areas. Similarly, bug zappers (a form of insect trap) could kill a beetle. Few to no lights exist in the Forest Service campground facilities on the Athens Unit because most sites are dispersed and undeveloped. Campers may use bug zappers, but most of these products require electricity to run. The campground areas on the Athens Unit do not

have electricity at this time. Still, a Forest-wide guideline (TES-21) reduces the potential for mortality from bug zappers.

Land exchange is beneficial primarily because it aids in consolidation of NFS lands, providing more opportunity for landscape-level forest management. Biologists would be involved in the review of all land exchange proposals, and evidence of suitable habitat would be noted and brought to the attention of Forest Service managers. While it is possible that potentially suitable, but unoccupied habitat could be exchanged, it is unlikely that known occupied sites would be exchanged.

### Cumulative Effects of the Alternatives

Cumulative effects were analyzed within the 1,108,199 acre action area (see *Location and Ecological Setting of the Proposed Action* for a description of the action area).

Modifications to forest habitat through timber harvesting and associated activities (i.e., prescribed fire, herbicides, crop tree release) could positively or negatively affect the American burying beetle, and these modifications could be immediately felt by individuals. Similarly, loss of potentially suitable habitat resulting from modifications to soil structure would be immediate. Therefore, the cumulative effects analysis period will extend over the first decade of the planning period.

The area within the action area has increased in forest cover since the 1940s, where almost 80 percent of the lands are forested today. Scientists believe the forest is denser than it was before European settlement, most likely because fire and timber harvesting have diminished in the last 75 years. American burying beetle experts believe that the beetle may be more of a forest edge species than previously thought (Ewing, 2003f). They base this idea on experiences with beetle releases (i.e., the beetles head for forest openings once they are released), and the fact that American burying beetles were first collected when Ohio forests had a more open condition. While just speculative, beetle experts in Ohio considered maturation of the forests of Ohio could have contributed to the species decline in this area.

Timber harvesting will likely continue to occur on other public and private lands in the proclamation boundary over the next ten years. Some even-aged management may occur on New Page/Esplanada lands and state-owned lands. Based on knowledge gained by WNF field-going staff, about 50% of the private lands in the Ironton Unit have been logged over the past 20 years. About 95 percent of the treatments were considered high-grading or diameter-limit cutting. These private lands are now in various stages of regeneration, from sapling to pole sized trees. This scenario is most likely similar for the Athens and Marietta Units.

These harvesting methods deliberately harvest mature trees and/or thin intermediate age classes, regenerating a new age class to replace the old. However, landowners frequently partially cut stands as a harvesting method without the deliberate effort to thin immature age classes or to regenerate a new crop. These partial cuttings often take the form of diameter-limit cuttings in which all trees of a specified diameter and larger are cut. A second type of partial cutting removes only the large, higher quality trees of sawtimber size, leaving an irregularly spaced residual stand without any particular balance or design. Both of these types of cuttings are undesirable because they "high grade" the woods. That is, the largest, best formed, and most valuable species are removed, leaving a forest stand of lower value and generally lower vigor (Pope et al., no date). The result is a more dense stand, opposite of what the American burying beetle requires.

For the most part, logging on private lands may decrease over the next decade due to immature age and poor accessibility of much of the remaining timber. Little to no prescribed fire or herbicide applications are used in combination with timber harvests on private or industrial timber lands.

In the no action alternative, a small amount of uneven-aged management would be used solely to improve wildlife habitat and maintain healthy forest communities (i.e., 5,000 acres). This type of harvesting may or may not be optimal for the beetle. It does open up the forest stand, but the understory would likely become denser where gaps in the canopy occurred within 2-3 years.

In comparison, Alternative E<sub>mod</sub> incorporates the Historic Forest MA, which combines thinning, and prescribed fire and/or herbicides to create a more open, oak-dominated forest. Short-term adverse effects may result because fire can reduce leaf litter temporarily, until leaf fall occurs once again, but Historic Forest prescriptions would have an overall beneficial cumulative effect in the long-term for beetle habitat quality. A total of 47,552 acres of NFS lands are allocated to this type of management. In addition, it also allocates 47,552 acres of NFS land to the FSM management area, which would provide optimal habitat for prey species like the ruffed grouse and wild turkey. One study showed that the American burying beetle exhibits a strong preference for forested sites and avoids clearcuts (Lomolino and Creighton 1996). Even-aged management on NFS lands could have short-term adverse effects on the availability of suitable habitat, but over time these stands would mature and once again become suitable. Based on the habitat needs of this species, these forest management strategies incorporated in Alternative E<sub>mod</sub> could have greater beneficial cumulative effects than that of the no action alternative.

After studying the beetle in Oklahoma, Lomolino and Creighton (1996) concluded that viable populations of the American burying beetle may be

restricted to sites with deep, loose soils and a substantial layer of litter. With these microhabitat conditions, the beetle can quickly bury carcasses and avoid competition from other scavengers. Data from a study in Oklahoma and Arkansas suggest that the American burying beetle may be a generalist when it comes to finding carcasses, but may be more specific in selecting sites for carcass burial (Lomolino et al., 1995). Much of the Athens Unit has been affected by surface and underground coal mining activities. Surface mining can modify soil structure and chemistry. Underground mining resulted in gob piles and areas of leaching acid mine drainage across the landscape. Soils that contain favorable structure for carcass burial may be limited in distribution in the Athens Unit, but more plentiful in other parts of the action area. Surface mining activities on NFS lands, could have long-term adverse cumulative effects on American burying beetle habitat.

Construction of roads and trails, parking lots, recreation facilities, oil and gas wells, and potential surface mining may eliminate potential burial habitat for carcasses. About 2,248 acres of NFS lands could be affected by these activities in the no action alternative, and about 2,853 acres could be affected in Alternative E<sub>mod</sub>.

Similar activities may occur on other ownerships in the proclamation boundary. The Nelsonville Bypass could affect up to 768 acres of land in the southwestern part of the Athens Unit, some of which has not been mined.

Of the 2,853 acres that could be affected on NFS lands, only a portion (about 560 acres) might occur on the Athens Unit, which is within the range of the beetle in Ohio. The majority of this acreage is due to road or trail construction, and the area affected could actually be less if road acreages were calculated using only surface or tread widths. When considering similar activities that may occur on other ownerships, including the Nelsonville Bypass, these activities are likely to have minimal cumulative effects on suitable beetle habitat. Designated trails or logging roads are localized in nature and experts consider the threat to the beetle minimal (Ewing, 2003f). American burying beetle experts believe these activities should be selective in nature in areas occupied by the beetle (Ewing, 2003f). Therefore, if the beetle is found on NFS lands or reintroduced to NFS lands, project-level analyses for these types of projects will need to consider overall habitat availability in the context of similar activities on other ownerships. Alternative E<sub>mod</sub> contains Forest-wide guidelines to minimize soil disturbance from earth-disturbing activities (i.e., GFW-TES 22, GFW-TES-24, and GFW-TES-25).

Fire may be beneficial, in that some animals may succumb to the fire and provide a carrion source for the beetle (Ewing, 2003f). Prescribed fire may reduce leaf litter, a component that researchers have noted as possibly important in successful carcass burial sites (Lomolino and Creighton,

1996). But, leaf litter soon accumulates on sites that have been burned. American burying beetle experts reported that prescribed fire appears to have little effect on other burying beetles (Ewing, 2003f). Prescribed fire is unlikely to occur on any private lands in the proclamation boundary, but could occur in small amounts on other public ownerships. The no action alternative and Alternative E<sub>mod</sub> both allow for a total of 69,819 acres of prescribed fire in the first decade. About a third of that could occur on the Athens Unit. For example, about 2,300 acres could be burned annually in the Athens Unit, but not burned again for at least ten years. There could be short-term cumulative effects on beetle habitat until leaf litter accumulated on burned acres again; however prescribed fire may likely have long-term beneficial cumulative effects because it can help reduce the density of forest communities.

### Determination of Effect and Rationale

A **No Effect** determination is made for the American burying beetle. This determination is based on the fact that there are currently no known populations of the beetle on NFS lands at this time. A reintroduction effort is ongoing at the Ohio Division of Wildlife's Waterloo Wildlife Research Station, located near the Athens Unit.

Table 23 presents a summary of the effects of the alternatives on American burying beetle habitat. A **Not Likely to Adversely Affect** determination is made for American burying beetle based on:

Although habitat may be affected, adverse impacts from Alternative E<sub>mod</sub> are not likely to impede recovery of this species. The Forest Service has incorporated both proactive conservation actions as well as protective measures into the Selected Alternative to aid in the recovery of this species:

1. The Selected Alternative incorporates conservation approaches or measures to proactively protect and conserve American burying beetle habitat.
  - The Forest Service is actively contributing to the recovery of the American burying beetle. It is working with The Ohio State University to reintroduce the species onto NFS lands. Potential reintroduction sites on the Athens Unit have been identified.
  - A Conservation Plan for Federally Listed Species was developed and included in the revised Forest Plan (see Appendix 1 of this Biological Assessment). This Conservation Plan summarizes the strategy the Forest Service will use during revised Forest Plan implementation to aid in the recovery of this species. The WNF Conservation Plan addresses the following 1991 American burying

beetle recovery plan objectives: (1) conduct additional reintroductions.

- The Historic Forest management area was developed, in part, to provide open to semi-open mature woodlands for species like the American burying beetle. The Selected Alternative allocates 47,522 acres to this management area.
2. Some activities may affect American burying beetle habitat, however measures are in place to minimize impacts. In addition, these activities would be spread across the WNF in time and space over the first decade.
    - Timber harvesting and prescribed fire activities may have short-term adverse effects on habitat quality, but over time these activities should improve forest stand conditions that would make them more suitable for the American burying beetle.
    - Roads, trails, and other activities that compact soils would occur on about 1% of NFS lands, and Forest-wide guidelines would be used to minimize adverse effects to habitat or individuals which may unknowingly move onto NFS lands from the Waterloo release site.
  3. Surface mining activities may reduce available habitat for carcass burial because soil characteristics may be altered permanently. Surface mining activities are out of the control of the Forest Service; however the Forest Service can use the project level planning process to consider how projects might influence short-term and long-term available habitat in the area of surface mines.

**Table 23. Summary of Effects Determinations for the American burying beetle.**

<b>Projected Management Activity</b>	<b>Alternative E<sub>mod</sub></b>
<b>Vegetation Management</b>	
Even-aged Hardwood Timber Harvest	I
Even-aged Pine Timber Harvest	I
Uneven-aged Timber Harvest	B
Thinning	B
Crop Tree Release	B
Grape Vine Control	N
Site Prep for Native Pine	I
Reforestation	B
Prescribed Fire	I
Herbicide Application	N
Development of Permanent Forest Openings	B
Maintenance of Permanent Forest Openings	B
Control of Non-Native Invasive Species-Mechanical	N
Control of Non-Native Invasive Species-Biological	N
Wetland Restoration & Enhancement	N
Waterhole Construction	I
Fishing Pond/Lake Construction	I
Restoration & Improvement of Aquatic/Riparian Habitat (Lentic)	N
Restoration & Improvement of Aquatic/Riparian Habitat (Lotic)	N
Installation of Bat-Friendly Gates on Mines	N
<b>Recreation Management</b>	
OHV Trail Construction	I
Hiking Trail Construction	I
Horse Trail Construction	I
Mountain Bike Trail Construction	I
Recreation Facility & Parking Lot Construction	I
<b>Transportation Management</b>	
Temporary Road Construction	I
Permanent Road Construction	I
Permanent Road Reconstruction	I
Road Decommissioning	B
Disturbance related to Timber (Skid Trails, Landings)	I
<b>Energy Minerals Management</b>	
Surface Coal Mining Activities	I
Reclamation of Depleted or Orphan Wells	B
Oil & Gas Well Development	I
<b>Special Uses Management</b>	
Utility Corridor Development & Maintenance	I
Agricultural Crop Production & Grazing	N
<b>Watershed Management</b>	
Treatment of AMD	N
Surface Mine Reclamation	B
Closure of Open Mine Portal/Subsidence	N
Stabilization of Disturbed Areas	B
<b>Fire Management</b>	
Reduction of Hazardous Fuels - Mechanical	D
<b>Lands Acquisition Management</b>	
Land Acquisition	B
Land Exchange	D
<b>N</b> = No Effect; <b>B</b> = Not Likely to Adversely Affect, Beneficial Effects; <b>I</b> = Not Likely to Adversely Affect, Insignificant Effects; <b>D</b> = Not Likely to Adversely Affect, Discountable Effects; <b>A</b> = Likely to Adversely Affect	

## Federally Listed Aquatic Species

Two native freshwater mussel species currently listed by the Fish and Wildlife Service as endangered occur in the vicinity of the WNF: the fanshell and pink mucket pearly mussel. These species have not been found in streams or rivers in the WNF.

### Fanshell

#### Status of the Species

##### Species Description

###### Rangewide

The fanshell was listed as endangered on June 21, 1990 under provisions of the Endangered Species Act of 1973, as amended.

Historically, the fanshell occurred in the Ohio River and in many of its larger tributaries in Pennsylvania, West Virginia, Ohio, Indiana, Virginia, Alabama, Tennessee, Kentucky, and Illinois (USFWS, 1991b).

Currently, the fanshell is thought to be reproducing only in the Green and Licking Rivers of Kentucky, in the Clinch River in Tennessee and Virginia (NatureServe, 2004). One 2-year-old individual was located in a sand bar on the lower Tippecanoe River in Indiana, which indicates that reproduction may be occurring there as well (Ball and Schoenung, 1996).



<p><b>Common Name:</b> Fanshell  <b>Scientific Name:</b> <i>Cyprogenia stegaria (=irrorata)</i>  <b>Groups:</b> Animals, Clams  <b>Current Status:</b> Endangered  <b>Lead Region:</b> 4  <b>Date First Listed:</b> June 21, 1990  <b>Critical Habitat:</b> None  <b>Special Rules:</b> None  <b>Recovery Priority:</b> 5  <b>Approved Recovery Plan?</b> Yes  <b>Historic Range:</b> AL, IL, IN, KY, OH, PA, TN, VA, WV  <b>This Status Likely To Occur In:</b> AL, IL, IN, KY, OH, TN, VA, WV  <i>Source: USDI Fish and Wildlife Service</i></p>
--

Small, apparently non-reproducing populations may still exist in Illinois, Indiana, Ohio, West Virginia, Kentucky, and Tennessee (NatureServe, 2004). Fresh dead shells, aged 9 and 11 years of age were found by biologists near the backchannel of Muskingum Island, a part of the Ohio River Islands National Wildlife Refuge (USFWS, 1996a).

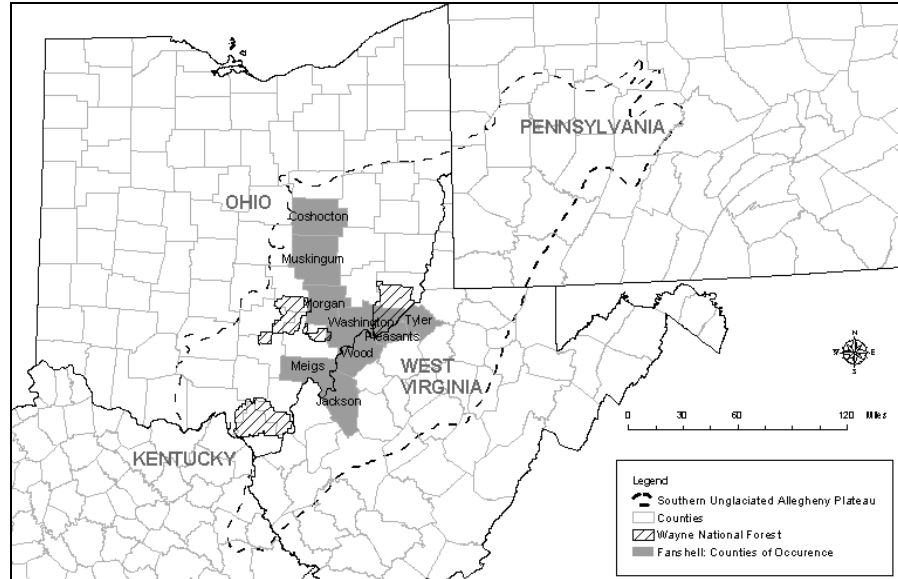
### **Species Range in Ohio**

Historically, this species was widely distributed in Ohio's larger rivers, but live and fresh dead individuals have only been found in the lower Muskingum River and Ohio River in recent years (Hoggarth, 1993; Watters and Dunn, 1993-1994; Ecological Specialists, Inc., 2000; A. Zimmerman, USFWS, personal communication) (Figure 10).

The discovery of a few younger individuals during a 1988-1993 survey suggested that reproduction was still occurring in the lower Muskingum River in Morgan and Washington counties (Hoggarth, 1993). National Forest System lands in the Marietta Unit are primarily located within the Little Muskingum River watershed, the Duck Creek watershed, or within small tributary watersheds that flow directly into the Ohio River. Only 0.5% of the Marietta Unit is located within the Muskingum River watershed, but no NFS lands are located within it.

The fanshell has not been collected from the Walhonding River since the construction of Mohawk Dam. Hoggarth (1994) surveyed this river in 1994 and found only relic specimens of the fanshell, which may indicate that it has been extirpated from this river system.

Live and fresh dead individuals have been found in the Belleville and Racine pools of the Ohio River during surveys conducted between 1993 and 1997 (Ecological Specialists, Inc., 2000). These pools are located immediately downstream of the Marietta Unit. Based on information from the West Virginia Division of Natural Resources (2000), fanshell distribution in the Bellville pool is likely outside the action area because the Division reports it occurring in the Ohio River in Wood County, WV.



**Figure 10. County occurrences of the fanshell in the Southern Unglaciaded Allegheny Plateau.**

### Life History

Freshwater mussels are relatively long-lived animals. Cummings and Mayer (1992) reported that mussel lifespans range from 10 years to more than 100 years. Ages of 84 relic and fresh dead fanshell specimens from the Clinch River in Tennessee ranged in age from 6 years to 26 years (Jones and Neves 2001).

The fanshell, described by Rafinesque in 1820, is a freshwater mussel with a shell up to approximately three inches in length. The shell exterior is greenish or tan, with green rays, often broken or composed of small spots or lines (USFWS, 1991b; Watters, 1995). The inside of the shell is silvery white. The hinge and teeth of this mussel are well-developed, with the hinge being short and arched.

Based on study of four female fanshell mussels, Jones and Neves (2001) found they were gravid from late October to late May. They determined mean fecundity of these four individuals was 43,494 mature glochidia per mussel; the larger females contained the most glochidia.

The fanshell is considered to be a medium to large river species (Cummings and Mayer, 1992; Watters, 1995). It does not occur in small tributary streams. The fanshell inhabits shoals of coarse sand-gravel-cobble substrates, moderate currents, and depths to about one meter (Gordon and Layzer, 1989).

Its reproductive biology is not fully known, however it is believed to be similar to other bivalves where the sexes are separate (USFWS, 1991b). As described by Watters (1995), males release sperm into the water, and

females take in the sperm through their siphon while feeding and respiring. The female retains the fertilized eggs in specialized regions of the gills, known as marsupia. Small bivalved larvae, or glochidia, develop over a period of days to months, depending on the species. The glochidia are shed by the female, and the glochidia must acquire a suitable vertebrate host within about 24 hours, or die. The glochidia attach to the host, either on the gills, fins or skin. The larvae will grow and transform into juveniles, then release themselves from the host and burrow into the substrate. The fanshell is reported to be a long-term breeder, or in other words it holds glochidia overwinter for spring release (NatureServe, 2004)

Nine fish hosts have been identified for the fanshell by Jones and Neves (2001): mottled sculpin (*Cottus bairdi*), banded sculpin (*Cottus carolinae*), greenside darter (*Etheostoma blennioides*), snubnose darter (*Etheostoma simotereum*), banded darter (*Etheostoma zonale*), tangerine darter (*Percina aurantiaca*), blotchside logperch (*Percina burtoni*), logperch (*Percina caprodes*), and Roanoke darter (*Percina roanoka*).

Freshwater mussels are generally sedentary, typically spending their lives very near to the site where they first successfully settled. Movement will occur in response to some stimulus, such as nearby water disturbance, exposure to conditions during low water or seasonal temperature change, and during spawning. Movement includes burrowing deeper into the substrate or horizontal movement of a few feet across the substrate (NatureServe, 2004). Through movements of the host fish, glochidia can be transported upstream and downstream from where the female is located.

Although the specific food habits of the fanshell are not known, its food habits are likely similar to other freshwater mussels, namely, filter feeding on diatoms, phytoplankton, zooplankton, and detritus (USFWS, 1991b).

### Population Dynamics

There is no information available to estimate the population size of the fanshell throughout its range. NatureServe (2005) has given a global rank of G1 and a national rank of N1 to the fanshell: (G1) Critically Imperiled – At very high risk of extinction due to extreme rarity (often fewer than 5 populations), very steep declines, or other factors; (N1) Critically Imperiled – Critically imperiled in the nation because of extreme rarity (often 5 or fewer), or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation.

### Status and Distribution

The fanshell has experienced tremendous declines, with only three reproducing populations known.

### **Rangewide Threats**

Freshwater mussels, as a group, comprise a higher percentage of endangered, threatened, and rare species than any other single group in North America. The alteration of habitat through dredging and the creation of impoundments, combined with siltation, decreased water quality, and the invasion of exotic mussels has been responsible for 141 mussel species in North America being listed as extinct, endangered, or threatened (USFWS, 1991b; Williams et al., 1992)

Impoundments and navigation projects historically have been the most serious threat to riverine mussels (Lauritsen and Watters, 1986). These structures alter the morphology of the natural river, changing the flow, oxygen levels and substrates. They can also impede upstream and downstream passage of fish hosts. As an example, Hoggarth (1994) found only dead shells of the fanshell below a dam on the Walhonding River in Ohio, where live specimens had previously been collected before the dam was constructed. In addition, he found only silt-tolerant mussel species above the dams in that river.

Mussels are susceptible to pollution from various sources: runoff from coal mines; runoff containing pesticides, fertilizers, animal waste and heavy metals; and discharges of water with temperature extremes (Lauritsen and Watters, 1986). Siltation from mining, dredging, road construction, farming and logging can bury shells, impact feeding and respiration, and affect host-fish populations by smothering eggs or larvae, reducing food availability, or filling spawning beds.

Other potential threats to this species include reduction of water flows, runoff from oil and gas exploration, toxic spills, water development projects, and collectors in rivers where the fanshell remains (USFWS, 1990a).

A relatively new threat to this species is the zebra mussel, a non-native invasive species which has extended its range to the Ohio River basin. Berg et al. (1993) found that zebra mussels encrust native unionids and affect their fitness.

### **Action Area Threats**

Of these rangewide threats, degradation of water quality is of concern in the action area. The effects of Alternative E<sub>mod</sub> on water quality will be addressed in the analysis of effects.

## Environmental Baseline

### Status of Species in the Action Area

#### Species Range in the Action Area

Freshwater mussel surveys have been conducted in the major Ohio River tributaries within the proclamation boundary of the WNF (Watters, 1988; Hoggarth, 2001). There are no known populations of the fanshell within the WNF.

Surveys of the Bellville and Racine pools of the Ohio River have found some individuals downstream, but outside the Action Area.

#### Suitable Habitat within the Action Area

The fanshell is a river species, and occurs in moderate currents. It is found in relatively deep waters in a gravel or sand substrate (Watters, 1995).

Streams within the WNF are primarily small, headwater streams; however larger Ohio River tributaries do pass through the proclamation boundaries. These larger tributaries (i.e., Pine Creek, Storms Creek, Raccoon Creek, Hocking River, and Little Muskingum River) do not possess the habitat qualities desired by the fanshell.

The Ohio River along the Marietta Unit could possess potentially suitable habitat for this species.

While there is no suitable habitat for the fanshell within the WNF, four known host fish species occur within watersheds containing NFS lands (WNF Fish Database). The banded darter, greenside darter, and logperch are found in the Little Muskingum River watershed, Symmes Creek watershed, Pine Creek watershed, the Little Scioto River watershed, and portions of the Hocking River watershed. The mottled sculpin has a limited distribution, and has only been documented in the Hocking River watershed between Enterprise and Monday Creek.

The greenside darter, banded darter, and logperch could potentially travel between the Ohio River and WNF streams. It is unlikely that these host fish would contribute to the colonization of sites within the WNF since habitat is not suitable, but these host fish could play a role in the life cycle of the fanshell when occupying sites in the Ohio River.

### Factors Affecting Species Environment within the Action Area

There are no known tribal actions ongoing within the action area that would affect this species. Ongoing State, local, or private actions occurring in close proximity to the Ohio River that could affect this species may include earth disturbing activities that result in sedimentation of aquatic habitat in the Ohio River (e.g., road construction, streambank

modifications, dredging). Activities that occur within the Ohio River or streams are generally regulated by the Corps of Engineers and State environmental agencies, therefore effects from these activities are often reduced or eliminated.

There are no known federal actions that have been completed informal or formal consultation that are affecting this species.

Beneficial activities are ongoing within the action area to reduce runoff of nutrients and pollutants. For example, reforestation of federal and non-federal lands is an ongoing activity; annual tree give-aways and tree sales are sponsored by the Ohio Division of Forestry, and local Soil and Water Districts. Several groups are working together to remediate acid mine drainage and other effects of past mining practices. State and federal agencies offer educational programs to landowners on best management practices.

## Direct and Indirect Effects of the Selected Alternative

### Activities with No Effects

Some activities projected to occur during the first decade would have no effect on downstream populations or habitat for the fanshell, or its host fish or their suitable habitat. These activities are not ground disturbing and would not pose a threat to increased sedimentation or changes in water quality.

- Crop tree release and grape vine control involving the manual treatment of individual vines and girdling or felling of individual trees
- Development and maintenance of permanent forest openings using mechanical methods (e.g., mowing, chainsaw work)
- Control or eradication on non-native invasive species using mechanical methods (e.g., brushing, mowing) or biological methods
- Restoration and improvement of ponds and lakes (e.g., placing underwater habitat structures)
- Herbicide application (i.e., spot treatment)
- Installation of bat-friendly gates

### Activities Not Likely to Adversely Affect the Fanshell - Beneficial Effects

Since the fanshell is not found within the WNF, protection and improvement of watershed health is important to its host fishes and to

fanshell populations located downstream in the Ohio River. National Forest activities which protect and improve stream habitat and water quality would benefit downstream areas.

The RC Management Area was established to emphasize the retention, restoration, and enhancement of the inherent ecological processes and functions associated with riverine systems. Alternative E<sub>mod</sub> allocate NFS lands to the RC Management Area along Symmes Creek, the Hocking River, the Little Muskingum River, and the Ohio River.

Alternative E<sub>mod</sub> incorporates Forest-wide goals (2.1 and 3.1) and objectives (2.1a-c, 3.1a-d) which promote the restoration and improvement of riparian and watershed health. Alternative E<sub>mod</sub> also includes numerous Forest-wide standards and guidelines that protect aquatic resources from potential sources of non-point source pollution.

Beneficial management activities that are projected to occur during the first decade of implementation of Alternative E<sub>mod</sub> include:

- 500 acres of reforestation
- 150 acres of wetland restoration
- 20 miles of stream restoration and improvement
- 10 miles of road decommissioning
- reclamation of 128 orphan or depleted oil and gas wells (70 acres)
- treatment of 180 abandoned mine land features that contribute to acid mine drainage conditions (270 acres)
- closure of 155 open mine features that contribute to acid mine drainage conditions (232 acres)
- 20 acres of surface mine reclamation
- stabilization of 100 acres of disturbed areas
- land acquisition of up to 40,000 acres

### **Activities Not Likely to Adversely Affect the Fanshell - Insignificant Effects**

Some management activities may result in a potential impact to fanshell populations or habitat downstream or to its host fish and their habitat, but the impact would not reach the scale where take would occur. Established Forest-wide standards and guidelines minimize the scale of the potential impact to a point where changes to water quality would not likely be detected.

- **Timber harvesting** (i.e., all methods) involves the felling of trees, removal of trees to a landing, and transport off-site. Mechanical

reduction of hazardous fuels may involve the dragging of trees and limbs across the ground. The act of dragging trees to the landing could result in some soil disturbance, but filterstrips minimize the potential for sediment introduction into streams (ARR-5 and 6). If any soil was to enter a stream during the removal of trees, it would likely be minimal and undetectable in mainstem habitats.

- When regenerating native pine, the forest floor must be opened to full sunlight and soil must be exposed so that native pine seeds can germinate and survive. In most cases, soil disturbances from logging or removal of leaf litter during prescribed fire will be enough to allow seeds to contact soil. However, in certain sites, it may be necessary to scarify the soil (**site prep for native pine**) to facilitate the appropriate environment for seed germination. The objective is to create small, scattered patches of exposed soil, but ground cover would remain on 75 percent or more of the treatment area. Filterstrips would minimize the potential for sediment introduction into streams from such activities (ARR-5 and 6).
- The **construction of firelines** using bulldozers for prescribed fire activities could result in soil disturbance, whereas firelines constructed by hand only affect the litter layer. The Forest Service attempts to use existing roads and fire breaks to avoid constructing fire line (FIRE-7). Furthermore, action would be taken to minimize the potential for sediment movement into streams (FIRE-12 and FIRE-13). If any soil were to enter the stream as a result of fireline construction, the amount would likely be minimal and undetectable in mainstem habitats.
- Surface erosion in relation to forest **roads/trails** is dependant on soils, road surfacing, road grade, and age of the road, traffic volumes, and the effectiveness and spacing of drainage structures. Proper design and placement of drainage structures are critical to minimizing the amount of surface flow and surface erosion.
- Road surfacing, maintenance and grade play a role in surface erosion. Some roads are surfaced with limestone aggregate or native material. When roads are not located, designed, or maintained properly to divert water from streams, aggregate or native material can move into streams during rainfall events. Movement of material into ditch lines and streams can be increased on roads with steeper grades. Grades of over 12% average slope are avoided unless there are stringent erosion control practices installed.

Sediment delivery to streams may be higher during and just after construction, but raw ditch lines and road surfaces with little binder can also remain chronic sources of sediment. High volumes of traffic on roads with aggregate and native material have a

greater affect on the integrity of the road and surfacing than it does on asphalt-surfaced roads.

Road-stream or trail-stream crossings can accelerate inputs of sediment. Use of native materials or aggregate that contain sand or materials smaller than ½ inch in size for road surfaces can degrade channels by filling in pools downstream of crossings. This generally occurs where the road slope approaching the channel is steep. Surface erosion can occur on roads/trails that are located in the floodplain of streams, specifically with roads/trails surfaced with native materials or aggregate. Floodwaters can wash over the road/trail surface and carry material into the stream.

These roads and trails would be spread out across the landscape, rather than concentrated in one watershed. Forest-wide standards and guidelines are incorporated in Alternative E<sub>mod</sub> to reduce the effects of roads on aquatic systems (i.e., filterstrips, stream crossings). The WNF, in all new construction and re-construction, is meeting or exceeding best management practices and professional engineering practices to reduce any effect the road system may have on soil transport (USDA Forest Service, 2003). Based on this, it is likely some sediment will enter the stream systems from roads and trails; however the amount is not expected to alter existing water quality or the composition of stream substrates.

- **Oil and gas activities** have the potential to affect water quality as a result of soil disturbance and subsequent sedimentation. Effects are generally short-lived; revegetation of areas disturbed during the construction of the access road and well pad reduces the potential for soil erosion. Established Forest-wide standards and guidelines can mitigate the effects of oil and gas exploration and development (i.e., filterstrips, stream crossings, stabilizing disturbed areas, NSO on steep slopes). Controlled surface use is allowed in riparian areas and floodplains. In these cases, roads, well pads, tank batteries may be allowed in riparian areas or floodplains when placement of such facilities in adjacent upland areas would cause long-term effects to other resources (e.g., TES species, cultural site).

For reserved and outstanding rights oil and gas wells, operators must follow state regulations which include best management practices for protecting aquatic resources.

Brine or oil spills could occur during oil and gas well operations, although they are rare. The operator is required to construct berms around the wells to contain any oil leaks. The brine is required to be removed by tank truck. Forest-wide standards and guidelines require the installation of control valves on all pipelines crossing

streams so that supply and flow of oil and gas can be shut down immediately upon detection of a leak.

Up to 121 acres could be disturbed from oil and gas well development. Some sediment could enter the stream systems; however the amount is not expected to alter existing water quality or the composition of stream substrates.

- **Surface coal mines** could alter surface and subsurface hydrology, and subsequently degrade existing stream habitat. Approximately 1,250 acres of NFS land could be affected by surface mining in the future. The Forest Service has no control over this projected activity since private mineral rights are involved in these possible activities. However at a minimum, the operator would need to follow state regulations associated with protection of aquatic resources.
- Nutrient enrichment of localized stream reaches could occur as a result of **grazing allotments**. However, surface runoff from such operations would need to flow through filter strips, which are designed to decrease nutrient loading of streams.
- Construction of **utility corridors**, specifically those which contain buried transmission lines, causes ground disturbance. Forest-wide standards and guidelines for stream crossings for pipelines (ARR-13 to ARR-17), and filterstrips (ARR-5 and 6) would minimize the potential for sediment introduction into streams.
- Up to 400 acres of **land exchange** could occur in the first decade of the plan. Land exchange can be beneficial (e.g., acquiring frontage along occupied habitat). The exchange could be negative if degradation of aquatic or riparian habitat occurred after the tract was in private ownership. But, there is no certainty in how the landowner would manage the land after it is exchanged out of federal ownership.

### Activities Not Likely to Adversely Affect the Fanshell - Discountable Effects

Some activities have discountable effects on potentially suitable habitat, which are effects that are extremely unlikely to occur. Land exchange is a primarily beneficial activity because it aids in consolidation of NFS lands, which provides more opportunity for landscape level forest management. Future management of the federal tract is uncertain once it is exchanged into private hands, and it is possible the private landowner could conduct activities that may result in sedimentation or modification of aquatic habitats.

## Cumulative Effects of the Selected Alternative

While any direct and indirect effects that could potentially occur as a result of implementing Alternative E<sub>mod</sub> would be contained in the action area, the cumulative effects analysis area includes the 31, 5<sup>th</sup> level watersheds that contain portions of the WNF proclamation boundary. To adequately assess cumulative effects as required by NEPA, watershed boundaries provide a better sense of what cumulative impact Forest Service activities could have on the two federally listed mussels found in the Ohio River. Other lands in these 31 watersheds also contribute to watershed integrity and water quality, as do NFS lands. Watersheds that contain part of the proclamation boundary, yet do not currently contain any NFS lands, were included because it is possible that land acquisition efforts could add up to 40,000 acres of NFS lands to these watersheds over the next decade.

The fanshell does not occur within the WNF, or within any of the 31 watersheds. No suitable habitat exists for it within the WNF. However, it occurs in the Ohio River, downstream of the Marietta Unit. The West Virginia Division of Natural Resources lists it occurring in the Bellville Pool in Wood County, which is outside the action area. Its host fishes could occur in tributary streams within the 31 watersheds during certain times of the year.

Throughout its range, fanshell populations have been impacted by alteration and degradation of stream habitat. Water quality and aquatic habitat have improved in many of the 31 watersheds in recent years, as evidenced by the mileage of streams that are attaining Ohio EPA's use designations. However, some streams remain impacted by past mining activities (i.e., primarily watersheds on the Athens Unit, but some streams in the Pine Creek watershed on the Ironton Ranger District), and from non-point source pollution (USDA Forest Service, 2001; 2002).

Ground disturbing activities occur on other lands and will likely to continue in the future. Timber harvesting occurs on private lands, but these activities are scattered across the watershed rather than being concentrated in one area. This trend is likely to continue in the future. An evaluation of logging best management practices on private lands indicated that best management practices were employed in at least 80% of all timber harvests and 95% of these best management practices were rated effective at minimizing sedimentation of streams (McClenehen et al., 1999).

Oil and gas well development on private lands may increase from present levels, based on a reasonably foreseeable future development scenario for federal lands. Operators are required to follow state regulations, which include best management practices for controlling erosion and minimizing impacts from potential spills.

Township and county governments are likely to continue maintaining existing roads, depending on funding. Maintenance primarily targets human safety, with environmental conditions secondary in concern. Some of the roads and road-stream crossings under these jurisdictions may continue to contribute to sedimentation or aquatic habitat modifications in the future.

The cumulative effects analysis period is for ten years, since concern for sedimentation of aquatic habitat diminishes as ground cover becomes established. Within southern Ohio, revegetation of disturbed areas can occur easily within one growing season. In terms of earth disturbing activities, Alternative E<sub>mod</sub> has the potential to disturb about 12,975 more acres of NFS lands than Alternative A (the no action alternative; see Table 7), specifically in the timber harvest, hiking and horse trail construction, and roads/skid trails categories. This equates to 5.4 percent of NFS lands, or 0.5 percent of the cumulative effects analysis area. These activities would be distributed over the WNF in time and space, and application of the Forest-wide standards and guidelines incorporated within Alternative E<sub>mod</sub> will further minimize the potential for any adverse cumulative effects to occur to downstream aquatic systems. Furthermore, efforts by the Forest Service, other state and federal agencies, conservation organizations, and private landowners continue to result in improved water quality conditions within the cumulative effects analysis area and action area.

### Determination of Effect and Rationale

A **No Effect** determination is made for the fanshell. This determination is based on the fact that the fanshell does not occur within the WNF or in the action area. There is no suitable habitat within the WNF. The fanshell occurs in the Ohio River, downstream of the Marietta Unit and outside the action area.

Table 24 presents a summary of the effects Alternative E<sub>mod</sub> on downstream fanshell populations and habitat, and to its host fishes and their habitat that may occur in the WNF and in the action area. A **Not Likely to Adversely Affect** determination is made for fanshell habitat. This determination is based on the following rationale:

1. The Selected Alternative incorporates beneficial elements that would protect, restore or improve water quality within and downstream of the WNF:
  - Allocation of the River Corridor Management Area along the Ohio River, Hocking River, Symmes Creek, and Little Muskingum River, a management area which emphasizes retaining, restoring, and enhancing the inherent ecological

- processes and functions associated with riverine systems.
- An active watershed restoration program that is improving water quality in the WNF and in downstream aquatic systems. The Selected Alternative incorporates goals and objectives to protect and restore water quality and soil productivity (Section 2 – Watershed Health) and to promote healthy riparian and aquatic ecosystems (Section 3 – Aquatic and Riparian Resources).
  - Improved guidance on the management of riparian corridors to maintain habitat diversity for aquatic and riparian-dependent species has been incorporated into Alternative E<sub>mod</sub> (ARR-1 through ARR-4).
  - Federal oil and gas lease-specific notifications and stipulations that aim to protect floodplains (Appendix H, Notification #2; Stipulation #15, #16), federally listed species and their habitat (Appendix H, Notification #3; Stipulation #12), steep slopes and unstable soils (Appendix H, Notification #4; Stipulations #8, #9, #17).
2. Ground disturbing activities could occur during implementation of some projects. Forest-wide standards and guidelines integrated into Alternative E<sub>mod</sub> are expected to minimize adverse effects to water quality where take would not be expected to occur. This Forest-wide direction includes, but is not limited to stabilization of disturbed areas, use of filterstrips, and restrictions for placing improvements on steep slopes or unstable soils, and controlled use of floodplains and riparian areas for federal oil and gas leases.

**Table 24. Summary of effects determinations for the fanshell.**

<b>Projected Management Activity</b>	<b>Alternative E<sub>mod</sub></b>
<b>Vegetation Management</b>	
Even-aged Hardwood Timber Harvest	I
Even-aged Pine Timber Harvest	I
Uneven-aged Timber Harvest	I
Thinning	I
Crop Tree Release	N
Grape Vine Control	N
Site Prep for Native Pine	I
Reforestation	B
Prescribed Fire	I
Herbicide Application	N
Development of Permanent Forest Openings	N
Maintenance of Permanent Forest Openings	N
Control of Non-Native Invasive Species-Mechanical	N
Control of Non-Native Invasive Species-Biological	N
Wetland Restoration & Enhancement	B
Waterhole Construction	I
Fishing Pond/Lake Construction	I
Restoration & Improvement of Aquatic/Riparian Habitat (Lentic)	N
Restoration & Improvement of Aquatic/Riparian Habitat (Lotic)	B
Installation of Bat-Friendly Gates on Mines	N
<b>Recreation Management</b>	
OHV Trail Construction	I
Hiking Trail Construction	I
Horse Trail Construction	I
Mountain Bike Trail Construction	I
Recreation Facility & Parking Lot Construction	I
<b>Transportation Management</b>	
Temporary Road Construction	I
Permanent Road Construction	I
Permanent Road Reconstruction	I
Road Decommissioning	B
Disturbance related to Timber (Skid Trails, Landings)	I
<b>Energy Minerals Management</b>	
Surface Coal Mining Activities	I
Reclamation of Depleted or Orphan Wells	B
Oil & Gas Well Development	I
<b>Special Uses Management</b>	
Utility Corridor Development & Maintenance	I
Agricultural Crop Production & Grazing	I
<b>Watershed Management</b>	
Treatment of AMD	B
Surface Mine Reclamation	B
Closure of Open Mine Portal/Subsidence	N
Stabilization of Disturbed Areas	B
<b>Fire Management</b>	
Reduction of Hazardous Fuels - Mechanical	I
<b>Lands Acquisition Management</b>	
Land Acquisition	B
Land Exchange	D
<b>N</b> = No Effect; <b>B</b> = Not Likely to Adversely Affect, Beneficial Effects; <b>I</b> = Not Likely to Adversely Affect, Insignificant Effects; <b>D</b> = Not Likely to Adversely Affect, Discountable Effects; <b>A</b> = Likely to Adversely Affect	

## Pink Mucket Pearly Mussel

### Status of the Species

#### Species Description

##### Rangewide

The pink mucket was listed as federally endangered in June 1976. Historically, this species has been considered a strictly Ohioan or Interior Basin species with populations primarily in the Tennessee, Cumberland, and Ohio River basins and occasional specimens from the Mississippi River basin (USFWS, 1985).



Though geographically widespread, known from 25 river systems including the Muskingum, Scioto and Kanawha Rivers, it has never been found in large numbers at any one site. The pink mucket is now found in 16 river systems in three geographic regions with reproduction and frequent encounters of specimens occurring in the Tennessee, Paint Rock, Meramac, and Cumberland Rivers (USFWS, 1985). It is considered extirpated in Ohio, Pennsylvania, and Illinois (NatureServe, 2004).

##### Species Range in Ohio

Weathered shells were found in the lower Muskingum River during surveys in 1983 and 1992, but there is no evidence it is still living in the Muskingum River (Hoggarth, 1993; Watters and Dunn, 1993-1994).

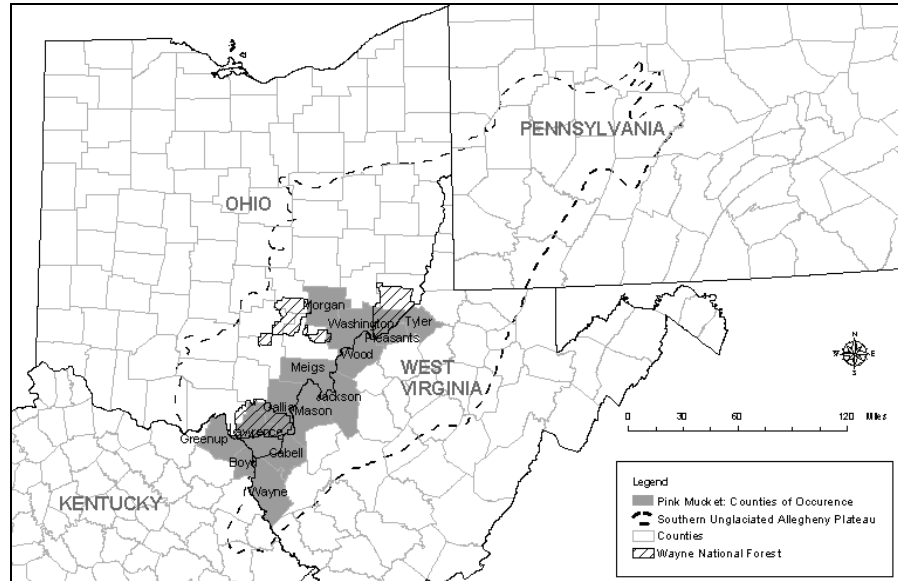
The pink mucket pearly mussel has been found in the nearby Ohio River. Individuals (live-weathered) have been found in the Belleville, Racine, Gallipolis, and Greenup pools of the Ohio River during surveys conducted between 1980 and 1995 (ESI, 2000).

Because of its presence in the Ohio River, and the recent findings of

**Common Name:** Mucket, pink (pearlymussel)  
**Scientific Name:** *Lampsilis abrupta (=orbiculata)*  
**Groups:** Animals, Clams  
**Current Status:** Endangered  
**Lead Region:** 4  
**Date First Listed:** June 14, 1976  
**Critical Habitat:** None  
**Special Rules:** None  
**Recovery Priority:** 5  
**Approved Recovery Plan?** Yes  
**Historic Range:** U.S.A. (AL, AR, IL, IN, KY, LA, MO, OH, PA, TN, VA, WV)  
**This Status Likely To Occur In:** AL, AR, IL, IN, KY, LA, MO, OH, PA, TN, VA, WV

Source: USDI Fish and Wildlife Service

weathered shells reported above, the USFWS lists its distribution as occurring in Gallia, Meigs, Morgan, Washington, and Lawrence counties (USFWS, 2004) (Figure 11).



**Figure 11. County occurrences of the pink mucket pearly mussel in the Southern Unglaciaded Allegheny Plateau.**

### Life History

The pink mucket pearly mussel is a large river species (60 feet wide or greater) (USFWS, 1985). While it has been reported from riffles with rocky substrates, strong currents, and depths to about three feet, it has also been collected from deep water habitats with slower flows (Gordon and Layzer, 1989).

The shell of the pink mucket pearly mussel is somewhat oval or elliptical in shape. This mussel is four inches long and 2.5 inches in height. The surface of the shell is smooth, except for the concentric growth rings. The outer shell color is greenish brown or yellow, with wide green rays in younger mussels. The inside of the shell is pink to solid white. This species is dimorphic (USFWS, 1985). The anterior margin of the shell is rounded with the posterior-ventral area expanded, broad, and somewhat truncated to accommodate the marsupium in females. The posterior ridge of the shell is well defined in males and younger specimens.

Reproduction of the pink mucket pearly mussel is similar to the fanshell and most freshwater mussels, where the male sperm is discharged to the water column and received by the female through feeding and respiration. Fertilization occurs within the gills of the female. Fertilized eggs are

retained in the posterior section of the outer gills, which are modified brood pouches. Small bivalved larvae, or glochidia, develop from the eggs, and are eventually released and attach to the gill filaments of their host fish (USFWS, 1985). The pink mucket pearly mussel is a bradyctytic, or long-term breeder. It becomes gravid in August; glochidia develop and are released the following year, in June (USFWS, 1985). The glochidia are of the hookless type with a delicate shell, and are shaped like the bowl of a very blunt spoon (TABS, 2002).

Barnhart et al. (1997) tested 19 fish species as potential hosts of pink mucket and found that four supported transformation of the glochidia to juvenile mussels: largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), spotted bass (*Micropterus punctulatus*), and walleye (*Stizostedion vitreum*). The sauger (*Stizostedion canadense*) and the freshwater drum (*Aplodinotus grunniens*) have also been identified as host fish (NatureServe, 2004). A mantle flap and eyespot found on the female mussel might aid in the attraction of host fish by resembling bait fish (Lauritsen, 1986).

Freshwater mussels are generally sedentary, typically spending their lives very near to the site where they first successfully settled. Movement will occur in response to some stimulus, such as nearby water disturbance, exposure to conditions during low water or seasonal temperature change, and during spawning. Movement includes burrowing deeper into the substrate or horizontal movement of a few feet across the substrate (NatureServe, 2004). Through movements of the host fish, glochidia can be transported upstream and downstream from where the female is located.

The pink mucket pearly mussel is a detritivore (NatureServe, 2004).

The Tennessee Animal Biogeographic System (TABS, 2002) reported that the pink mucket has a lifespan of 50 or more years.

### Population Dynamics

There was no information in the literature to assess fecundity or population size. NatureServe (2005) has given a global rank of G2 and a national rank of N2 to the pink mucket pearly mussel: (G2) Imperiled – At high risk of extinction due to a very restricted range, very few populations (often 20 or fewer), steep declines, or other factors; (N2) Imperiled – Imperiled in the nation due to a very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation.

### Status and Distribution

The pink mucket's distribution has declined from 25 to 16 known rivers and tributaries.

#### Rangewide Threats to the Species

Please refer to the discussion of threats to the fanshell (previous species addressed). Those threats would be the same for the pink mucket pearly mussel.

## Environmental Baseline

### Status of the Species in the Action Area

#### Species Range in the Action Area

Freshwater mussel surveys have been conducted in the major Ohio River tributaries within the proclamation boundary of the WNF (Watters, 1988; Hoggarth, 2001). There are no known populations of the pink mucket pearly mussel within the WNF.

It has been reported from the Bellville, Racine, Gallipolis and Greenup pools of the Ohio River, but no exact locations were available. It is not known for sure it occurs inside or outside the action area.

#### Suitable Habitat within the Wayne National Forest and Action Area

The pink mucket pearly mussel is a large river species. Streams within the WNF are primarily small, headwater streams; however larger Ohio River tributaries do pass through the WNF proclamation boundaries. These larger tributaries (i.e., Pine Creek, Storms Creek, Raccoon Creek, Hocking River, and Little Muskingum River) do not possess the habitat qualities desired by the pink mucket.

Suitable habitat occurs within the Ohio River, partially which is included in the action area.

While there is no suitable habitat for the fanshell within the WNF, five known host fish species occur within watershed containing NFS lands (WNF Fish Database). The black basses, sauger, and freshwater drum are found within most watersheds that are not impacted by acid mine drainage from past coal mining.

## Direct and Indirect Effects of the Selected Alternative

Please refer to the discussion of direct and indirect effects of the Selected Alternative on the fanshell (previous species addressed). Those direct and indirect effects would be the same for the pink mucket pearly mussel and its habitat, and its host fish.

### Cumulative Effects of the Selected Alternative

Please refer to the cumulative effects analysis for the fanshell. The cumulative effects of the Selected Alternative on the pink mucket pearly mussel would be the same as those displayed for the fanshell.

### Determination of Effect and Rationale

A **No Effect** determination is made for the pink mucket pearly mussel. This determination is based on the fact that the pink mucket pearly mussel does not occur within the WNF, and there is not suitable habitat for it within the WNF. The pink mucket pearly mussel occurs in the Ohio River, downstream of the Marietta Unit and Ironton Ranger District.

A **Not Likely to Adversely Affect** determination is made for the pink mucket pearly mussel habitat. This determination is based on the following rationale:

- The Selected Alternative incorporates beneficial elements that would protect, restore or improve water quality within and downstream of the WNF. It also incorporates the River Corridor Management Area along the Ohio River, a management area which emphasizes retaining, restoring, and enhancing the inherent ecological processes and functions associated with riverine systems.
- Ground disturbance could occur during implementation of some management. Forest-wide standards and guidelines integrated into Alternative E<sub>mod</sub> are expected to minimize adverse effects to water quality where take would not be expected to occur.

## Federally Listed Terrestrial Plant Species

Four plant species currently listed by the Fish and Wildlife Service as endangered or threatened occur in the vicinity of WNF: northern monkshood, running buffalo clover, small whorled pogonia, and Virginia spiraea. Only one of the four species has been found within the action area (running buffalo clover).

### Northern Monkshood

#### Status of the Species

#### Species Description

##### Rangewide

The northern monkshood was listed as a federally threatened species in 1978 (43 Fed. Reg. 17,910 (April 26, 1978)). The plant occurs in and around the unglaciated areas of northeastern Iowa and southwestern Wisconsin, in the Catskills of New York, and in eastern Ohio (USFWS, 1983c).

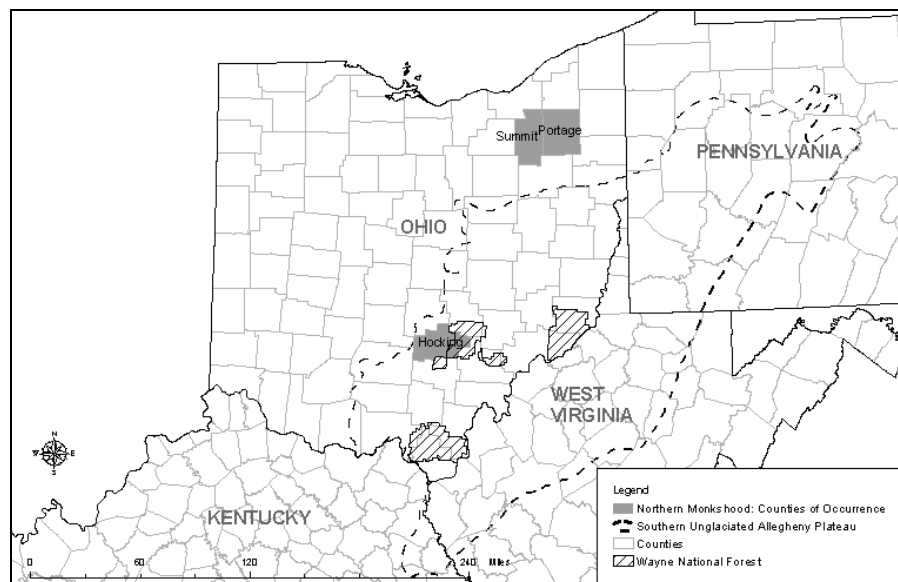
##### Species Range in Ohio

All Ohio populations of northern monkshood are located in the area where shale and conglomerate sandstone of Mississippian and Pennsylvanian age contact (USFWS, 1983c). There are currently three populations in Ohio, located in Portage, Summit, and Hocking Counties (Cochrane et al., 1995; USFWS, 2004). Of these counties of occurrence, only Hocking County contains NFS lands (Figure 12).



**Common Name:** Northern monkshood  
**Scientific Name:** *Aconitum noveboracense*  
**Family:** Ranunculaceae  
**Group:** Flowering Plants  
**Historic Range:** U.S.A. (IA, NY, OH, WI)  
**Population to Which Status Applies:** Entire Range  
**Current Status:** Threatened  
**Date First Listed:** April 26, 1978  
**Critical Habitat:** NA  
**Special Rules:** NA  
**Recovery Plan?** Yes  
**Lead Region:** Great Lakes-Big Rivers Region (3)  
**Current Range:** IA, NY, OH, WI

Source: USDI Fish and Wildlife Service



**Figure 12. County occurrences of the northern monkshood within the Southern Unglaciaded Allegheny Plateau.**

The Ohio Division of Natural Areas and Preserves conducted a two-year monitoring and survey project to obtain additional information on the status and possible introduction of the northern monkshood to new sites in Ohio. In this survey, only the Hocking County and Summit County populations were monitored. The Hocking County population, located in privately owned and managed Crane Hollow State Nature Preserve, was found to be reasonably stable in the 1990's (Cochrane et al., 1995), but the population is declining in numbers and has low reproduction. The Summit County population has sharply declined in size since the early 1980's, but numbers have begun to increase since 2000 (S. Selbo, pers. comm.).

Possible sites for introduction of the northern monkshood are being surveyed in Ohio. Of the sites surveyed, two were found to be potentially suitable for introduction of the plant: the Nelson-Kennedy Ledges State Park in Portage County and Thompson Village Park in Geauga County. Neither of these counties contains NFS lands. Cochrane et al. (1995) recommended that areas in northeast and southeast Ohio continue to be surveyed for possible introduction sites.

### Life History

The northern monkshood is a perennial herb of Ranunculaceae, the buttercup family. It has short tuberous roots, with basal and cauline leaves that are palmately cleft or dissected, with blue to whitish flowers borne in a terminal raceme or panicle. The flowers are about 1 inch in length, and a

single stem may have many flowers. Stems range from about 1 to 4 feet in length (USFWS, 1994a).

Northern monkshood is typically found on shaded to partially shaded cliffs, algific talus slopes, or on cool, streamside sites. These areas have a microclimate with cool soil conditions, cold air drainage, or cold groundwater flowage (USFWS, 1994a).

Survival from season to season occurs through the annual production of daughter tubers; however vegetative reproduction occurs by means of aerial and subterranean bulbils, as well as adventitious root buds (Kuchenreuther, 1996). Sexual reproduction also occurs through pollination by the bumblebee (USFWS, 1983c).

One plant can yield flowers from late June through September, and the large individual flowers last several days. It can produce large numbers of seeds, which possess a high degree of viability and germinate readily when exposed to an appropriate stratification regime (Kuchenreuther, 1996).

Northern monkshood, like other monkshoods, does not transplant well. Although there have been some successes, greenhouse survival rates of these high-maintenance, slow-growing plants are not encouraging (USFWS, 1983c). Germination trials have produced a success rate of less than one percent. In successive trials, when a better rate has occurred, the germinated seedlings all died off at the same rate, leaving only one remaining.

### Population Dynamics

NatureServe (2005) has given a global rank of G3 and a national rank of N3 to northern monkshood: (G3) Vulnerable - at moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors (N3) Vulnerable—Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

NatureServe (2005) reports the largest concentrations are in Iowa and Wisconsin, where the species is known from about 60 localities. Some of the populations in this region are quite large (one population in Iowa has about 10,000 individuals). There are seven-nine extant occurrences in New York and only three in Ohio.

### Status and Distribution

A major threat to a major population of northern monkshood in Wisconsin was the catalyst for data collection and subsequent listing of the species

(USFWS 1983c). Many northern monkshood populations are being monitored to determine long-term population trends. Genetic studies are being conducted so population differences can be better understood. A variety of government and private conservation agencies are all working to preserve the northern monkshood and its habitat. Voluntary protection agreements have also been made with some private landowners (USFWS 1994a).

The 775 acre Driftless Area National Wildlife Refuge was established in 1989 to permanently protect populations of the northern monkshood (USFWS, no date). Its habitat cannot be restored once lost and the primary objective of the recovery plan is providing protection for remaining colonies. Concern over threats to the habitat stemmed from logging, grazing, filling of sinkholes, agricultural runoff, roads and quarries.

### **Rangewide Threats to the Species**

The recovery plan lists a variety of threats to northern monkshood populations, each of which may affect only certain populations or parts of populations (USFWS, 1983c). The species presence along streams has made it vulnerable to reservoir projects. Reservoirs located downstream of monkshood populations tend to substantially limit their dispersal of seeds by flowing water. Historically, road construction and maintenance activities, such as summer herbicide use and winter deicing operations, have threatened monkshood plants and their habitat. Logging operations have caused declines in certain northern monkshood populations, not only due to the use of heavy machinery, but also from the removal of shade. Grazing, recreational foot trail development, scientific over collection, and natural catastrophes, such as droughts and flooding, have also been identified as threats to northern monkshood populations.

In Ohio, although the Hocking County population has been relatively stable, the Summit County population has seen a sharp decline due to such factors as high soil salt concentration from road maintenance activities, animal and insect damage, competing vegetation, and human trampling (Cochrane et al., 1995).

The invasion of garlic mustard (*Alliaria petiolata*) onto algific talus slopes has emerged as a threat in recent years. No one knows the potential effects of modern global warming (USFWS, no date-b).

## Environmental Baseline

### Status of Species in Action Area

#### Species Range in the Action Area

The northern monkshood has not been found in the action area. The closest occurrence of the species is in Hocking County at the Crane Creek Hollow Nature Preserve, but this is outside the action area.

#### Suitable Habitat within the Action Area

Habitat providing favorable growth conditions for the northern monkshood may occur in various locations on the WNF. Typically, the northern monkshood grows on cliff faces that possess a cold soil environment due to the flow of subterranean air or water escaping to the surface (USFWS, 1983c). The year-round temperature of the soils in which this species exists can be as cold as 43° F, but typically ranges from 52° to 64° F. Another characteristic of soils at northern monkshood sites is that available phosphorous levels are typically much lower than those of adjacent sites (Evans, 1984).

The northern monkshood can also occur in partially-shaded, high-elevation seepage springs and in streamside crevices. Thus, a common characteristic of the preferred habitat of the species is that there is either continuous cold air drainage or cold groundwater flow from neighboring bedrock. These habitats tend to have constant high relative humidity. There are many underground mine openings on the WNF with a constant flow of cold air or water escaping to the surface. However, the forest floor surrounding some of these underground mine portals are barren of vegetation due to leaching from overburden or gob, or acid mine drainage.

Although all known Ohio populations of the northern monkshood are located in the contact zone between the Mississippian and Pennsylvanian age bedrock, there does not seem to be any rock substrate that is preferred by the species across its entire range. The contact zone between the Mississippian and Pennsylvanian age bedrock occurs in the western half of Hocking County, the extreme northern portion of Perry County, the extreme western portion of Vinton County, the extreme western portion of Jackson County, and in eastern Scioto County (Ohio Division of Geological Survey, no date). This contact zone lies very near to, but outside of, the boundary of the WNF, particularly close to the western boundary of the Athens Unit and the northwestern portion of the Ironton Unit. The western boundary of the Marietta Unit of the WNF lies approximately 50 miles to the east of this contact zone.

Adult monkshoods survive, but do not reproduce every year, suggesting that the low temperature of the soil may be a factor in dormancy breaking and seed germination. Since the species has very narrow habitat

requirements, existing only on cliffs and talus slopes and in headwater streams/springs, the amount of area on which the monkshood could be found is limited (USFWS, 1983c). Some headwater streams occur throughout the WNF near rock outcrops. These areas may provide suitable habitat for the northern monkshood.

The northern monkshood has no strong affinity for other plant species. There are over 100 plant species associated with the plant across its range. Most of the vascular plant associates of this species are those common to eastern deciduous forest and to marsh or swamp wetlands. Some of the deciduous forest associates include: sugar maple (*Acer saccharum*), red elder (*Sambucus pubens*), yellow birch (*Betula alleghaniensis*), eastern hemlock (*Tsuga canadensis*), mountain maple (*Acer spicatum*), wood nettle (*Laportea canadensis*), and white snakeroot (*Eupatorium rugosum*). Ferns are usually associated with the moist environment of cliffs and talus slopes. Common fern associates include bulblet fern (*Cystopteris bulbifera*), fragile fern (*Cystopteris fragilis sensu lato*), northern beech fern (*Thelypteris phegopteris*), oak fern (*Gymnocarpium dryopteris*), lady fern (*Athyrium filix-femina*), and florist's fern (*Dryopteris Spinulosa sensu lato*) (USFWS, 1983c).

Field surveys for this species have been completed in parts of the WNF, in association with land management projects. To date, the surveys have not resulted in the discovery of the northern monkshood on NFS lands.

### Factors Affecting Species Environment within the Action Area

The northern monkshood has not been found within the action area to date, however potentially suitable habitat exists. For the most part, state and local governments conduct some form of field review prior to implementing projects, but private landowners generally do not. Some activities occurring on private lands could affect potentially suitable habitat or undiscovered populations of northern monkshood, such as woodland grazing, construction of homes, timber harvesting, and energy minerals development. These activities are ongoing within the action area.

Please refer to *Factors Affecting Species Environment* for the Indiana bat for a list of ongoing activities that affect forest habitat.

Beneficial activities are occurring and will likely continue to occur as the proposed action is implemented. These include plant surveys on NFS lands, state properties and lands administered by The Nature Conservancy; reforestation activities on NFS lands, state properties and on private lands; and watershed improvement activities on NFS lands, state properties and on private lands (through programs administered by the Corps of Engineers, Natural Resources Conservation Service).

## Direct and Indirect Effects of the Proposed Action on Northern Monkshood

### Activities with No Effect

Several management activities projected to occur in the first decade of implementation of Alternatives E<sub>mod</sub> would have no effect on northern monkshood or its habitat.

- The Forest Service would use prescribed fire and mowing on the WNF to **maintain permanent forest openings**. The northern monkshood prefers partially-shaded habitats on cliffs and near headwaters of streams; permanent forest openings are not maintained in these areas because of protective standards and guidelines, and therefore these activities should have no effect on the species.
- **Restoration of lakes and ponds** primarily involves projects to improve aquatic species habitat (e.g., placing underwater habitat structures) and would not impact terrestrial habitat.
- **Wetland restoration and enhancement** activities occur in bottomland areas that have been tilled or ditched in the past. Wetlands and open agricultural areas do not provide habitat for this species, and therefore these management activities will not impact the monkshood.

### Activities Not Likely to Adversely Affect - Beneficial Effects

Activities conducted on NFS lands that have the potential to protect and promote suitable habitat for the northern monkshood include those which would protect cliffs and talus slopes from shade modification and construction and those which would protect stream channels from alterations in water flow and erosion. There are no known populations of the northern monkshood on the WNF; however, there may be yet undiscovered populations that exist on NFS lands. Management activities occurring on NFS lands that would benefit potential habitat for the northern wild monkshood would also benefit populations of the species, should they occur.

- **Control of non-native invasive species (NNIS)** by mechanical and biological means would protect ecosystem integrity and prevent habitat degradation, thus protecting potential habitat for monkshood.
- **Surface mine reclamation and stabilization of disturbed areas** would involve erosion control and planting to return areas to forested conditions. These activities, over time could create potential habitat in areas that currently do not support monkshood.

- **Restoration and improvement stream habitat** include projects such as, bank stabilization and culvert repairs to decrease sedimentation and improve habitat quality for monkshood. Tree planting activities to provide shade along streams would create partially-shaded habitats favored by the monkshood.
- **Crop tree release and grape vine control** involve the manual treatment of individual vines and trees in young (15-25 years old), even-aged stands by ground crews. Over time these activities may create a diverse, semi-shaded forest that could provide potential habitat for monkshood.
- **Reforestation** tends to occur on open lands, such as agricultural fields or reclaimed strip mine areas. Reforestation of partially-forested areas does not typically occur on the WNF. Since the northern monkshood prefers partially shaded habitats, conversion of open habitats to forested conditions may provide new potential habitat for this species.
- **Land acquisition** can be beneficial when private lands containing known population of federally-listed, or potential habitat for a federally listed species, are transferred into public ownership. Protection and management of these areas would become a federal responsibility assuring long-term protection of the habitat or species.

### Activities Not Likely to Adversely Affect - Discountable Effects

Activities with the potential to affect potentially suitable habitat for the northern monkshood include any construction activities that result in erosion or compaction; vegetation management activities which result in the removal of shade (canopy); and activities which would alter the course of stream channels or create impoundments. These activities have discountable effects on potentially suitable habitat, which are effects that are extremely unlikely to occur.

- Alternative E<sub>mod</sub> incorporates Forest-wide standards and guidelines that protect potentially suitable habitat from impact include those that prohibit vegetation management activities within 50 feet of rock shelters and rock faces (TES-32 and TES-33) and the requirement of filterstrips, 50 to 100 feet wide, between riparian areas and construction activities (ARR-5).
- **Herbicides** would be used by the Forest Service to eliminate shade tolerant tree species to promote oak-hickory forests, to control NNIS, and to control nuisance plants (e.g. poison ivy around recreation sites). Use of herbicides for these activities will primarily involve selective, spot spraying to avoid affecting non-target vegetation. Alternative E<sub>mod</sub> incorporates Forest-wide

standards and guidelines that emphasize proper use of herbicides to protect non-target vegetation and riparian areas (FH-17, FH-18, FH-19, FH-20, and FH-21). Although selective vegetation management is preferred for utility or other rights-of-way or easements, broadcast use of herbicides may be permitted with written Forest Supervisor approval. Aerial spraying of herbicides is conducted on some utility corridors that have outstanding rights on the WNF. Following the standards and guidelines for herbicide usage would reduce the risk of herbicide drift onto suitable northern monkshood habitat, or harming an individual.

- **Site prep for native pine** should not occur in potentially suitable habitat because vegetation management is not allowed within 50 feet of rock outcrops (SFW-TES-32). Forest-wide direction protects ravine habitats from soil disturbance (GFW-ARR-2, GFW-ARR-3, GFW-ARR-5, and GFW-ARR-6).
- **Agricultural activities** occurring on special use agricultural permits may involve the use of pesticides and fertilizers. Use of pesticides and fertilizers in these areas could result in harmful stream runoff, depending on how close application is to water bodies. Since the northern wild monkshood prefers headwater streams - upslope locations, the risk of adverse effects on the species or suitable habitat occurring from agricultural nonpoint source pollution would be unlikely. As added protection, filterstrips would be used along all streams to minimize effects from nonpoint source pollution (ARR-5).
- **Livestock grazing** would be permitted on NFS lands except in the RC, TRL, SA, RNA, and CA MAs. Livestock grazing currently occurs on only six special use permit areas, approximately 300 acres, on the Marietta Unit and Ironton Ranger District. Grazing is restricted to suitable open land; no woodland or brushland would be converted to rangeland. Although grazing has been identified as a threat to the northern monkshood, very little grazing occurs on the Forest and the potential for this activity to occur on suitable northern monkshood habitat is unlikely.
- **Creation of permanent wildlife openings** historically involved the removal of trees from forested areas; however, Forest Service managers would rely primarily on the designation of existing open land on acquired properties to serve as permanent forest openings (e.g. old home sites, agricultural fields) (WLF-5). Similarly, development of agreements with utility companies would be pursued to manage utility corridors as quality permanent forest openings (WLF-4). While it could occur, it is unlikely a forested area would be converted to a permanent opening. Such instances would likely be associated with a vegetation management project

where a log landing may be designated to be maintained as an opening. Sites for log landings would be field reviewed and would not be placed in potentially suitable northern monkshood habitat.

- **Waterhole construction** is projected to only involve approximately 15 acres over the next decade. Waterholes are small in size and would likely be built in forested areas already disturbed by other project activities. Tree removal would not likely occur for waterhole construction. The impact of waterhole construction would be discountable since it would occur in areas already disturbed, and of which the other activities (e.g. timber harvest, oil and gas development) would have a larger impact on habitat.
- **Exchanging** NFS lands with other landowners may affect the northern monkshood if land containing the species or its habitat is transferred out of federal ownership. However, since assessments of all land exchanges occur before action is taken; the chance of exchanging a tract with populations of northern monkshood would be unlikely. The amount of land exchanged over a decade is only projected to be 400 acres of the WNF. Conversely, land exchanges could benefit the species by exchanging unsuitable lands for those with suitable habitat.

### Activities Not Likely to Adversely Affect - Insignificant Effects

The following activities are expected to have insignificant effects on potentially suitable habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs.

- Construction of both temporary and permanent **roads** has the potential to affect suitable habitat for the northern monkshood. Construction activities involving the use of heavy machinery may result in the direct removal of vegetation, soil compaction and erosion, and may increase the likelihood of colonization by non-native invasive species. Road construction and maintenance activities have been identified as a primary threat to the northern monkshood, as these activities tend to impact viable populations and suitable habitat for the species (USFWS, 1983a). During operation, temporary unsurfaced roads have the potential to cause soil erosion; however, after use, erosion control measures would be implemented, including construction of water diversions and seeding, and they would be allowed to revert back to vegetative cover. Similarly, standards and guidelines incorporated into Alternative E<sub>mod</sub> call for measures to reduce erosion in riparian areas when building roads or trails that cross streams and requires filterstrips for roads built along streams. Direct effects from road construction on potential northern monkshood habitat would not be expected, as road construction does not tend to occur on steep

slopes near headwaters. If all standards and guidelines are followed during road construction activities, erosion and sedimentation impacts on potential habitat for the northern monkshood would be minimized. Forest-wide standards and guidelines would provide for prevention and control of NNIS during construction activities, and would allow for treatment of NNIS in areas where there is a high potential for spread.

- **Road decommissioning** activities may have initial effects on suitable habitat similar to road construction, but over the long-term road closures may increase the acres of suitable monkshood habitat on NFS lands. Approximately 29 acres of temporary and permanent roads on the WNF are projected to be closed and vegetated over the next decade.
- **Construction of recreation facilities** (e.g. parking lots) may involve clearing and grading sites and the use of heavy machinery. A maximum of 50 acres is projected over the first decade for recreation facility construction. Recreation facility construction is also unlikely to occur near headwater streams or seeps, and would not occur within 50 feet of rock outcrops. The small amount of forest cleared for recreation facilities and the unlikelihood of them occurring in monkshood habitat make the potential for permanent loss of monkshood habitat low.
- **Construction of hiking, horse, biking and OHV trails** are projected to increase over the next decade. Construction of designated OHV trails would likely involve the use of heavy equipment, which may have similar impacts on potential northern monkshood habitat as described for road construction. Non-motorized recreational trail construction may involve either hand tools or heavy machinery.
- **Use of designated trails** could result in soil compaction and erosion, which may contribute to increased sedimentation and runoff to streams. As northern wild monkshood habitat tends to be located near headwater streams, trail use may affect potential stream bank habitat for this species. However, Alternative E<sub>mod</sub> incorporates measure to minimize potential impacts. Normal drainage control on designated trails would be provided by water bar installation and lead-off ditching, with the use of side ditching where necessary. In addition, OHV designated trails would be inspected at least twice a year, and necessary erosion control measures implemented. Construction and use of trails would also increase the probability for NNIS introduction and spread along the corridors. Forest-wide standards and guidelines provide for prevention and control of NNIS during construction of trails, and

allow for treatment of NNIS in areas where there is a high potential for spread (Forest-wide objective 7.2b).

- **Even-aged vegetation management** (clearcut, shelterwood, thinning and two-aged harvest methods) results in the removal of all or most trees in areas ranging from 2-30 acres in size, exposing the area to full sun conditions. Even-aged management may temporarily reduce suitable habitat for the northern monkshood if such habitat exists prior to clearing. These effects are short-term in nature because the treated stands would regenerate to closed canopy conditions over time. Removal of shade has been identified as a factor eliminating populations of the monkshoods (USFWS, 1983a). Alternative E<sub>mod</sub> incorporates Forest-wide standards and guidelines that require low growing flowering and fruiting trees under six inches in diameter to not be cut during even-aged harvest unless the amount left would inhibit natural regeneration of tree species (VEG-12). These remaining trees may provide some shade in these areas, and minimize impacts on potential northern monkshood habitat. Other Forest-wide standards and guidelines require the assessment of NNIS threats during project planning and the use of prevention and control measures during and after project implementation (FH-1).
- **Uneven-aged harvest** has the potential to temporarily impact northern monkshood habitat by increasing light penetration to the forest floor. However, these impacts are short-term in nature as remaining tree canopies and understory trees grow to fill in light gaps over time. An established Forest-wide standard (TES-8) directs the Forest Service to maintain at least 60% canopy cover in all hardwood stands treated with uneven-aged management methods.
- Both **uneven- and even-aged vegetation management** activities may temporarily impact monkshood habitat due to vegetation removal, soil disturbance and compaction, erosion and increased susceptibility of areas to NNIS invasion and establishment. All skid trails and log landings are temporary in nature; these areas are rehabilitated after use to control any erosion or NNIS concerns. Alternative E<sub>mod</sub> incorporates measures to address NNIS establishment and spread during construction activities.
- **Mineral exploration and development** is on-going throughout the WNF, and will continue as long as the demand for oil and gas remains high. Removal of vegetation and topsoil required for the construction of access roads, well pads, and pipeline corridors during oil and gas activities may temporarily affect suitable habitat for the northern monkshood, in the same way roads do. These activities could result in the exposure of soil to erosion by rain and

wind, which may contribute to increased sedimentation and runoff to streams. Since many known populations of the northern monkshood are located in headwater stream/spring locations, these activities may affect potential streambank habitat for this species. No Surface Occupancy (NSO) restrictions for federally leased minerals are in place on FOF, CA, SA, RNA, DR and TRL MAs. Surface occupancy for private mineral rights require mitigation measures including seasonal restrictions, road construction and maintenance requirements, controlled use in riparian areas, and wildlife coordination. Established Forest-wide standards and guidelines in Alternative E<sub>mod</sub> mitigates the effects of oil and gas exploration and development (i.e., filterstrips, stream crossings, stabilizing disturbed areas, NNIS prevention and analysis, NSO on steep slopes, controlled surface use on riparian areas). Effects from road and well pad construction are long-term since they remain in use until mineral resources are depleted. Once depleted, the operators are required to restore the disturbed areas (Forest-wide objective 10.2a and b, MIN-2, MIN-8).

- **Surface coal mines** would alter and remove surface soils and vegetation, and subsequently degrade existing habitat. Approximately 1,250 acres of NFS land could be affected by surface mining in the future. The Forest Service has no control over this projected activity since private mineral rights are involved, however the Forest Service would work closely with the operator to incorporate as many Forest-wide standards and guidelines into the operation plan. Furthermore, the operator would need to meet all state regulations.
- **Mineral exploration and development** activities may also result in accidental spills of crude oil or brine, which could affect surrounding vegetation, contaminate soils, and cause harmful runoff to streams. However, State of Ohio regulations require a Spill Prevention and Control Countermeasures Plan (SPCC) for mineral development activities. Dikes are required around all wells on the Forest to contain brine in the event of an accidental spill. In addition, the Ohio Environmental Protection Agency (EPA) is required to be contacted immediately upon discovery of an accidental spill. Remedial action for cleanup of water and soil resources will be conducted by the lessee as directed by the Ohio EPA.
- **Reclamation of depleted or orphan wells** requires clearing the immediate area of the well, and would have similar impacts as those described for construction of well pads; however, these areas are rehabilitated immediately after well reclamation, and over the long-term, closure would benefit the environment by preventing the potential for future leaks or spills from these wells.

- **Prescribed fire** is used on the WNF to reduce hazardous fuels, to promote oak-hickory regeneration, to improve herbaceous and grassy habitats, and to control NNIS. Creation of firelines using bulldozers could result in soil disturbance, soil compaction, removal of vegetation and increased susceptibility for invasion by NNIS, whereas firelines constructed by hand only affect the litter layer. Forest-wide standards and guidelines incorporated into Alternative E<sub>mod</sub> emphasize the use of existing roads and fire breaks to avoid constructing fireline (FIRE-7). Firelines would be rehabilitated after burns (e.g. water diversions, seed and mulch), to prevent long-term erosion impacts. Fire will reduce overstory cover resulting in a more open habitat that could increase light penetration and dry out the understory, potentially impacting monkshood habitat. However, moist habitats (e.g., cliffs, streambanks) preferred by monkshood are less likely to experience high burn intensities due to their high humidity environments, instead these areas are likely to experience low intensity, mosaic burns and therefore significant alterations to micro-environment in these areas are unlikely to occur.
- The increased density of forests, combined with fire suppression and natural disturbances, has led to an increase of woody material on the forest floor. **Treatment of hazardous fuels** would occur primarily in stands where fuels are greatest, often in pine stands. The work would involve the lopping and scattering of woody material on the ground. However, it is possible that a leaning or standing tree would be felled and bucked up or removed, either as part of the fuels reduction work or to protect workers from a potential hazard tree. Increased light penetration due to tree removal could impact monkshood habitat. Construction of roads, trails and landings during hazard fuel treatment projects could have similar impacts as those discussed for roads and trails.
- **Utility corridor construction and maintenance** is similar in impacts to habitat as road and trail construction, since vegetation would be removed and soil compaction from heavy machinery use would occur. Filterstrip requirements would protect riparian habitat.
- **Small lake and pond construction** would occur for wildlife habitat and to enhance recreation on the WNF. Constructing an impoundment on a stream and flooding the upgradient streambanks could affect potential habitat. However, most ponds constructed in the past were a result of reclamation efforts. Projections are to create 15 acres of small lakes or ponds over the next decade.
- **Installation of bat-friendly gates** at mine openings could impact monkshood habitat. Mine openings often provide suitable habitat

for monkshood due to cold air flows escaping from underground mines. Installation of gates involves removal of some soil around mine openings in order to sink gates below ground surface. Removal of soil in these areas could directly impact plants or disturb any habitat present. However, soil removed during installation would be returned afterwards to pre-installation levels to avoid changing airflows and micro-environments, thus retaining any seedbanks that may exist for the species.

- Areas targeted for **acid mine drainage treatment** often have a history of underground and surface mining that has restricted or altered natural water flows. Often these mine drainages result in barren soils unable to support vegetation due to highly acidic soils. Acid mine drainage treatments often involve closing mine portals which could result in the loss of potential habitat for monkshood if the portals have cold air or water flows. Pre-project surveys of mine portals slated for closure would occur to determine if monkshood individuals exist within the project areas. Treatment of acid mine drainage may involve soil movement and disturbance to restore surface drainage. The construction and heavy equipment involved could impact suitable habitat. However, these areas have undergone severe disturbance in the past, often limiting their ability to provide quality habitat for this species. Over the long-term, restoring drainage within these areas would restore riparian characteristics to these areas improving habitat and water quality and thus improving suitable habitat for monkshood. Approximately 270 acres are expected to undergo acid mine treatment in the first decade.

### Cumulative Effects of the Selected Alternative

Forest cover has increased across Ohio from about 15 percent in 1940 to almost 30 percent today (Ohio Division of Forestry, 2004). Almost 80 percent of the lands (public and private) within the action area are forested (Ohio Land Use Cover, based on Landsat TM 1994). Riparian corridors are primarily forested (i.e., 72.5 percent) (National Landcover Database, 1992).

These reforestation trends have benefited northern monkshood by increasing potential shaded habitat and improving water quality conditions within the WNF. Many mine portals that contain potentially suitable habitat for the species are surrounded by shade trees and habitable soils, in comparison to full sunlight, barren soils of the past.

Activities that occur on non-federal lands within the WNF proclamation boundary include private oil and gas development, surface mining of coal, clay, and limestone, construction of buildings and other structures, road construction and maintenance, and timber harvest. There is a chance that

any of these activities may impact suitable habitat for or existing populations of, the northern monkshood, should it occur. Management of non-federal lands are under the discretion of the landowner and conservation measures applied on NFS lands may not be used on these other ownerships.

Land exchanges and acquisition to consolidate federally managed land in these areas may result in the revegetation of acquired lands with mining and agricultural histories. Water quality of nearby streams would improve as runoff into these streams would be reduced. Since preferred habitats of the northern monkshood include shaded streambanks and rock outcrops, land consolidation may increase the amount of potentially suitable habitat for the northern monkshood and improve habitat quality.

Any potential cumulative adverse effects that may occur to northern monkshood habitat or unknown populations as a result of implementing the Selected Alternative would be mitigated through the implementation of the protective Forest-wide standards and guidelines.

### Determination of Effect and Rationale

A **No Effect** determination is made for the northern monkshood. This determination is based on the fact that there are currently no known populations of the northern monkshood within the action area. The closest known population is located in Hocking County, which contains NFS lands within the Athens Unit of the Forest.

A **Not Likely to Adversely Affect** determination is made for northern monkshood habitat (Table 25). This determination is based on:

- Alternative E<sub>mod</sub> incorporates beneficial management activities that would protect, restore and create suitable habitat for the northern monkshood;
- Forest-wide goals and objectives promote healthy watershed conditions;
- Forest-wide standards and guidelines to protect streams and rock shelters/faces, a preferred habitat for monkshood;
- Forest-wide standards and guidelines ensure proper pesticide use on the Forest;
- While ground disturbance would occur during management implementation, Forest-wide standards and guidelines would minimize soil erosion, stabilize disturbed areas, and minimize adverse effects from NNIS;
- Plant surveys would be conducted on lands affected by land exchange, surface-disturbing activities and vegetation removal.

**Table 25. Summary of effects determinations for the northern monkshood.**

<b>Projected Management Activity</b>	<b>Alternative E<sub>mod</sub></b>
<b>Vegetation Management</b>	
Even-aged Hardwood Timber Harvest	I
Even-aged Pine Timber Harvest	I
Uneven-aged Timber Harvest	I
Thinning	I
Crop Tree Release	B
Grape Vine Control	B
Site Prep for Native Pine	D
Reforestation	B
Prescribed Fire	I
Herbicide Application	D
Development of Permanent Forest Openings	D
Maintenance of Permanent Forest Openings	N
Control of Non-Native Invasive Species-Mechanical	B
Control of Non-Native Invasive Species-Biological	B
Wetland Restoration & Enhancement	N
Waterhole Construction	D
Fishing Pond/Lake Construction	I
Restoration & Improvement of Aquatic/Riparian Habitat (Lentic)	N
Restoration & Improvement of Aquatic/Riparian Habitat (Lotic)	B
Installation of Bat-Friendly Gates on Mines	I
<b>Recreation Management</b>	
OHV Trail Construction	I
Hiking Trail Construction	I
Horse Trail Construction	I
Mountain Bike Trail Construction	I
Recreation Facility & Parking Lot Construction	I
<b>Transportation Management</b>	
Temporary Road Construction	I
Permanent Road Construction	I
Permanent Road Reconstruction	I
Road Decommissioning	I
Disturbance related to Timber (Skid Trails, Landings)	I
<b>Energy Minerals Management</b>	
Surface Coal Mining Activities	I
Reclamation of Depleted or Orphan Wells	I
Oil & Gas Well Development	I
<b>Special Uses Management</b>	
Utility Corridor Development & Maintenance	I
Agricultural Crop Production & Grazing	D
<b>Watershed Management</b>	
Treatment of AMD	I
Surface Mine Reclamation	B
Closure of Open Mine Portal/Subsidence	I
Stabilization of Disturbed Areas	B
<b>Fire Management</b>	
Reduction of Hazardous Fuels - Mechanical	I
<b>Lands Acquisition Management</b>	
Land Acquisition	B
Land Exchange	D
<b>N</b> = No Effect; <b>B</b> = Not Likely to Adversely Affect, Beneficial Effects; <b>I</b> = Not Likely to Adversely Affect, Insignificant Effects; <b>D</b> = Not Likely to Adversely Affect, Discountable Effects; <b>A</b> = Likely to Adversely Affect	

## Small Whorled Pogonia

### Status of the Species

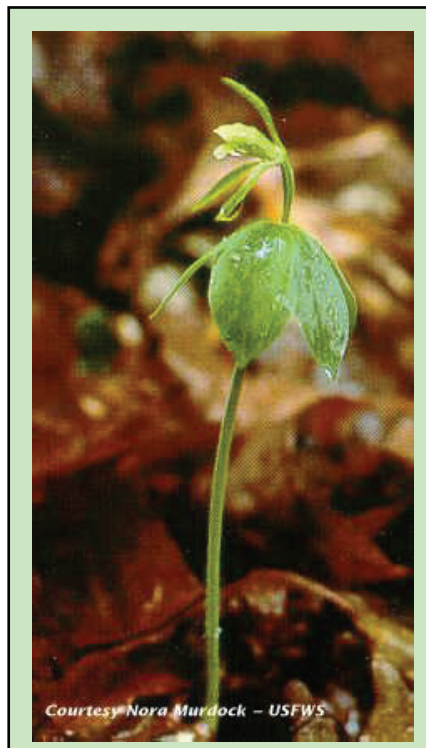
#### Species Description

##### Rangewide

The small whorled pogonia was listed as an endangered plant in 1982. A recovery plan for this species was initiated three years later to protect existing colonies and to create and discover new populations. In 1994, the small whorled pogonia was reclassified as threatened based on fulfillment of the downlisting criteria set forth in the recovery plan (USFWS, 1994b).

The range of the small whorled pogonia spans the Atlantic seaboard from Maine to Georgia, with occurrences in the Midwestern United States and Canada. Although the historic range of the plant included many more states, the small whorled pogonia now likely occurs in seventeen states and Canada (Ontario). These states include: Maine, New Hampshire, Massachusetts, Connecticut, Pennsylvania, Delaware, Virginia, West Virginia, Illinois, Georgia, Michigan, North Carolina, New Jersey, Ohio, Rhode Island, South Carolina, and Tennessee (USFWS, 1992a). Despite its wide range, the plant remains rare; in some states, only a single plant has been documented.

There are three main population centers of the small whorled pogonia. One is in Virginia, in the region between the mountains and the coastal plains, with outlying populations in New Jersey and Delaware. A second center occurs at the southernmost portion of the Appalachian



Courtesy: Nora Murdock – USFWS

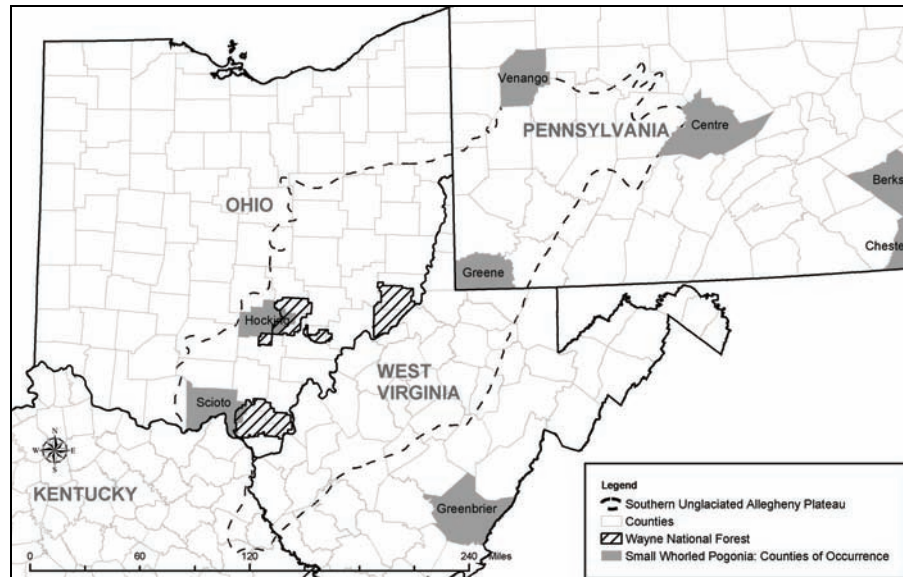
**Common Name:** Small whorled pogonia  
**Scientific Name:** *Isotria medeoloides*  
 Family: Orchidaceae -- Orchid family  
**Groups:** Plants, Flowering Plants  
**Current Status:** Threatened  
**Lead Region:** 5  
**Date First Listed:** September 10, 1982  
**Critical Habitat:** None  
**Special Rules:** None  
**Recovery Priority:** 14  
**Approved Recovery Plan?** Yes  
**Historic Range:** U.S.A. (CT, DC, DE, GA, IL, MA, MD, ME, MI, MO, NC, NH, NJ, NY, PA, RI, SC, TN, VA, VT, WV), Canada (Ont.)  
**This Status Likely To Occur In:** CT, DE, GA, IL, MA, ME, MI, NC, NH, NJ, OH, PA, RI, SC, TN, VA, WV, Canada (Ont.)

Source: USDI Fish and Wildlife Service

Mountains, the Blue Ridge Mountains, where Tennessee, Georgia, and North and South Carolina connect. The northernmost population center is located in the foothills of the Appalachian Mountains in New England and Massachusetts (USFWS, 1992a; USFWS, 1994b).

### Species Range in Ohio

Occurrences of the species in Ohio are displayed in Figure 13. In 1985, the small whorled pogonia was documented at one site in Shawnee State Forest in Scioto County, Ohio (Ohio Division of Natural Areas and Preserves, 1992). Scioto County contains the western portion of the Ironton Unit of the WNF. Follow-up visits to the Scioto County population failed to reveal any plants since it was first discovered in 1985, however this species does exhibit periods of long dormancy (from 10-20 years). The site must be visited annually for many years before it can be assumed that the population is no longer present (S. Selbo, personal communication). The small whorled pogonia was discovered in Hocking County near Camp Otý'Okwa in 1998 (S. Selbo, personal communication). Hocking County contains the western portion of the Athens Unit.



**Figure 13. County occurrences of the small whorled pogonia in the Southern Unglaciaded Allegheny Plateau.**

### Life History

The genus *Isotria* consists of only two species, the small whorled pogonia and the large whorled pogonia (*I. verticillata*). Both species are herbaceous perennials with hairy fibrous roots surrounding a rootstock. These plants develop by forming over-wintering buds for the next year's

shoot on the rootstock. *Isotria* plants have five or six elliptic leaves, grayish-green or milky green in color, surrounding the apex of a smooth, hollow stem. One flower, or a pair of flowers, yellowish-green in color, rises at the center of the false whorl of leaves, creating the appearance of a typical orchid. The sepals and petals of *Isotria* are narrower than those of typical orchids, and the two lateral petals protrude over the greenish-white lip. The flower's three sepals of nearly equal length led to the name of the genus (*Isos* = equal; *treis* = three) (USFWS, 1992a).

While both species are similar in appearance, there are key characteristics used to differentiate them, as summarized in the recovery plan (USFWS, 1992a). The small whorled pogonia is usually single stemmed, although a plant may produce two or more stems in a cluster. The stem ranges from 2-13 inches tall in a flowering plant and is similar in color and degree of glaucousness as a white seedless grape. The elliptic to elliptic-obovate leaves are also a pale milky-green or grayish-green. The flower is yellowish-green with a greenish-white lip. The sepals vary from linear-oblong to narrowly spatula-like in shape, and spread outward when in full flower. The lateral petals are oblong-elliptic and point forward above the lip. The sepals are approximately ½ to 1 inch long and either equal in length to the lateral petals or up to 1.5 times as long.

A population of the small whorled pogonia may contain plants in one of four different life cycle states: vegetative; flowering, but with an abortive flower bud; flowering; or dormant. It is believed to be self-pollinating, occasionally reproducing vegetatively; the flower contains neither nectar guides nor fragrance (USFWS, 1992a). Flowering occurs from mid-May through mid-June, although not always annually, with flowers lasting no longer than a week (USFWS, 1996a). The plant's past cycles are fairly indicative of its future cycles. For example, large plants are more likely to become flowering plants and bloom the following year, while a small plant is more likely to return as a vegetative plant the next year, or to go dormant or die (USFWS, 1992a).

Like other orchid seeds, those of the small whorled pogonia contain very little food reserves. It is impossible for these plants to germinate or establish seedlings unless they fall into a suitable substrate containing mycorrhizal fungus. The strands of the fungus penetrate the cells of the orchid, and the two form a symbiotic relationship. The orchid provides cellulose and carbohydrates to the fungus, as the seedling obtains water and nutrients through the strands. No specific fungus has ever been linked to the small whorled pogonia (USFWS, 1992a).

### Population Dynamics

NatureServe (2005) has given a global rank of G2 and a national rank of N2 to small-whorled pogonia: (G2) Imperiled – At high risk of extinction

due to a very restricted range, very few populations (often 20 or fewer), steep declines, or other factors; (N2) Imperiled – Imperiled in the nation due to a very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation.

According to NatureServe (2005), there are 104 extant sites known, with 66 in New England, 18 in the southern Appalachians, 13 in coastal plain of Virginia, Delaware and New Jersey, and the rest widely scattered. Populations are typically small, and the total number of individuals is probably less than 3000.

Monitoring of various colonies has shown the small whorled pogonia is susceptible to wide population fluctuations from year to year. Individual plants may not emerge in a given year and are considered either dead or dormant. Dormant plants usually return as vegetative plants, but may return in the flowering state (USFWS, 1992a).

### Status and Distribution

The small whorled pogonia was reclassified from endangered to threatened in 1994 based on the fulfillment of reclassification criteria as stated in the Recovery Plan and substantial improvement in the status of this orchid species. As outlined in the revised Recovery Plan, reclassification of *Isotria medeoloides* from endangered to threatened should proceed when a minimum of 25 percent of the known viable sites (as of 1992) are protected. As of 1994, 61 percent of the viable populations were permanently protected.

### Threats to the Species

Two main threats to the existence of the small whorled pogonia have been identified: habitat destruction and overcollection for scientific, commercial, or recreational purposes. Destruction of the plant's habitat has occurred primarily from residential and commercial development. In addition, construction of roads, power lines, and sewer mains to connect settled areas has occurred in areas surrounding small whorled pogonia habitat, leading to its destruction (USFWS, 1994b). Such construction can serve as a barrier to seed dispersal, which may inhibit recolonization of suitable habitat. Other threats to the small whorled pogonia include collection of the plant for recreational use, such as for home gardening and herbivory by white-tailed deer and invertebrates (USFWS, 1992a).

In some parts of its range, other threats may include vandalism or the formation of barriers (e.g., clearings, development) to seed dispersal.

## Environmental Baseline

### Status of the Species in the Action Area

#### Species Range in the Action Area

The small whorled pogonia has not been found within the action area. The closest counties having occurrences are Scioto and Hocking, but the populations are outside the action area.

A survey for the small whorled pogonia was conducted in June 1996 on the Ironton Ranger District, specifically in Scioto County, Ohio. A total of 260 acres were surveyed. The survey resulted in the discovery of several populations of the large whorled pogonia; however, no populations of small whorled pogonia were found (Boyle, 1996).

Approximately 1,500 acres of NFS lands were surveyed in 2003 for this species, in Lawrence, Scioto, and Gallia counties in preparation for two ice storm hazardous fuels treatment projects. The species was not located on these tracts; however one large whorled pogonia was found.

In 2004, approximately 3,500 acres were surveyed in Lawrence County in preparation for additional ice storm hazardous fuel treatments. While no small whorled pogonias were found, approximately 10 populations of the large whorled pogonia were.

No small-whorled pogonias were found during the 2005 field season. About 1,511 acres of NFS lands were surveyed on the Ironton Ranger and 473 acres of NFS lands were surveyed on the Athens Ranger District.

#### Suitable Habitat within the Action Area

The plant is found under a wide variety of forest conditions, therefore habitat providing favorable growth conditions for the small whorled pogonia may occur throughout the Action Area. The small whorled pogonia occurs in mixed deciduous or mixed deciduous/coniferous forests, which tend to be in second- to third-growth successional stages. The plant grows in both somewhat young forests as well as in maturing stands, which vary in composition (USFWS, 1992a). Several characteristics are common among most small whorled pogonia sites. Decaying wood litter or other decaying vegetative matter, including fallen tree trunks and limbs, leaf litter, stumps, and roots of dead trees, is almost always present at *I. medeoloides* sites (USFWS, 1994b). There is often sparse to moderate groundcover, except when in association with ferns, and a fairly open understory canopy. Proximity to logging roads, streams, or other physical features, which tend to create long semi-permanent breaks in the forest canopy, encourages the growth of this species (USFWS, 1992a). In addition, historical agricultural use of the small whorled pogonia habitat is not uncommon. Although these characteristics are common for most small

whorled pogonia sites, there are many exceptions and variations that can occur locally and regionally.

The array of suitable habitats of the small whorled pogonia includes dry, rocky, wooded slopes to moist slopes or slope bases braided by vernal streams (USFWS, 1994b). Slope exposure and degree, however, vary throughout the range of the species. Slopes on which the small whorled pogonia occurs typically vary from 0 to 30 percent. Most populations of the species are found at the base of a slope or at mid-slope positions (USFWS, 1992a).

Many species are associated with the small whorled pogonia, including a few taxa that are associated with the plant in both the northeastern part of its range and the southern portion of its range. However, associates of the small whorled pogonia vary widely between regions, none of which occurs commonly enough to be considered a true indicator species. In the Ohio region, the plants associated with small whorled pogonia include: witch hazel (*Hamamelis virginiana*), striped maple (*Acer pensylvanica*), serviceberry (*Amelanchier arborea*), partridgeberry (*Mitchella repens*), Indian cucumber root (*Medeola virginiana*), and New York fern (*Thelypteris noveboracensis*) (USFWS, 1992a). In addition, the small whorled pogonia often occurs near or intermixed in populations of the large whorled pogonia (USFWS, 1992a). The large whorled pogonia has been known to occur at the bases of sandstone cliffs, or on the upper slopes above sandstone cliffs. Such cliffs are found throughout the WNF, on all three Units.

Although soil moisture fluctuates seasonally, small whorled pogonia populations typically occur on soils ranging from dry-mesic to wet-mesic (Rawinski, 1986). The substrate in which the plant is rooted may be of a variety of different textures, ranging from extremely stony glacial till, to stone-free sandy loams, to sterile duff (USFWS, 1992a). The small whorled pogonia thrives in acidic soils, particularly those with an impermeable soil layer (fragipan), which restricts downward water movement, beneath the acidic soil layer. On these slopes, which are typically 8 to 15 percent slopes, water is forced to move laterally above the fragipan. It is hypothesized that this surface and near-surface water movement removes soluble nutrients, leaving a strongly acidic duff (Rawinski, 1986). Soil analyses have found a range in soil pH values from 4.0 to 5.0 where small whorled pogonia grows (USFWS, 1992a).

Acidic soil types are found throughout the WNF. The majority of the soils that occur on the WNF have a surface soil pH ranging from 3.6 to 5.5. In localized areas, the soil is acidic due to leaching of metals into the soil from past mine operations. Acid mine drainage affects riparian areas near such old mines, lowering the pH values of the waters to less than 5.5, and also affects the soils on lands adjacent to these riparian areas, up to about 15 feet up the streambanks. Past mine operations, and subsequent acid

mine drainage, are prevalent throughout the Athens Unit, particularly in the central and western portions of the Unit. The Ironton Unit also contains old mines, particularly in Pine Creek watershed. Past mine operations are not found in the Marietta Unit and subsequent acid mine drainage does not occur there.

### Factors Affecting Species Environment within the Action Area

The small whorled pogonia has not been found within the action area to date, however potentially suitable habitat exists. For the most part, state and local governments conduct some form of field review prior to implementing projects, but private landowners generally do not. Some activities occurring on private lands could affect potentially suitable habitat or undiscovered populations of small whorled pogonia, such as woodland grazing, construction of homes, timber harvesting, and energy minerals development. These activities are ongoing within the action area.

Please refer to *Factors Affecting Species Environment* for the Indiana bat for a description of ongoing activities in the action area that affect forest conditions.

Beneficial activities are occurring and will likely continue to occur as the proposed action is implemented. These include plant surveys on NFS lands, state properties and lands administered by The Nature Conservancy; reforestation activities on NFS lands, state properties and on private lands; and watershed improvement activities on NFS lands, state properties and on private lands (through programs administered by the Corps of Engineers, Natural Resources Conservation Service).

## Direct and Indirect Effects of the Selected Alternative on Small Whorled Pogonia

### Activities with No Effect

Several management activities projected to occur in the first decade of implementation of Alternative E<sub>mod</sub> would have no effect on small whorled pogonia or its habitat.

- The Forest Service uses prescribed fire and mowing to **maintain permanent openings**. Since the small whorled pogonia prefers partially-shaded habitats, the species would not likely be found in permanent openings.
- **Livestock grazing** is permitted to allow continued current use by livestock, contribute to wildlife habitat objectives and to help control NNIS. Livestock grazing occurs on only six special use permit areas, approximately 300 acres, on the Marietta Unit and Ironton Ranger District. Grazing is restricted to suitable open land;

no woodland or brushland would be converted to rangeland. Agricultural activities occurring on special use agricultural permits may involve the use of pesticides and fertilizers. Since the small whorled pogonia prefers forested habitat, grazing activities would not affect this species.

- **Restoration of lakes and ponds** primarily involves projects to improve aquatic species habitat (e.g., placing underwater habitat structures) and would not impact terrestrial habitat.
- **Wetland restoration and enhancement** activities often occur in bottomland areas that have been tilled or ditched to promote agricultural use. Wetlands and open agricultural areas do not provide habitat for these species, and therefore management activities will not impact the pogonia.

### Activities Not Likely to Adversely Affect - Beneficial Effects

There are no known populations of the small whorled pogonia within the WNF; however, there may be yet undiscovered populations that exist on NFS lands. Management activities occurring on NFS lands that would benefit potential suitable habitat for the small whorled pogonia would also benefit populations of the species, should they occur.

This species is known to favor mesic hillsides. There are many Forest-wide standards and guidelines that are designed to protect the water quality of water resources on the Forest, to minimize erosion, and to stabilize disturbed areas. Water and soil resource management standards and guidelines for the Forest are focused on reducing soil erosion and discharge into watercourses and establishing filterstrips for riparian areas to prohibit sediments from entering stream habitats. Protecting riparian habitat could protect any pogonia populations or potential habitat occurring at the base of slopes or near streambanks.

- **Control of non-native invasive species (NNIS)** by mechanical and biological means would protect ecosystem integrity and prevent habitat degradation, thus protecting potential habitat for small whorled pogonia
- **Surface Mine Reclamation and stabilization of disturbed areas** would involve erosion control and planting to return areas to forested condition. These activities, over time could create potential habitat in areas that currently do not support the pogonia.
- Timber stand improvement activities such as, **crop tree release** and **grape vine control** involve the manual treatment of individual vines and trees in even-aged, young stands by ground crews. Overtime these activities may create a diverse, semi-shaded forest that could provide potential habitat for small whorled pogonia.

Currently, the dense growth and shading within these stands do not provide suitable habitat for the species.

- **Reforestation** tends to occur on open lands, such as agricultural fields or reclaimed strip mine areas. Reforestation of partially-forested areas does not typically occur on the WNF. Since small whorled pogonia prefers partially shaded habitats, conversion of open habitats to forested conditions may provide new potential habitat for this species.
- **Restoration and improvement of stream habitat** include projects such as, bank stabilization and culvert repairs to decrease sedimentation and improve habitat quality for small whorled pogonia. Tree planting activities to provide shade along streams would create partially-shaded habitats favored by the pogonia.
- **Land acquisition** can be beneficial when private lands containing known populations of federally listed species, or potential habitat for a federally listed species, are transferred into public ownership. Protection and management of these areas would become a federal responsibility, assuring long-term protection of the habitat or species.

#### Activities Not Likely to Adversely Affect - Discountable Effects

There are no known populations of the small whorled pogonia on the WNF. However, there may be undiscovered populations, or potential habitat, that could be impacted by activities that occur on the WNF. These activities have discountable effects on potentially suitable habitat, which are effects that are extremely unlikely to occur.

- **Herbicides** would be used by WNF to eliminate shade tolerant tree species to promote oak/hickory forests, to control non-native invasive species, and to control nuisance plants (e.g. poison ivy) around recreation sites. Use of herbicides for these activities will primarily involve selective, spot spraying to avoid affecting non-target vegetation. Each alternative incorporates Forest-wide standards and guidelines that emphasize proper use of herbicides to protect non-target vegetation (FH-17, FH-18, FH-19, FH-20, and FH-21). Although selective vegetation management is preferred for utility or other rights-of-way or easements, broadcast use of herbicides may be permitted with written Forest Supervisor approval. Aerial spraying of herbicides is conducted on utility corridors that have outstanding rights on the Forest. Following standards and guidelines for herbicide usage would reduce the potential for herbicides to drift onto suitable pogonia habitat, or an individual.

- **Creation of permanent wildlife openings** historically involved the removal of trees from forested areas, however, Forest Service managers rely primarily on the designation of existing open land on acquired properties to serve as permanent forest openings (e.g. old home sites, agricultural fields) (WLF-5). Similarly, development of agreements with utility companies would be pursued to manage utility corridors as quality permanent forest openings (WLF-4). While it could occur, it is unlikely a forested area would be converted to a permanent forested opening.
- **Waterhole construction** is projected to only involve approximately 15 acres over the next decade. Waterholes are small in size and would likely be built in forested areas already disturbed by other project activities. Tree removal would not likely occur for waterhole construction. The impact of waterhole construction will be discountable since it will occur in areas already disturbed, and of which the other activities (e.g. timber harvest, oil and gas development) will have a larger impact on habitat.
- **Exchanging** NFS lands with other owners may affect the small whorled pogonia if land containing the species, or its habitat, is transferred out of federal ownership. However, since assessments of all land exchanges by biologists occur before action is taken; the chance of exchanging a tract with populations of small whorled pogonia would be unlikely. The amount of land exchanged over a decade is only projected to be 400 acres. Conversely, land exchanges could benefit the species by exchanging unsuitable lands for those with suitable habitat.
- **Installation of bat-friendly gates** involves the removal of soils around mine openings in order to sink gates below ground surface. Removal of soil in these areas could directly impact any plants or habitat present. Soils removed during installation are returned afterwards to pre-installation conditions to avoid changing airflows and micro-environments, thus retaining any seedbanks that may be exist for the species. Many of the areas impacted by installation are devoid of vegetation due to any combination of dense shade, acid mine drainage, or soil compaction by human use. The small amount of soil disturbance coupled with the small probability of potential habitat occurring in these areas makes this impact unlikely.

### Activities Not Likely to Adversely Affect - Insignificant Effects

The following activities are expected to have insignificant effects on potentially suitable habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs.

- While **roads** could provide semi-permanent breaks in the forest canopy, which tend to encourage the growth of small whorled pogonia, the heavy construction associated with these developments may impact pogonia habitat. (USFWS, 1992a). Construction activities involving the use of heavy machinery may result in the direct removal of vegetation, soil compaction and erosion, and may increase the likelihood of colonization by non-native invasive species. Road construction and maintenance activities have been identified as a primary threat to the small whorled pogonia, as these activities tend to impact viable populations (seed dispersal barriers) and suitable habitat for the species (USFWS, 1994b). During operation, temporary unsurfaced roads have the potential to cause soil erosion; however, after use, they are water barred, seeded, and allowed to revert back to vegetative cover to prevent erosion after closing. Similarly, standards and guidelines call for measures to reduce erosion on riparian systems when building roads or trails that cross streams and requires filterstrips for roads built parallel to riparian systems. Forest-wide standards and guidelines would provide for prevention and control of non-native invasives during construction activities, and would allow for treatment of non-natives in areas where there is a high potential for spread.
- When regenerating native pine, the forest floor must be opened to full sunlight and soil must be exposed so that native pine seeds can germinate and survive. In most cases, soil disturbances from logging or removal of leaf litter during prescribed fire will be enough to allow seeds to contact soil. However, in certain sites it may be necessary to scarify the soil (**site prep**) to facilitate the appropriate environment for seed germination. The objective is to create small, scattered patches of exposed soil, but ground cover would remain on 75 percent or more of the treatment area. Since potentially suitable habitat may be available in pine stands, such actions could directly disturb undiscovered populations. This activity could also encourage the establishment of NNIS, which could indirectly affect undiscovered populations or could degrade habitat quality.
- **Road decommissioning** activities may have initial effects on suitable habitat similar to road construction, but over the long-term road closures may increase the acres of suitable for small whorled pogonia on the WNF.

- **Construction of recreation facilities** (e.g. parking lots) may involve clearing and grading sites and the use of heavy machinery. Such developments could result in the permanent loss of suitable habitat for the small whorled pogonia. A maximum of 50 acres is projected over the first decade for recreation facility construction. The small amount of forest cleared for recreation facilities combined with the likelihood of suitable pogonia habitat occurring would make the potential for permanent loss of habitat low.
- **Construction of hiking, horse, biking and OHV trails** is projected to occur over the next decade. Construction of designated OHV trails would likely involve the use of heavy equipment, which may have similar impacts on potential small whorled pogonia habitat as described for road construction. Non-motorized recreational trail construction may involve either hand tools or heavy machinery.
- **Use of designated trails** could result in soil compaction and erosion, which may contribute to increased sedimentation in streams. As small whorled pogonia habitat can be located near streams, trail use may affect potential stream bank habitat for this species. However, each alternative incorporates measures to minimize potential impacts. Normal drainage control on designated trails would be provided by water bar installation and lead-off ditching, with the use of side ditching where necessary. In addition, OHV designated trails will be inspected twice a year, and necessary erosion control measures implemented. Construction and use of trails will also increase the probability for non-native invasive species introduction and spread along the corridors. Forest-wide standards and guidelines provide for prevention and control of non-native invasives during construction of trails, and allow for treatment of non-natives in areas where there is a high potential for spread (Forest-wide objective 7.2b).
- **Even-aged vegetation management** (clearcut, shelterwood, thinning and two-aged harvest methods) results in the removal of all or most trees in areas ranging from 2-30 acres in size, exposing the area to full sun conditions. Changes in light intensities reaching the forest floor could cause the herbaceous layer to flourish and result in more competition and shading, and temporarily reducing the quality of suitable habitat for the small whorled pogonia (USFWS, 1992a). These effects are short-term in nature because the treated stands would regenerate to closed canopy conditions over time. Alternative E<sub>mod</sub> incorporates Forest-wide standards and guidelines that require low growing flowering and fruiting trees under six inches in diameter not be cut during even-aged harvest unless the amount left would inhibit natural regeneration of tree species (VEG-12). These remaining trees may provide some shade

in these areas, and minimize impacts on pogonia habitat. Other Forest-wide standards and guidelines also require the assessment of non-native species threats during project planning and the use of prevention and control measures during and after project implementation (FH-1).

- **Uneven-aged harvest** has the potential to temporarily benefit small whorled pogonia habitat by increasing light penetration to the forest floor. Since the species often likes to grow near breaks in the canopy (USFWS, 1992a), canopy removal could be beneficial until trees grow fill in light gaps.
- Both **uneven- and even-aged vegetation management** activities may temporarily impact small whorled pogonia habitat due to vegetation removal, soil disturbance and compaction, erosion and increased susceptibility of areas to NNIS invasion and establishment. All skid trails and log landings are temporary in stature; these areas are rehabilitated after use to control any erosion or NNIS concerns. Alternative E<sub>mod</sub> incorporates measures to address non-native invasive species establishment and spread during construction activities. Roads, skid trails and log landings associated with timber removal could provide breaks in the overstory canopy and benefit the pogonia initially until canopies recover.
- **Mineral exploration and development** is on-going throughout the WNF, and will continue as long as the demand for oil and gas remains high. Removal of vegetation and topsoil required for the construction of access roads, well pads, and pipeline corridors during oil and gas activities may temporarily affect suitable habitat the same as road and trail construction. No Surface Occupancy restrictions for USA-owned minerals are in place on the FOF, CA, SA, RNA, DR and TRL management areas. Surface occupancy for private mineral rights require mitigation measures including seasonal restrictions, road construction and maintenance requirements, setbacks from streams, marshes and ponds, noise abatement, wildlife coordination, and visual resource coordination. Established Forest-wide standards and guidelines in each of the alternative mitigate the effects of oil and gas exploration and development (i.e., filterstrips, stream crossings, stabilizing disturbed areas, NNIS prevention and analysis, NSO on steep slopes, controlled surface use on riparian areas). Effects from road and well pad construction are long-term since they remain in use until mineral resources are depleted. Once depleted, the operators are required to restore the disturbed areas (Forest-wide objective 10.2a and b, MIN-2, MIN-8).

- **Surface coal mines** would alter and remove surface soils and vegetation, and subsequently degrade existing habitat. Approximately 1,250 acres of NFS land could be affected by surface mining in the future. The Forest Service has no control over this projected activity since private mineral rights are involved, however the Forest Service would work closely with the operator to incorporate as many Forest-wide standards and guidelines into the operation plan. Furthermore, the operator would need to meet all state regulations.
- **Mineral exploration and development** activities may also result in accidental spills of crude oil or brine, which could affect surrounding vegetation, contaminate soils, and cause harmful runoff to streams. However, State of Ohio regulations require a Spill Prevention and Control Countermeasures Plan (SPCC) for mineral development activities. Dikes are required around all wells on the Forest to contain brine in the event of an accidental spill. In addition, the Ohio Environmental Protection Agency (EPA) is required to be contacted immediately upon discovery of an accidental spill. Remedial action for cleanup of water and soil resources will be conducted by the lessee as directed by the Ohio EPA.
- **Reclamation of depleted or orphan wells** requires clearing the immediate area of the well, and would have similar impacts as those for construction for well pads; however, these areas are rehabilitated immediately after well reclamation, and over the long-term closures would benefit the environment by preventing the potential for future leaks or spills from these wells.
- **Prescribed fire** is used on the WNF to control hazardous fuel build-up, to promote oak-hickory regeneration and to control non-native invasive species. Creation of firelines using bulldozers for prescribed fire activities could result in soil disturbance, soil compaction, removal of vegetation and increased susceptibility for invasion by NNIS, whereas firelines constructed by hand only affect the litter layer. Forest-wide standards and guidelines incorporated into Alternative E<sub>mod</sub> emphasize the use of existing roads and fire breaks to avoid constructing fireline (FIRE-7). Firelines would be rehabilitated after burns (e.g. water diversions, seed and mulch), to prevent long-term erosion impacts. Fire will reduce understory cover resulting in a more open habitat that could benefit habitat for the small whorled pogonia in the short-term, and if areas are burned repeatedly, the benefit could be long-term. Mosaic pattern burning is encouraged (GFW-WLF-2).
- The increased density of forests, combined with fire suppression and natural disturbances, has led to an increase of woody material

on the forest floor. **Treatment of hazardous fuels** would occur primarily in stands where fuels are greatest, often in pine stands. The work would involve the lopping and scattering of woody material on the ground. However, it is possible that a leaning or standing tree would be felled and bucked up or removed, either as part of the fuels reduction work or to protect workers from a potential hazard tree. Increased light penetration due to tree removal could benefit pogonia, as could the increase in wood litter that would decay overtime. Construction of roads, trails and landings during hazard fuel treatment projects would have similar impacts as those discussed in roads and trails.

- **Utility corridor construction and maintenance** is similar in impacts to habitat as road and trail construction, since vegetation will be removed and soil compaction from heavy machinery use may occur. Filterstrip requirements would protect riparian habitat. Over the long-term, these semi-permanent breaks in the canopy could create small whorled pogonia habitat along corridor edges.
- **Small lake and pond construction** would occur for wildlife habitat and to enhance recreation on the WNF. Constructing an impoundment on a stream and flooding the upgradient streambanks could affect potential habitat. However, most ponds constructed in the past were a result of reclamation efforts on the Forest. Projections are to create 15 acres of small lakes or ponds over the next decade.
- Areas targeted for **acid mine drainage treatment** often have a history of underground and surface mining that has restricted or altered natural water flows. Often these mine drainages result in barren soils unable to support vegetation due to highly acidic soils. Treatment of acid mine drainage may involve large amounts of soil movement and disturbance to restore surface drainage. The construction and heavy equipment involved could impact suitable pogonia habitat. However, these areas have undergone severe disturbance in the past often limiting their ability to provide quality habitat for this species. Over the long-term, restoring drainage within these areas will restore riparian characteristics to these areas, improve water quality, create canopy breaks over drainages, and improve habitat quality for small whorled pogonia. Approximately 270 acres are expected to undergo acid mine treatment in the first decade.

### Cumulative Effects of the Selected Alternative

Forest cover has increased across Ohio from about 15 percent in 1940 to almost 30 percent today (Ohio Division of Forestry, 2004). Almost 80 percent of the lands (public and private) within the action area are forested

(Ohio Land Use Cover, based on Landsat TM 1994). Riparian corridors are primarily forested (i.e., 72.5 percent) (National Landcover Database, 1992).

These reforestation trends have benefited small whorled pogonia by increasing potential shaded habitat and improving water quality conditions within the WNF. Accumulation of forested lands, with litter and decaying matter, has replaced full sunlight, barren soils of the past.

Activities that occur on non-federal lands within the WNF proclamation boundary include private oil and gas development, surface mining of coal, clay, and limestone, construction of buildings and other structures, road construction and maintenance, and timber harvest. There is a chance that any of these activities may impact suitable habitat for, or existing populations of, the small whorled pogonia, should it occur. Management of non-federal lands are under the discretion of the landowner and conservation measures applied on NFS lands may not be used on these other ownerships.

Land exchanges and acquisitions to consolidate federally managed land in these areas may result in the revegetation of acquired lands with mining and agricultural histories. Water quality of nearby streams would improve as runoff into these streams would be reduced. Since shaded forests are the preferred habitat of small whorled pogonia, land consolidation may increase the amount of potential habitat for the pogonia and improve the quality of that habitat.

Any potential adverse cumulative effects that may occur as a result of implementing Alternative E<sub>mod</sub> would be mitigated through the implementation of the protective Forest-wide standards and guidelines.

## Determination of Effect and Rationale

A **No Effect** determination is proposed for the small whorled pogonia. This determination is based on the fact that there are currently no known populations of the pogonia within the WNF. The closest known populations are located in Hocking County, which contains lands within the Athens Unit of the Forest, and Scioto County, which contains lands within the Ironton Unit.

A **Not Likely to Adversely Affect** determination is made for pogonia habitat (Table 26). This determination is based on:

- While small whorled pogonia is not known to occur within the action area, suitable habitat does exist;
- Alternative E<sub>mod</sub> incorporates beneficial management activities that would protect, restore and create suitable habitat for the small whorled pogonia;

- Forest-wide goals, and objectives promote healthy watershed conditions;
- Forest-wide standards and guidelines ensure proper pesticide use on the Forest;
- While ground disturbance will occur during management implementation, Forest-wide standards and guidelines minimize erosion, stabilize disturbed areas, and minimize adverse effects from non-native invasive species;
- Plant surveys will be conducted on lands affected by land exchange, surface-disturbing activities and vegetation removal.

**Table 26. Summary of effects determinations for small whorled pogonia.**

<b>Projected Management Activity</b>	<b>Alternative E<sub>mod</sub></b>
<b>Vegetation Management</b>	
Even-aged Hardwood Timber Harvest	I
Even-aged Pine Timber Harvest	I
Uneven-aged Timber Harvest	I
Thinning	I
Crop Tree Release	B
Grape Vine Control	B
Site Prep for Native Pine	I
Reforestation	B
Prescribed Fire	I
Herbicide Application	D
Development of Permanent Forest Openings	D
Maintenance of Permanent Forest Openings	N
Control of Non-Native Invasive Species-Mechanical	B
Control of Non-Native Invasive Species-Biological	B
Wetland Restoration & Enhancement	N
Waterhole Construction	D
Fishing Pond/Lake Construction	I
Restoration & Improvement of Aquatic/Riparian Habitat (Lentic)	N
Restoration & Improvement of Aquatic/Riparian Habitat (Lotic)	B
Installation of Bat-Friendly Gates on Mines	D
<b>Recreation Management</b>	
OHV Trail Construction	I
Hiking Trail Construction	I
Horse Trail Construction	I
Mountain Bike Trail Construction	I
Recreation Facility & Parking Lot Construction	I
<b>Transportation Management</b>	
Temporary Road Construction	I
Permanent Road Construction	I
Permanent Road Reconstruction	I
Road Decommissioning	I
Disturbance related to Timber (Skid Trails, Landings)	I
<b>Energy Minerals Management</b>	
Surface Coal Mining Activities	I
Reclamation of Depleted or Orphan Wells	I
Oil & Gas Well Development	I
<b>Special Uses Management</b>	
Utility Corridor Development & Maintenance	I
Agricultural Crop Production & Grazing	N
<b>Watershed Management</b>	
Treatment of AMD	I
Surface Mine Reclamation	B
Closure of Open Mine Portal/Subsidence	I
Stabilization of Disturbed Areas	B
<b>Fire Management</b>	
Reduction of Hazardous Fuels - Mechanical	I
<b>Lands Acquisition Management</b>	
Land Acquisition	B
Land Exchange	D
<b>N</b> = No Effect; <b>B</b> = Not Likely to Adversely Affect, Beneficial Effects; <b>I</b> = Not Likely to Adversely Affect, Insignificant Effects; <b>D</b> = Not Likely to Adversely Affect, Discountable Effects; <b>A</b> = Likely to Adversely Affect	

## Virginia Spiraea

### Status of the Species

#### Species Description

##### Rangewide

Virginia spiraea was listed as a federally threatened species by the U. S. Fish and Wildlife Service on June 15, 1990. The range of the Virginia spiraea spans from Pennsylvania and Ohio south to Georgia and Tennessee (Walton, 1995). Historically, Virginia spiraea has been found in Georgia, Kentucky, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia within the Blue Ridge or Appalachian Plateau provinces in the Ohio River Basin (USFWS, 1992b; 1990b). In 1992, the species had 31 populations along streams in seven states, including West Virginia, Virginia, Tennessee, North Carolina, Ohio, Kentucky, and Georgia (USFWS, 1992b).



Courtesy: West Virginia Nongame Wildlife and Natural Heritage Program

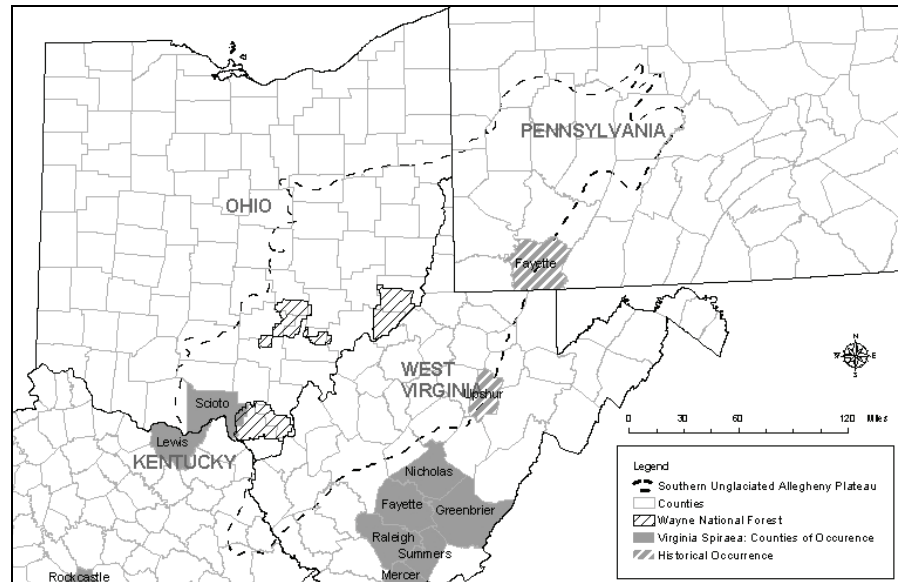
##### Species Range in Ohio

Occurrences of the Virginia spiraea in Ohio are displayed in Figure 14. In 1991, the southeastern portion of Ohio, including portions of all three units of the WNF, was surveyed for the Virginia spiraea (Stine, 1993). Four populations of Virginia spiraea were found along Scioto Brush Creek in Scioto County, Ohio. Three of these populations were found between the communities of Otway and Arion. The fourth population was discovered in close proximity to an island between the community of McDermott and the mouth of the Scioto Brush Creek

**Common Name:** Virginia spiraea  
**Scientific Name:** *Spiraea virginiana*  
**Family:** Rosaceae -- Rose family  
**Groups:** Plants, Flowering Plants  
**Current Status:** Threatened  
**Lead Region:** 5  
**Date First Listed:** June 15, 1990  
**Critical Habitat:** None  
**Special Rules:** None  
**Recovery Priority:** 8  
**Approved Recovery Plan?** Yes  
**Federal Register Citation Numbers:** First Listing--389, Current Status--389  
**Historic Range:** GA, KY, NC, OH, PA, TN, VA, WV  
**This Status Likely To Occur In:** GA, KY, NC, OH, PA, TN, VA, WV

Source: USDI Fish and Wildlife Service

(Stine, 1993). Although Scioto County, Ohio, contains NFS land, no new populations were found within the action area.



**Figure 14. County occurrences of Virginia spiraea in the Southern Unglaciated Allegheny Plateau.**

### Life History

The Virginia spiraea, a member of the rose family (Rosaceae), is a perennial flowering shrub with a modular growth pattern. This growth pattern may exhibit many genetically identical, but phenotypically different, “forms,” which are determined by age and environmental conditions. These various phenotypic forms have contributed to identification problems with this species (Ogle, 1991).

Virginia spiraea produces showy, tightly packed, white to cream-colored flowers, and ranges in size from two to ten feet tall (USFWS, 1990b). Flowering typically occurs in June and July. Virginia spiraea stems are sparsely branched and either upright (up to 4 feet) or arching (Walton, 1995). Larger stems appear grayish in color, while younger stems are greenish-yellow to reddish-brown. Leaves of Virginia spiraea are simple and alternate, varying widely in shape, size, and degree of serration.

According to the recovery plan (USFWS, 1992b), Virginia spiraea reproduces primarily asexually, through fragmentation of rhizomes or clones, which are generally separated during high water events and washed downstream. Young vigorous plants often send out long lateral rhizomes, but slightly older plants sprout prolifically to form a dense clump. The species flowers are visited by a host of insects, most

commonly beetles. Flowers may abort without producing follicles, particularly if the water supply is inadequate.

Additionally, Virginia spiraea may have impaired and limited reproductive capacity. Few seeds collected from research sites have germinated. Research indicates that spiraea seeds germinate best in water or mineral soils (USFWS, 1990b). Existing plant populations may be represented by only one genotype within a single drainage, thereby making it difficult for the plant to sexually reproduce and widely establish (55 Fed. Reg. 24,242 (June 15, 1990)). Genetic studies are currently underway to understand the genome of the species. Cross pollination between cultivated clones from different localities have resulted in viable seeds, whereas seeds obtained from plants pollinated by plants at the same locality tend to be abortive, and have low germination rates (Walton, 1995).

The seeds of this species are small and are produced at only a few known localities in the wild. Seed dispersal can occur by wind and water (USFWS, 1992b). Experts believe that the paucity of seed production may be due to having only one genome present at any given locality; when clones from different localities are grown together, they fruit prolifically and produce seed.

### Population Dynamics

NatureServe (2005) has given a global rank of G2 and a national rank of N2 to Virginia spiraea: (G2) Imperiled – At high risk of extinction due to a very restricted range, very few populations (often 20 or fewer), steep declines, or other factors; (N2) Imperiled – Imperiled in the nation due to a very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation.

### Status and Distribution

Virginia spiraea was listed as threatened because of its small population size, the paucity of sexual reproduction and dispersal, and manipulation of riverine habitat (USFWS, 1992b). Little population expansion has been reported, and most of the extant populations consist of just a few clumps; fewer than 30 different genotypes are thought to exist (NatureServe, 2005).

### Threats to the Species

Virginia spiraea is threatened by alteration of riverine habitats, small population size, and a low level of sexual reproduction and dispersal (USFWS, 1992b). However, human activities, especially reservoir construction, are the principal cause of the destruction of Virginia spiraea habitat. Both flood control and inundation caused by dams,

impoundments, and other water stabilization and improvement projects eliminate plant populations (USFWS, 1990b). Rising water destroys clones and washes propagules downstream. Watershed clearing and water diversions have destroyed Virginia spiraea habitat, as have road construction and maintenance activities. Natural factors, such as insect damage caused primarily by aphids and caterpillars, have also impacted the species. However, damage caused by insects is only evident at a few locations (USFWS, 1992b). Several species of non-native plants such as the Japanese knotweed (*Polygonum cuspidatum*), Chinese privet (*Ligustrum sinense*), and multiflora rose (*Rosa multiflora*) also aggressively compete with the native Virginia spiraea.

One of the threats to West Virginia populations of Virginia Spiraea that we see at almost all sites is damage to individual plants and to their habitat by recreational users of the rivers upon which they occur. Populations along the Gauley, Meadow, Bluestone, Greenbrier, and Buckhannon Rivers are being impacted by the clearing of riverside sites for fishing, camping, and rafting. Overuse by hikers, fishermen, and boaters have resulted in breakage of the fragile stems of these plants (WVDNR, 1998).

## Environmental Baseline

### Status of the Species in the Action Area

#### Species Range in the Action Area

Field surveys for this species have been completed in parts of the action Area, in association with NFS land management projects. In addition, stream survey crews were taught how to recognize this species so they could look for it during fish and mussel surveys along the Little Muskingum River, Symmes Creek, and Pine Creek. To date, surveys have not resulted in the discovery of Virginia spiraea on NFS lands. The closest county having occurrences is Scioto, but populations are outside the action area.

#### Suitable Habitat within the Action Area

Habitat providing favorable growth conditions for the Virginia spiraea may occur in some locations within the WNF. The plants are usually found in riverine and riparian habitats, along the banks of high gradient streams or along lower stream reaches, sandbars, natural levees, or flatrock habitat with crevices (USFWS, 1992b). Virginia spiraea prefers disturbed or geologically active areas where erosion, deposition, and scouring inhibit competition of other woody plant species (USFWS, 1992b). Disturbance, usually by flooding and scouring, are essential to the survival of the plant. The species root system allows it to inhabit areas of appropriate disturbance (USFWS, 1992b). The riverine areas in which the Virginia spiraea tends to occur are not, however, sites of maximum

erosion. Such areas are typically sites where deposition occurs after high water flows, such as overwash islands and floodplains (Ogle, 1991).

The habitat of the species is often disturbed early successional areas. Its many associates are usually determined by their availability to recolonize after a disturbance (USFWS, 1992b). Competition with aggressive colonizing species appears to be one of the most important variables related to the persistence of the species in these disturbed habitats. This is a species that was once more widespread and probably occurred more frequently during and near glaciation when tree competition was much reduced, and erosion was more severe and widespread (Ogle, 1991). Regular flooding and scour are important in reducing competition for the species. The scour must be severe enough to collapse the larger trees and wash out the smaller vegetation, without being so severe as to wash out the shrub's fibrous roots or its lateral rhizome (USFWS, 1992b).

In Ohio, Virginia spiraea generally occurs along the banks of streams associated with sandstone bedrock that is subjected to scouring during flooding, and on gravel bars that have riparian debris. In Ohio, it is associated with a variety of species, a sample of which includes: sugar maple, southern blue monkshood (*Aconitum uncinatum*), royal fern (*Osmunda regalis*), trumpet creeper (*Campsis radicans*), fowl mannagrass (*Glyceria striata*), Canadian clearweed (*Pilea pumila*), lizard's tail (*Saururus cernuus*), and American basswood (*Tilia Americana*) (Walton, 1995).

In places, the mainstem of Symmes Creek exhibits several characteristics common to the preferred habitat of the Virginia spiraea. Regular flooding and scouring occurs along the creek, particularly on the outside of bends. Areas of forested land and open agricultural land surround the banks of Symmes Creek, providing an alternate pattern of shaded and full sun conditions.

### Factors Affecting Species Environment within the Action Area

The Virginia spiraea has not been found within the action area to date, however potentially suitable habitat exists. For the most part, state and local governments conduct some form of field review prior to implementing projects, but private landowners generally do not. Some activities occurring on private lands could affect potentially suitable habitat or undiscovered populations of Virginia spiraea, such as woodland grazing, construction of homes, timber harvesting, stream channel modifications, and energy minerals development. These activities are ongoing within the action area.

Ongoing State, local, or private actions occurring in close proximity to streams that could affect this species may include earth disturbing activities that result in sedimentation of aquatic habitat (e.g., road

construction, streambank modifications, dredging). Activities that occur within the Ohio River or streams are generally regulated by the Corps of Engineers and State environmental agencies, therefore effects from these activities are often reduced or eliminated.

Please refer to *Factors Affecting Species Environment* for the Indiana bat for a description of ongoing activities in the action area that affect forest conditions.

Beneficial activities are occurring and will likely continue to occur as the proposed action is implemented. These include plant surveys on NFS lands, state properties and lands administered by The Nature Conservancy; reforestation activities on NFS lands, state properties and on private lands; and watershed improvement activities on NFS lands, state properties and on private lands (through programs administered by the Corps of Engineers, Natural Resources Conservation Service).

## Direct and Indirect Effects of the Selected Alternative on Virginia Spiraea

### Activities with No Effects

Several management activities projected to occur in the first decade of implementation of Alternative E<sub>mod</sub> would have no effect Virginia spiraea or its habitat.

- The Forest Service uses prescribed fire and mowing on the WNF to **maintain wildlife openings**. While a wildlife opening could occur near a riparian habitat that supports spiraea or its habitat, the opening would have a buffer strip between it and any streams. Therefore, maintenance of these areas would not impact this species or its habitat.
- **Creation of permanent wildlife openings** historically involved the removal of trees from forested areas, however, today Forest Service managers would rely primarily on the designation of existing open land on acquired properties to serve as permanent forest openings (e.g. old home sites, agricultural fields) (WLF-5). Similarly, development of agreements with utility companies is pursued to manage utility corridors as quality permanent forest openings (WLF-4). Creation or designation of permanent wildlife openings would not occur in high gradient stream habitat.
- **Small lake and pond construction** would occur for wildlife habitat and to enhance recreation on the WNF. Constructing an impoundment would only occur on intermittent or headwater streams, not on large streams where this species would occur.

- **Restoration of lakes and ponds** primarily involves projects to improve aquatic species habitat (e.g., placing underwater habitat structures) and would not impact streamside habitat.
- **Waterhole construction** will occur in forested areas already disturbed by other project activities. Since these activities are small in scope, and do not occur within riparian habitat, they will have no impact on Virginia spiraea habitat.

### Activities Not Likely to Adversely Affect: Beneficial Effects

Activities conducted on the WNF that have the potential to protect and promote suitable habitat for the Virginia spiraea include those which would protect or improve riparian habitats to maintain natural waterflows and reduce sedimentation. There are no known populations of the Virginia spiraea on the WNF; however, there may be yet undiscovered populations that exist on NFS lands. Management activities occurring on NFS lands that would benefit potential habitat for the Virginia spiraea would also benefit populations of the species, should they occur.

- **Control of non-native invasive species (NNIS)** by mechanical and biological means would protect ecosystem integrity and prevent habitat degradation, thus protecting potential habitat for Virginia spiraea from aggressive competitors.
- **Surface mine reclamation and stabilization of disturbed areas** would involve erosion control and planting to return areas to forested conditions. These activities, over time could improve water quality and natural stream flow and improve habitat for the spiraea.
- **Crop tree release and grape vine control** involve the manual treatment of individual vines and trees in young (15-25 years old), even-aged stands by ground crews. The low soil impact from these operations would not affect water quality. Removal of competitive trees and shading within riparian areas could improve habitat for the species.
- Areas targeted for **acid mine drainage treatment** often have a history of strip mining that has restricted or altered natural water flows. Virginia spiraea requires high gradient streams for habitat and would not likely occur in areas targeted for AMD treatment. Over the long-term, restoring drainage within these areas will restore riparian characteristics to these areas, and improve water quality, which could have secondary beneficial impacts on downstream potential spiraea habitat. Approximately 270 acres are expected to undergo acid mine treatment in the first decade.
- **Restoration and improvement of stream habitat** includes projects such as bank stabilization and culvert repairs to decrease

sedimentation and improve habitat quality for Virginia spiraea along streambanks. Tree planting activities to provide bank stabilization along streams could decrease sedimentation, improving stream quality and spiraea habitat.

- **Reforestation** tends to occur on open lands, such as agricultural fields or reclaimed strip mine areas. Reforestation of partially-forested areas does not typically occur on the Forest. Reforestation could improve water quality by decreasing erosion and sedimentation in streams. Reforestation would not occur within suitable habitat for the species, and therefore would not present a competition concern. Increasing watershed health would benefit this species.
- **Wetland restoration and enhancement activities** often occur in bottomland areas that have been tilled or ditched to promote agricultural use. Wetlands restoration and enhancement activities occur outside of stream channels and are constructed to restore wetlands where they originally occurred. The restoration of wetlands in areas where they were historically drained, would increase watershed health and benefit stream habitat and the Virginia spiraea.
- **Land acquisition** can be beneficial when private lands containing known population of federally-listed or potential habitat for a federally listed species are transferred into public ownership. Protection and management of these areas would become a federal responsibility assuring long-term protection of the habitat or species.

### Activities Not Likely to Adversely Affect: Discountable Effects

There are no known populations of Virginia spiraea on the WNF. However, there may be undiscovered populations, or potential habitat, that could be impacted by activities that occur on the Forest. These activities have discountable effects on potentially suitable habitat, which are effects that are extremely unlikely to occur.

- **Herbicides** would be used to eliminate shade tolerant tree species to promote oak/hickory forests, to control non-native invasive species, and to control nuisance plants (e.g. poison ivy) around recreation sites. Use of herbicides for these activities will primarily involve selective, spot spraying to avoid affecting non-target vegetation. Alternative E<sub>mod</sub> incorporates Forest-wide standards and guidelines emphasize proper use of herbicides to protect non-target vegetation (FH-17, FH-18, FH-19, FH-20, and FH-21). Although selective vegetation management is preferred for utility or other rights-of-way or easements, broadcast use of herbicides

may be permitted with written Forest Supervisor approval. Aerial spraying of herbicides is conducted on utility corridors that have outstanding rights on the Forest. Following standards and guidelines for herbicide usage would reduce the potential for herbicides to drift onto suitable spiraea habitat.

- Forest-wide direction protects streamside and instream habitat from upland activities (GFW-ARR-2, GFW-ARR-3, GFW-ARR-5, and GFW-ARR-6), therefore the potential for **site prep for native pine** activities to directly or indirectly affect this species or its habitat is unlikely.
- **Exchanging NFS lands** with other owners may affect the Virginia spiraea if land is transferred out of federal ownership that contains potential habitat for the species. However, since assessments of all land exchanges by biologists occur before action is taken, the chance of exchanging a tract with spiraea is unlikely. The amount of land exchanged over a decade is only projected to be 400 acres. Conversely, land exchange could benefit the species by exchanging unsuitable lands for those with suitable habitat.

### Activities Not Likely to Adversely Affect: Insignificant Effects

The following activities are expected to have insignificant effects on potentially suitable habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs.

- **Road and trail construction, and use**, may result in soil disturbance, erosion and sedimentation. Construction and use also increases the susceptibility for NNIS invasion which could degrade habitat for or directly compete with Virginia spiraea. Alternative E<sub>mod</sub> incorporates standards and guidelines to reduce erosion on riparian systems when building roads or trails that cross streams, and include filterstrips for roads built parallel to riparian systems. These Forest-wide standards and guidelines also provide for prevention and control of non-native invasives during construction activities, and allow for treatment of non-natives in areas where there is a high potential for spread (Forest-wide Objective 7.2b).
- **Timber harvesting** (even and uneven aged methods) involves the felling of trees, removal of trees to a landing and transport off-site. These activities will result in soil disturbance and may have erosion and sedimentation into streams and an increased susceptibility of NNIS invasion. However, filterstrips minimize the potential for sediment introduction into streams. While timbering activities could take place in riparian areas, it would not occur within the stream channel or on stream islands that contain suitable spiraea habitat. Standards and guidelines also require the assessment of non-native species threats during project planning

and the use of prevention and control measures during and after project implementation (FH-1).

- **Mineral exploration and development** is on-going throughout the Forest, and will likely continue as long as the demand for oil and gas remains high. Removal of vegetation and topsoil required for the construction of access roads, well pads, and pipeline corridors during oil and gas activities would have similar impacts as road and trail construction. These activities could contribute to increased sedimentation and runoff to streams. No Surface Occupancy restrictions for USA-owned minerals are in place in the FOF, CA, SA, RNA, DR and TRL management areas. Surface occupancy for private mineral rights may require site-specific seasonal construction restrictions, road construction and maintenance requirements, setbacks from streams, marshes and ponds, noise abatement, wildlife coordination, and visual resource coordination. Established Forest-wide standards and guidelines mitigate the effects of oil and gas exploration and development (i.e. filterstrips, stream crossings, stabilizing disturbed areas, NNIS prevention and analysis, NSO on steep slopes, controlled surface use on riparian areas). Effects from road and well pad construction are long-term since they remain in use until mineral resources are depleted. Once depleted, the operators are required to restore the disturbed areas (Forest-wide objective 10.2a and b, MIN-2, MIN-8).
- **Surface coal mines** would alter and remove surface soils and vegetation, and subsequently degrade existing habitat. Approximately 1,250 acres of NFS land could be affected by surface mining in the future. The Forest Service has no control over this projected activity since private mineral rights are involved, however the Forest Service would work closely with the operator to incorporate as many Forest-wide standards and guidelines into the operation plan. Furthermore, the operator would need to meet all state regulations.
- **Mineral exploration and development** activities may also result in accidental spills of crude oil or brine, which could affect surrounding vegetation, contaminate soils, and cause harmful runoff to streams. However, State of Ohio regulations require a Spill Prevention and Control Countermeasures Plan (SPCC) for mineral development activities. Dikes are required around all wells on the Forest to contain brine in the event of an accidental spill. In addition, the Ohio Environmental Protection Agency (EPA) is required to be contacted immediately upon discovery of an accidental spill. Remedial action for cleanup of water and soil resources will be conducted by the lessee as directed by the Ohio EPA.

- **Reclamation of depleted or orphan wells** requires clearing the immediate area of the well, and would have similar impacts as those for construction for well pads, however, these areas are rehabilitated immediately after well reclamation and over the long-term, and closure would benefit the environment by preventing the potential for future leaks or spills from these wells.
- **Prescribed fire** is used on the WNF to control hazardous fuel build-up, to promote oak-hickory regeneration and to control non-native invasive species. Creation of firelines using bulldozers for prescribed fire activities could result in soil disturbance, soil compaction, removal of vegetation and increased susceptibility for invasion by NNIS; however old existing roads are typically used. Firelines constructed by hand only affect the litter layer. Forest-wide standards and guidelines incorporated into Alternative E<sub>mod</sub> emphasize the use of existing roads and firebreaks to avoid constructing fireline (FIRE-7).
- The increased density of forests, combined with fire suppression and natural disturbances, have led to an increase of woody material on the forest floor. **Treatment of hazardous fuels** would occur primarily in stands where fuels are greatest, often in pine stands. The work involves the lopping and scattering of woody material on the ground. Soil disturbance during cutting and dragging of fuels could cause erosion and increased sedimentation into streams. Construction of roads, trails and landings during hazard fuel treatment projects would have similar impacts as those discussed in roads and trails. Forest-wide standards and goals incorporated into Alternative E<sub>mod</sub> would protect riparian and soil resources during soil disturbing activities.
- **Utility corridor construction and maintenance** is similar in impacts to habitat as road and trail construction, since vegetation will be removed and soil compaction from heavy machinery use may occur. Filterstrip requirements in Alternative E<sub>mod</sub> would protect riparian habitat
- **Agricultural activities** occurring on special use agricultural permits may involve the use of pesticides and fertilizers. Use of pesticides and fertilizers on these special use areas could result in harmful stream runoff, depending on how close application is to water bodies. Alternative E<sub>mod</sub> requires filterstrips be used along all streams to minimize effects from nonpoint source pollution (ARR-5).
- **Livestock grazing** would be permitted on NFS lands except RC, TRL, SA, RNA and CA. Livestock grazing currently occurs on only 6 special use permit areas, approximately 300 acres, on the Marietta and Ironton Units of the Forest. Grazing is restricted to

suitable open land on the Forest; no woodland or brushland will be converted to rangeland. Impacts from grazing could include soil compaction and sedimentation of streams. Alternative E<sub>mod</sub> incorporates Forest-wide standards and guidelines that require filterstrips be used along all streams to minimize effects from sedimentation (ARR-5). Another guideline requires the use of fencing and placement of salt to protect aquatic resources from livestock impacts (RANGE-4). Very little grazing occurs on the WNF and the potential for this activity to occur on suitable Virginia spiraea habitat is unlikely.

### Cumulative Effects of the Selected Alternative

Virginia spiraea populations are threatened by alteration and degradation of stream habitat. In Ohio, it only occurs in Brush Creek in Scioto County, Ohio. Efforts by the Forest Service, other state and federal agencies, conservation organizations, and private landowners continue to result in improved water quality conditions within the planning area. Effects from past mining and other land use activities are being addressed through active restoration projects on public and private lands.

Reforestation trends on WNF have benefited Virginia spiraea by improving water quality conditions along NFS streams and rivers. Reductions in sedimentation have allowed more natural water flows and flooding events that benefit the species.

Activities that occur on non-federal lands within the WNF proclamation boundary include private oil and gas development, surface mining of coal, clay, and limestone, construction of buildings and other structures, road construction and maintenance, and timber harvest. There is a chance that any of these activities may impact suitable habitat for or existing populations of the Virginia spiraea, should it occur. Management of non-federal lands are under the discretion of the landowner and conservation measures applied on NFS lands may not be used on these other ownerships.

Any potential adverse cumulative effects that may occur as a result of implementing the Selected Alternative would be mitigated through the implementation of the protective Forest-wide standards and guidelines.

### Determination of Effect and Rationale

A **No Effect** determination is made for Virginia spiraea. This determination is based on the fact that there are currently no known populations of the spiraea in the action area. The closest known population to the Forest is located in Scioto County.

A **Not Likely to Adversely Affect** determination is made for Virginia spiraea (Table 27). This determination is based on:

- While Virginia spiraea is not known to occur within the action area, suitable habitat may exist;
- The Selected Alternative incorporates beneficial management activities that would protect, restore and create suitable habitat for the spiraea;
- Forest-wide goals, and objectives promote healthy watershed conditions;
- Forest-wide standards and guidelines ensure proper pesticide use on the Forest;
- While ground disturbance will occur during management implementation, Forest-wide standards and guidelines are incorporated into all alternative to minimize erosion, stabilize disturbed areas, and minimize adverse effects from non-native invasive species;
- Plant surveys will be conducted on lands affected by land exchange, surface-disturbing activities and vegetation removal.

**Table 27. Summary of effects determinations for potential habitat for Virginia Spiraea.**

<b>Projected Management Activity</b>	<b>Alternative E<sub>mod</sub></b>
<b>Vegetation Management</b>	
Even-aged Hardwood Timber Harvest	I
Even-aged Pine Timber Harvest	I
Uneven-aged Timber Harvest	I
Thinning	I
Crop Tree Release	B
Grape Vine Control	B
Site Prep for Native Pine	D
Reforestation	B
Prescribed Fire	I
Herbicide Application	D
Development of Permanent Forest Openings	N
Maintenance of Permanent Forest Openings	N
Control of Non-Native Invasive Species-Mechanical	B
Control of Non-Native Invasive Species-Biological	B
Wetland Restoration & Enhancement	B
Waterhole Construction	N
Fishing Pond/Lake Construction	N
Restoration & Improvement of Aquatic/Riparian Habitat (Lentic)	N
Restoration & Improvement of Aquatic/Riparian Habitat (Lotic)	B
Installation of Bat-Friendly Gates on Mines	N
<b>Recreation Management</b>	
OHV Trail Construction	I
Hiking Trail Construction	I
Horse Trail Construction	I
Mountain Bike Trail Construction	I
Recreation Facility & Parking Lot Construction	I
<b>Transportation Management</b>	
Temporary Road Construction	I
Permanent Road Construction	I
Permanent Road Reconstruction	I
Road Decommissioning	I
Disturbance related to Timber (Skid Trails, Landings)	I
<b>Energy Minerals Management</b>	
Surface Coal Mining Activities	I
Reclamation of Depleted or Orphan Wells	I
Oil & Gas Well Development	I
<b>Special Uses Management</b>	
Utility Corridor Development & Maintenance	I
Agricultural Crop Production & Grazing	I
<b>Watershed Management</b>	
Treatment of AMD	B
Surface Mine Reclamation	B
Closure of Open Mine Portal/Subsidence	B
Stabilization of Disturbed Areas	I
<b>Fire Management</b>	
Reduction of Hazardous Fuels - Mechanical	I
<b>Lands Acquisition Management</b>	
Land Acquisition	B
Land Exchange	D
<b>N</b> = No Effect; <b>B</b> = Not Likely to Adversely Affect, Beneficial Effects; <b>I</b> = Not Likely to Adversely Affect, Insignificant Effects; <b>D</b> = Not Likely to Adversely Affect, Discountable Effects; <b>A</b> = Likely to Adversely Affect	

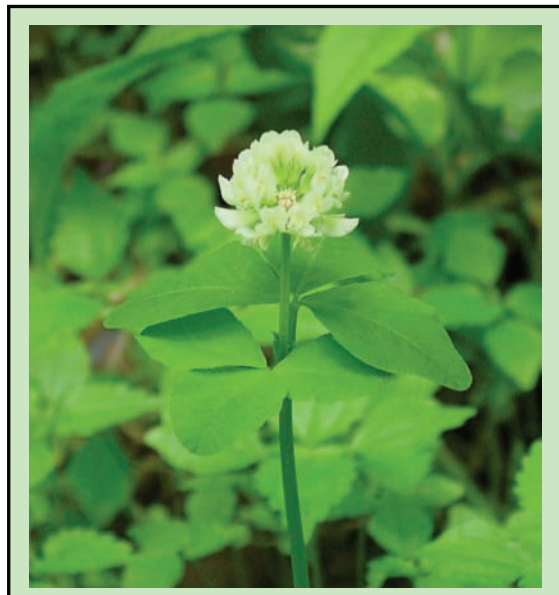
## Running Buffalo Clover

### Status of the Species

#### Species Description

##### Rangewide

When running buffalo clover was first proposed for listing as a federally endangered species, it was known to be extant at only two sites in West Virginia (51 fed. Reg. 8,217 (March 10, 1986)). Consequently, this species was listed as federally endangered on June 5, 1987 (52 Fed. Reg. 21,478 (June 5, 1987)).



The historic range of the running buffalo clover included Arkansas, Illinois, Indiana, Kentucky, Missouri, Nebraska, Ohio, and West Virginia (USFWS, 1989). Until the mid-1800's this clover ranged from eastern Kansas to West Virginia and was apparently abundant in certain locations, such as the Bluegrass Region of Kentucky (West Virginia Natural Heritage Program, 1990).

Until the rediscovery of two small populations of the running buffalo clover in 1985 in West Virginia, the plant was believed to be extinct (USFWS, 1992c). It is currently known from 120 sites in the Appalachian region (West Virginia, southeastern Ohio, and western Kentucky), Bluegrass region (southwestern Ohio, central Kentucky, and Indiana) and in the Ozarks (Missouri) (USFWS, 2005b). A population was discovered in Hamilton County, Ohio in 2004, and populations in Brown and Lawrence counties in 2005 (S. Selbo, personal communication).

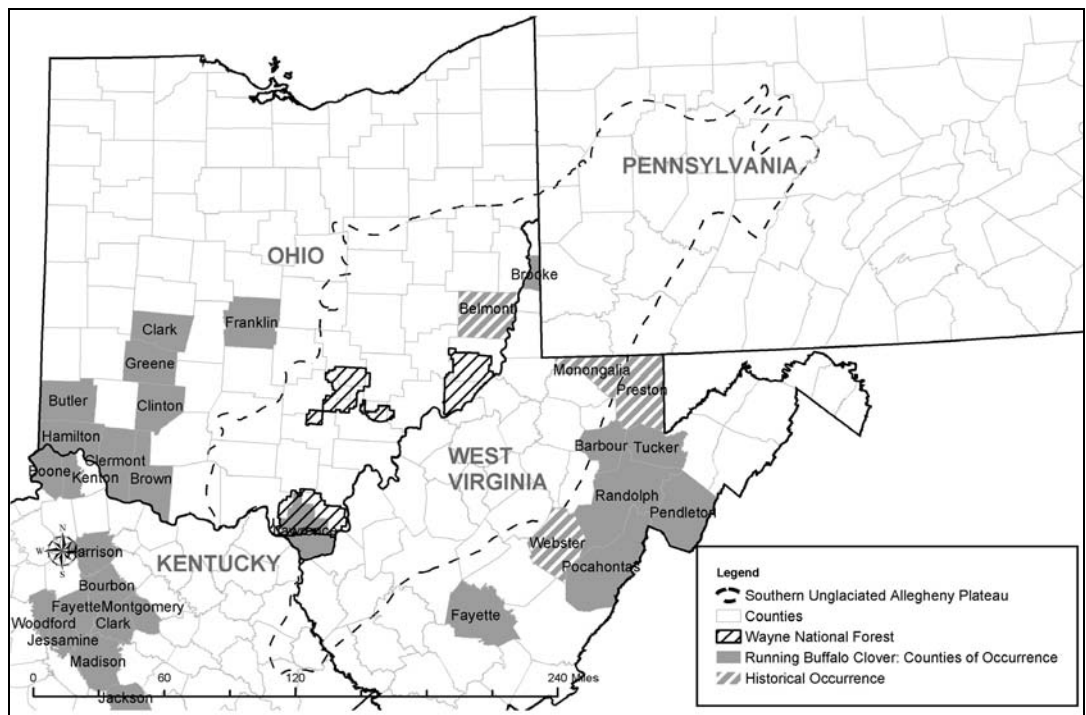
**Common Name:** Running buffalo clover  
**Scientific Name:** *Trifolium stoloniferum*  
**Family:** Fabaceae -- Pea family  
**Groups:** Plants, Flowering Plants  
**Current Status:** Endangered  
**Lead Region:** 3  
**Date First Listed:** June 5, 1987  
**Critical Habitat:** None  
**Special Rules:** None  
**Recovery Priority:** 2  
**Approved Recovery Plan?** Yes  
**Historic Range:** AR, IL, IN, KS, KY, MO, OH, WV  
**This Status Likely To Occur In:** AR, IN, KY, MO, OH, WV

Source: USDI Fish and Wildlife Service

In the five states with populations, the populations vary in size from a few individuals covering a few square feet to hundreds of individuals occupying more than a quarter of an acre (USFWS, 1992c).

### Species Range in Ohio

At the time the recovery plan for the running buffalo clover was drafted, only eight populations had been discovered in Ohio (Cusick, 1989). As of 2004, there were 17 occurrences in Hamilton, Clermont, and Lawrence counties (S. Selbo, personal communication) (Figure 15). In addition to these 17 sites, there are seven which are considered extirpated (S. Selbo, pers. comm.). A new population was discovered on the Wayne National Forest (Lawrence County) in 2005.



**Figure 15. County occurrences of running buffalo clover in the Southern Unglaciated Allegheny Plateau.**

### Life History

Running buffalo clover is a member of the pea family (Fabaceae), and is one of the four species of clover native to the eastern United States. The erect, flowering stems of the plant, typically three to six inches in height with two leaves near the apex, are topped by a round flower head (USFWS, 1989). Flowering occurs from April to June and the seed heads are visible until August. It has a pair of leaves on the flower stalk, which distinguishes it from most other species of clover.

It is a perennial that forms long runners or stolons that root at the nodes, allowing it to spread and form new plants (USFWS, 1992c). It also spreads by seeds. Scarification of seeds by large herbivores is thought to be important for germination and seed dispersal (USFWS, 1989). The running buffalo clover can be grown from cuttings (USFWS, 1992c).

Growth and development of a the plant varies across its range, but in Ohio it has displayed the following pattern: (May-June) the plant flowers and produces stolons with associated unrooted daughter crowns; (by July) daughter crowns begin to root but remain connected by stolons to the parent plant; (by July) 1<sup>st</sup> or 2<sup>nd</sup> year plants are also present; (September) stolons senesce and parent and daughter crowns are no longer connected (S. Selbo, pers. comm.).

### Population Dynamics

Running buffalo clover populations can display cyclic patterns of population size and structure, possibly due to weather patterns, management, or other unknown factors (S. Selbo, pers. comm.).

It is pollinated by bees (*Apis* spp. and *Bombis* spp.), and there is evidence that cross-pollination occurs (S. Selbo, pers. comm.). The number of seeds produced by an individual flower head can vary across its range, and by individual plants. Studies on seed production showed ranges from 4-68 seeds per head (S. Selbo, pers. comm.).

NatureServe (2005) has given a global rank of G3 and a national rank of N3 to running buffalo clover: (G3) Vulnerable - at moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors; (N3) Vulnerable—Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

### Status and Distribution

Running buffalo clover was listed as endangered because the few known populations were threatened by habitat alteration (USFWS, 2005b). There are 120 known populations.

### Threats to the Species

Habitat loss, alteration and degradation are primary threats to this species. This species appears to have been dependent upon the woodland disturbance, soil enrichment, seed dispersal, and seed scarification provided by large ungulates such as the American bison (*Bison bison*) (USFWS 1992c; S. Selbo, pers. comm.). Without some level of disturbance, a site will become too shaded to provide enough sunlight for the species. Appropriate grazing intensity at the Bluegrass Army Depot in

Kentucky appears to be suitable for maintaining populations of this species, as does uneven-aged timber harvest treatments on the Fernow Experimental Forest in West Virginia (S. Selbo, pers. comm.). Direct loss of habitat through urban sprawl and land development is a threat in some parts of its range. Non-native invasive species, including such as white clover (*Trifolium repens*), Japanese stilt grass (*Microstegium vimineum*), garlic mustard (*Alliaria petiolata*), Japanese honeysuckle (*Lonicera japonica*), amur honeysuckle (*Lonicera maackii*), wintercreeper (*Euonymus fortunei*), and periwinkle (*Vinca minor*) pose risks to this species and its habitat (S. Selbo, pers. comm.).

Collection of running buffalo clover, disease, and parasitism pose a minimal threat to this species (S. Selbo, pers. comm.). Herbivory or predation by rabbits, ground hogs, slugs, and white-tailed deer have been reported across its range, however herbivores may also serve as seed dispersers (S. Selbo, pers. comm.).

NatureServe (2005) reported that a 1995 meeting of botanical experts resulted in the following list of the major threats to the species: (1) any irreversible, catastrophic disturbance, such as road construction that completely destroys the habitat and/or kills all plants and seeds within the path of the disturbance; (2) the closing of forest canopies through succession to the point of severe shading, leading to reduced flower and fruit production; (3) loss of habitat through natural or human causes; (4) a reduction of hooved mammals for dispersal of the species' seeds and vegetative fragments, 5) low genetic diversity among populations (6) low population size (less than 30 rooted crowns, or "D-ranked quality" of 41% of the extant occurrences and associated fragility and susceptibility to destruction by vehicle and foot traffic, use of heavy equipment, etc.; (7) a range of viruses that have been observed attacking the species at Missouri Botanical Garden and in introduced populations in Missouri; (8) herbivory by mammals, especially rabbits, groundhogs, etc.; (9) fungal diseases, including "tar spot"; (10) canopy closure causes too much shade, or canopy removal causing too much sunlight; (11) reduction in a plant pollinator (12) competition from non-native invasive plant species, especially from *Microstegium vimineum*, *Trifolium repens*, and *Alliaria petiolata*; (13) over grazing; and (14) disruption of moderate prolonged disturbance.

## Environmental Baseline

### Status of the Species in the Action Area

#### Species Range in the Action Area

The running buffalo clover was discovered on the WNF (Lawrence County) in June 2005. The population is located along a 20 foot section of an old ATV/skid trail. There are 34 rooted plants (ramets) in this area.

The total population may be higher because individuals of non-stoloniferous *Trifolium* spp. were present that could not be positively identified. Of the 34 individuals, 27 are located on the old road, and 7 are located on the edge of the old road.

The habitat is fairly open with scattered trees. Two large trees, an American elm (*Ulmus americana*) and bitternut hickory (*Carya cordiformis*), provide dappled shading. Canopy cover above this old road section averaged 47±% (measured with a spherical densiometer at four points and in the cardinal directions at each point).

The dominant herbaceous species association with this site include running buffalo clover, Asiatic stilt grass, cat greenbrier (*Smilax glauca*), vetch (*Vicia sp.*), panic grass (*Dichanthelium sp.*), common yellow oxalis (*Oxalis stricta*), poison ivy (*Toxicodendron radicans*), Japanese honeysuckle (*Lonicera japonica*), hairy leafcup (*Smallanthus uvedalius*), common hop (*Humulus lupulus*), sassafras (*Sassafras albidum*), eastern bottlebrush grass (*Hystrix patula*), aster (*Aster sp.*), ragweed (*Ambrosia sp.*), Virginia creeper (*Parthenocissus quinquefolius*), smallspike false nettle (*Boehmeria cylindrica*), common St. Johnswort (*Hypericum perforatum*), white ash (*Fraxinus americana*), black locust (*Robinia pseudoacacia*), tulip poplar (*Liriodendron tulipifera*), common boneset (*Eupatorium perfoliatum*), common moonseed (*Menispermum canadense*), spicebush (*Lindera benzoin*), American lopseed (*Phryma leptostachya*), deertongue (*Dichanthelium clandestinum*), ryegrass (*Elymus sp.*), Carolina elephantsfoot (*Elephantopus carolinianus*), roundleaf greenbrier (*Smilax rotundifolia*), redbud (*Cercis canadensis*), common plantain (*Plantago major*), American elm, bitternut hickory. Asiatic Stilt grass is by far the most dominant species at this site, cover over 75% of the RBC patch.

The old road was recently disturbed during a spring 2005 fire suppression operation, but has since received little traffic. It appears that this trail has not received much illegal OHV traffic in recent years. The fire burned on either side of the old road and may have lightly burned over the road, but there was no direct fire evidence, four months after the fire occurred.

There is a second population of running buffalo clover in Lawrence County, but it is about 8 miles outside the action area north-northeast of the city of Proctorville, Ohio.

#### **Suitable Habitat within the Action Area**

Running buffalo clover occurs in mesic habitats in partial to filtered sunlight, where there is a pattern of moderate periodic disturbance for a prolonged period, such as mowing, trampling or grazing, and is often found in areas underlain by limestone or other calcareous bedrock (S.

Selbo, pers. comm.). The plant is not found in mature habitats or in areas of severe disturbance (Cusick, 1989). Ohio populations are found in mesic wooded sites and lawn sites (S. Selbo, pers. comm.).

The original range of the running buffalo clover is believed to have been areas of rich soils located in the edge between open forest and prairie (USFWS, 1992c). Such areas probably were maintained by American bison disturbance. Most of the recently discovered populations are in areas experiencing at least some disturbance, such as that caused by grazing and mowing. The preferred habitats for running buffalo clover are old trails, traces, and roads; grazed bottomlands; low moist forests; successional areas in mesic forests; streambanks; lawns; shoals; and cemeteries with native vegetation, with well-drained and mesic soils and filtered to partial light (West Virginia Natural Heritage Program, 1990).

There is no known correlation between the range of the running buffalo clover and any specific soil type. Soil associations are only weakly correlated with the distribution of the species. However, all of the existing Ohio populations grow in fine-textured, loamy soil of lacustrine or alluvial origin (Cusick, 1989). Most soils on the WNF have a surface texture that is silt loam, loam, or sandy loam. Subsoil textures, however, range from sandy loam to clay.

A survey for the running buffalo clover was conducted in May 1996 on the Ironton Ranger District of the Forest, specifically in Lawrence County, Ohio. A total of 320 acres were surveyed. Approximately 1,500 acres were surveyed in 2003, in Lawrence, Scioto and Gallia counties. The surveys did not result in the discovery of the running buffalo clover on the WNF (R. Boyle, pers. comm.; M. Freidhof, pers. comm.). In 2004, approximately 3,500 acres were surveyed in Lawrence County in preparation for ice storm hazardous fuel treatments. About 1,980 acres were surveyed for this species in 2005.

### **Factors Affecting the Species Environment within the Action Area**

For the most part, state and local governments conduct some form of field review prior to implementing projects, but private landowners generally do not. Some activities occurring on private lands could affect potentially suitable habitat or undiscovered populations of running buffalo clover, such as woodland grazing, construction of homes, timber harvesting, road construction, illegal OHV riding, and energy minerals development. These activities are ongoing within the action area.

Please refer to *Factors Affecting Species Environment* for the Indiana bat for a description of ongoing activities in the action area that affect forest conditions.

Beneficial activities are occurring and will likely continue to occur as the proposed action is implemented. These include plant surveys on NFS

lands, state properties and lands administered by The Nature Conservancy; reforestation activities on NFS lands, state properties and on private lands; and watershed improvement activities on NFS lands, state properties and on private lands (through programs administered by the Corps of Engineers, Natural Resources Conservation Service).

## Direct and Indirect Effects of the Selected Alternative on Running Buffalo Clover

### Activities with No Effect

Several management activities projected to occur in the first decade of implementation of alternative  $E_{mod}$  would have no effect on running buffalo clover or its habitat.

- The Forest Service would use prescribed fire and mowing on the WNF to **maintain permanent forest openings**. Since running buffalo clover prefers partially-shaded habitats, the species would not be expected in these openings. Therefore, no effect from this activity is expected on this species or its habitat.
- **Site prep for native pine** would occur in areas where suitable habitat is not present.
- **Restoration of lakes and ponds** primarily involves projects to improve aquatic species habitat (e.g., placing underwater habitat structures) and would not impact terrestrial habitat.
- **Wetland restoration and enhancement** activities often occur in bottomland areas that have been tiled or ditched to promote agricultural use. Wetlands and open agricultural areas do not provide habitat for this species, and therefore this management activity would not impact the clover.
- **Livestock grazing** would be permitted on NFS lands except in the RC, TRL, SA, RNA, and CA management areas. Livestock grazing currently occurs on only six special use permit areas, approximately 300 acres, on the Marietta Unit and Ironton Ranger District. Grazing is restricted to suitable open land; no woodland or brushland would be converted to rangeland. Since the running buffalo clover prefers forested habitat, grazing activities would not affect this species.

### Activities Not Likely to Adversely Affect: Beneficial Effects

Activities conducted on the WNF that have the potential to protect, promote, or introduce suitable habitat for running buffalo clover include those which would result in a moderate amount of sunlight reaching the ground and light to moderate, periodic soil disturbance. Management

activities occurring on NFS that would benefit potential habitat for the running buffalo clover in most cases (with the exception of prescribed fire) would also benefit populations of the species.

While suitable habitat for running buffalo clover will be available in every management area, and well-distributed across the WNF, four management areas created to maintain more open stands will improve long-term habitat for this species (however, see discussion of fire in following section). The DCF and DCFO management areas primarily use uneven-aged vegetation management to create structurally diverse and more open forest stands. The HF and HFO management areas primarily use uneven-aged vegetation management combined with prescribed fire to create forest communities with more open understory conditions. The combined disturbances from timber harvesting (e.g. skid trails) with more open light habitats could create the ideal habitat for this species.

Alternative E<sub>mod</sub> incorporates Forest-wide standards and guidelines that minimize erosion, and stabilize disturbed areas. These standards and guidelines focus on reducing soil erosion and discharge into watercourses and establishing filterstrips for riparian areas to reduce sediments and nutrients entrance into stream habitats. Since running buffalo clover is known to occur along streambanks, these standards and guidelines would help protect potentially suitable habitat.

- **Control of non-native invasive species (NNIS)** by mechanical and biological means would protect ecosystem integrity and prevent habitat degradation, thus protecting potential habitat for running buffalo clover.
- **Restoration and improvement of stream habitat** include projects such as bank stabilization and culvert repairs to decrease sedimentation and improve habitat quality for running buffalo clover. Tree planting activities to provide shade along streams would create partially-shaded habitats favored by the clover.
- **Surface Mine Reclamation and stabilization of disturbed areas** would involve erosion control and planting to return areas to forested condition. These activities, over time could create potentially suitable habitat for the running buffalo clover in areas that currently would not support the species.
- **Crop tree release and grape vine control** involve the manual treatment of individual vines and trees in young, even-aged stands by ground crews. Overtime these activities will create a diverse, semi-shaded forest that could provide potential habitat for running buffalo clover. Currently the dense growth and shading within these stands do not provide suitable habitat for the species.

- **Reforestation** on the WNF tends to occur on open lands, such as agricultural fields or reclaimed strip mine areas. Reforestation of partially-forested areas does not typically occur on the WNF. Since the running buffalo clover prefers partially shaded habitats, conversion of open habitats to forested conditions would provide new potential habitat for this species where it does not currently exist.
- **Uneven-aged vegetation management** removes individual or groups of trees and opens a portion of the canopy. Small openings in the canopy from single tree selection harvests may directly benefit running buffalo clover habitat because the species cannot withstand full-shade environments (Cusick, 1989). Likewise, the moderate disturbance created by skid trails could benefit this species (Madarish and Schuler, 2002). While the removal of timber would improve habitat, the effects of road construction and log landings (discussed in following section) could impact individuals or habitat.
- **Land acquisition** can be beneficial when private lands containing known populations of federally listed species or potential habitat for a federally listed species are transferred into public ownership. Protection and management of these areas would become a federal responsibility, assuring long-term protection of the habitat or species.

### Activities Not Likely to Adversely Affect: Discountable Effects

Some activities could have discountable effects on potentially suitable habitat, which are effects that are extremely unlikely to occur.

- **Agricultural activities** occurring on special use agricultural permits may involve the use of pesticides and fertilizers. Use of pesticides and fertilizers in these areas could result in harmful stream runoff, depending on how close application is to water bodies. Since the running buffalo clover does not occur in open lands, run-off would likely become diluted before reaching potential habitat and thus the chance of an adverse effect occurring from agricultural run-off on the species would be unlikely. As added protection, filterstrips would be used along all streams to minimize effects from nonpoint source pollution (ARR-5).
- **Creation of permanent wildlife** openings historically involved the removal of trees from forested areas, however, Forest Service managers would rely primarily on the designation of existing open land on acquired properties to serve as permanent forest openings (e.g. old home sites, agricultural fields) (WLF-5). Similarly, development of agreements with utility companies would be

pursued to manage utility corridors as quality permanent forest openings (WLF-4). While it could occur, it is unlikely a forested area would be converted to a permanent forested opening. If it did, it would most likely occur when a log landing is designated for permanent opening status. Plant surveys are conducted prior to construction of log landings, and therefore it is unlikely that creation of openings in this manner would affect the species.

- **Small lake and pond construction** would occur for wildlife habitat and to enhance recreation on the WNF. Constructing an impoundment on a stream and flooding the upgradient streambanks could affect potential habitat. However, most ponds constructed in the past were a result of reclamation efforts.
- **Waterhole construction** is projected to only involve approximately 15 acres over the next decade. Waterholes are small in size and would likely be built in forested areas already disturbed by other project activities. Tree removal would not likely occur primarily for waterhole construction. The impact of waterhole construction will be discountable since it will occur in areas already disturbed, and of which the other activities (e.g. timber harvest, oil and gas development) will have a larger impact on habitat.
- **Installation of bat-friendly gates** involves the removal of soils around mine openings in order to sink gates below ground surface. Removal of soil in these areas could directly impact any plants or habitat present. However, soils removed during installation are returned afterwards to pre-installation conditions to avoid changing airflows and micro-environments, thus retaining any seedbanks that may exist for the species. Many of the areas impacted by installation are devoid of vegetation due to any combination of dense shade, acid mine drainage, or soil compaction by human use. The small amount of soil disturbance coupled with the small probability of potential running buffalo clover habitat occurring in these areas makes this impact unlikely.
- **Exchanging NFS lands** with other owners may affect the running buffalo clover if land containing the species or its habitat is transferred out of federal ownership. However, since assessments of all land exchanges by biologists occur before action is taken, the chance of exchanging a tract with populations of running buffalo clover is unlikely. The amount of land exchanged over a decade is only projected to be 400 acres. Conversely, land exchanges could benefit the species by exchanging unsuitable lands for those with suitable habitat.

### Activities Not Likely to Adversely Affect: Insignificant Effects

The following activities are expected to have insignificant effects on potentially suitable running buffalo clover habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Potential impacts to known running buffalo clover populations, or to potentially suitable habitat, are minimized with implementation of Forest-wide standards and guidelines TES-27 through TES-31.

- **Herbicides** would be used by WNF to eliminate shade tolerant tree species to promote oak/hickory forests, to control non-native invasive species, and to control nuisance plants (e.g. poison ivy) around recreation sites. Use of herbicides for these activities will primarily involve selective, spot spraying to avoid affecting non-target vegetation. Alternative E<sub>mod</sub> incorporates Forest-wide standards and guidelines that emphasize proper use of herbicides to protect non-target vegetation (FH-17, FH-18, FH-19, FH-20, and FH-21). In addition, a Forest-wide guideline restricts the use of herbicides within 25 feet of known populations. (GFW-TES-29). Although selective vegetation management is preferred for utility or other rights-of-way or easements, broadcast use of herbicides may only be permitted with written Forest Supervisor approval. Aerial spraying of herbicides is conducted on utility corridors that have outstanding rights on the Forest. Following standards and guidelines for herbicide usage would reduce the potential for herbicides to drift onto suitable clover habitat, or an individual.
- **Use of designated trails** could result in soil compaction and erosion, which may contribute to increased sedimentation in streams. As running buffalo clover habitat can be located near streams, trail use may affect potential stream bank habitat for this species. However, Alternative E<sub>mod</sub> incorporates measure to minimize potential impacts. Normal drainage control on designated trails will be provided by water bar installation and lead-off ditching, with the use of side ditching where necessary. In addition, OHV designated trails will be inspected twice a year, and necessary erosion control measures implemented. Construction and use of trails will also increase the probability for non-native invasive species introduction and spread along the corridors. Forest-wide standards and guidelines provide for prevention and control of non-native invasives during construction of trails, and allow for treatment of non-natives in areas where there is a high potential for spread (Forest-wide Objective 7.2b). Conversely, if trails are free of NNIS, provide for semi-permanent breaks in the forest canopy that the species likes, and therefore could benefit clover habitat.

- The increased density of forests, combined with fire suppression and natural disturbances, has led to an increase of woody material on the forest floor. **Treatment of hazardous fuels** will occur primarily in stands where fuels are greatest, often in pine stands. The work would involve the lopping and scattering of woody material on the ground. However, it is possible that a leaning or standing tree would be felled and bucked up or removed, either as part of the fuels reduction work or to protect workers from a potential hazard tree. Increased light penetration due to tree removal could benefit running buffalo clover habitat. Construction of roads, trails and landings during hazard fuel treatment projects would have similar impacts as those discussed in roads and trails.
- **Utility corridor maintenance** of existing corridors, over the long-term, could provide semi-permanent breaks in the canopy, but maintained corridors themselves are not likely to be considered as suitable habitat for this species.
- Areas targeted for **acid mine drainage treatment** often have a history of underground and surface mining that has restricted or altered natural water flows. Often these mine drainages result in barren soils unable to support vegetation due to highly acidic soils. Acid mine drainage treatments often involve closing mine portals and may involve large amounts of soil movement and disturbance to restore surface drainage. The construction and heavy equipment involved could impact suitable clover habitat. However, these areas have undergone severe disturbance in the past that have removed good topsoil often limiting their ability to provide quality habitat for this species. Over the long-term, restoring drainage within these areas will restore riparian characteristics to these areas, improve soil and water quality, create semi-permanent canopy breaks, and improve habitat quality for running buffalo clover.

### Activities Likely to Adversely Affect

There are some activities, or components of activities, projected to occur within the first decade that could negatively impact running buffalo clover. Potential impacts to known running buffalo clover populations, or to potentially suitable habitat, are minimized with implementation of Forest-wide standards and guidelines TES-27 through TES-31.

- Construction of both temporary and permanent **roads** has the potential to affect individuals or potentially suitable habitat. Construction activities involving the use of heavy machinery may result in the direct removal of individuals, or may affect soil compaction and erosion, and may increase the likelihood of colonization by non-native invasive species which could degrade

running buffalo habitat (competition from non-native species has been identified as a primary threat to running buffalo clover). During operation, temporary unsurfaced roads have the potential to cause soil erosion; however, after use, they are water barred, seeded, and allowed to revert back to vegetative cover to prevent erosion after closing. Similarly, standards and guidelines incorporated into Alternative E<sub>mod</sub> require measures to reduce erosion on riparian systems when building roads or trails that cross streams and providing filterstrips for roads built parallel to riparian systems. Forest-wide standards and guidelines would provide for prevention and control of non-native invasives during construction activities, and allow for treatment of non-natives in areas where there is a high potential for spread. While the heavy construction associated with road development may result in the loss of suitable habitat, over the long-term, road corridors will provide for semi-permanent breaks in the forest canopy that the species requires (USFWS, 1992c), and therefore could benefit clover habitat along edges of roads.

- **Road decommissioning** activities may have short-term effects on suitable habitat similar to road construction, but over the long-term road closures may increase the acres of suitable habitat for running buffalo clover on the Forest by decreasing the amount of Forest acres containing NNIS or that are susceptible to NNIS invasion.
- **Construction of recreation facilities** (e.g. parking lots) may involve clearing and grading sites and the use of heavy machinery. Such developments could result in the disturbance of individuals or the permanent loss of suitable habitat for running buffalo clover.
- **Construction of hiking, horse, biking and OHV trails** is projected to occur over the next decade, as is the construction of developed and dispersed recreation facilities. Construction of OHV trails would likely involve the use of heavy equipment, which may have similar impacts as described for road construction. Non-motorized recreational trails construction may involve either hand tools or heavy machinery.
- **Use of designated trails** could result in soil compaction and erosion, which may contribute to increased sedimentation in streams. As running buffalo clover habitat can be located near streams, trail use may affect potential stream bank habitat for this species. However, Alternative E<sub>mod</sub> incorporates measures to minimize potential impacts. Normal drainage control on designated trails will be provided by water bar installation and lead-off ditching, with the use of side ditching where necessary. In addition, OHV designated trails will be inspected twice a year, and necessary erosion control measures implemented. Construction and

use of trails will also increase the probability for non-native invasive species introduction and spread along the corridors. Forest-wide standards and guidelines provide for prevention and control of non-native invasives during construction of trails, and allow for treatment of non-natives in areas where there is a high potential for spread (Forest-wide Objective 7.2b). Conversely, if trails are free of NNIS, trails create breaks in the forest canopy that the species likes (USFWS, 1992c).

- **Even-aged vegetation management** (clearcut, shelterwood, thinning and two-aged harvest methods) results in the removal of all, or most, trees in areas ranging from 2-30 acres in size, exposing the area to partial to full sun conditions. Changes in light intensities reaching the forest floor might cause the herbaceous layer to flourish and result in more competition and shading, and may affect undiscovered populations or may temporarily reduce the quality of suitable habitat for running buffalo clover, if such habitat exists prior to cutting. These effects are short-term in nature since the treated stands would regenerate to closed canopy conditions over time. Alternative E<sub>mod</sub> incorporates Forest-wide standards and guidelines require that low growing flowering and fruiting trees under six inches in diameter not be cut during even-aged harvest unless the amount left would inhibit natural regeneration of tree species (VEG-12). These remaining trees may provide some shade in these areas, and minimize impacts on clover habitat. Other Forest-wide standards and guidelines require the assessment of non-native species threats during project planning and the use of prevention and control measures during and after project implementation (FH-1).
- Both uneven- and even-aged vegetation management activities could affect undiscovered individuals or may temporarily impact running buffalo clover habitat due to **road and log landing construction** which involves soil compaction, erosion and increased susceptibility of areas to NNIS invasion and establishment. All log landings are temporary in stature and are rehabilitated after use to control any erosion or NNIS concerns. Alternative E<sub>mod</sub> incorporates measures to address non-native invasive species establishment and spread during construction activities. Skid trails can be beneficial to running buffalo clover (Madarish and Schuler, 2002), while roads and log landings could provide short-term breaks in the uneven-age managed canopies and benefit habitat for the clover. A healthy population of running buffalo clover in Hamilton County, Ohio occurs along the perimeters of an old logging road and the canopy break it provides.
- **Mineral exploration and development** is on-going throughout the WNF, and will continue as long as the demand for oil and gas

remains high. Removal of vegetation and topsoil required for the construction of access roads, well pads, and pipeline corridors during oil and gas activities may affect undiscovered individuals or suitable habitat the same as road and trail construction. No Surface Occupancy restrictions for USA-owned minerals are in place in the FOF, CA, SA, RNA, DR and TRL management areas. Surface occupancy for private mineral rights may require seasonal restrictions, road construction and maintenance requirements, setbacks from streams, marshes and ponds, noise abatement, wildlife coordination, and visual resource coordination. Established Forest-wide standards and guidelines in Alternative E<sub>mod</sub> mitigates the effects of oil and gas exploration and development (i.e. filterstrips, stream crossings, stabilizing disturbed areas, NNIS prevention and analysis, NSO on steep slopes, controlled surface use on riparian areas). Effects from road and well pad construction are long-term since they remain in use until mineral resources are depleted. Once depleted, the operators are required to restore the disturbed areas (Forest-wide objective 10.2a and b, MIN-2, MIN-8).

- **Surface coal mines** would alter and remove surface soils and vegetation, and subsequently degrade existing habitat and possibly affecting undiscovered populations. Approximately 1,250 acres of NFS land could be affected by surface mining in the future. The Forest Service has no control over this projected activity since private mineral rights are involved, however the Forest Service would work closely with the operator to incorporate as many Forest-wide standards and guidelines into the operation plan. Furthermore, the operator would need to meet all state regulations.
- **Mineral exploration and development** activities may also result in accidental spills of crude oil or brine, which could affect surrounding vegetation, contaminate soils, and cause harmful runoff to streams. However, State of Ohio regulations require a Spill Prevention and Control Countermeasures Plan (SPCC) for mineral development activities. Dikes are required around all wells on the Forest to contain brine in the event of an accidental spill. In addition, the Ohio Environmental Protection Agency (EPA) is required to be contacted immediately upon discovery of an accidental spill. Remedial action for cleanup of water and soil resources will be conducted by the lessee as directed by the Ohio EPA.
- **Reclamation of depleted or orphan wells** requires clearing the immediate area of the well, and would have similar adverse affects as those for construction for well pads, however, these areas are rehabilitated immediately after well reclamation and over the long-

term, and closure would benefit the environment by preventing the potential for future leaks or spills from these wells.

- **Prescribed fire** is used on the WNF to control hazardous fuel build-up, to promote oak-hickory regeneration and to control non-native invasive species. Creation of firelines using bulldozers for prescribed fire activities could result in soil disturbance, soil compaction, removal of vegetation and increased susceptibility for invasion by NNIS, whereas firelines constructed by hand only affect the litter layer. Forest-wide standards and guidelines incorporated into Alternative E<sub>mod</sub> emphasize the use of existing roads and fire breaks to avoid constructing fireline (FIRE-7). In addition, mechanical construction of firelines is to be avoided near known populations of running buffalo clover (SFW-TES-28). Firelines would be rehabilitated after burns (e.g. water diversions, seed and mulch), to prevent long term erosion impacts. Since the clover has stolons that remain on the soil surface, direct burning of any undiscovered plants would likely eliminate them; conversely, the disturbance and opening of understory by fire would likely encourage the species emergence from any existing seedbanks. Fire will reduce understory cover resulting in a more open habitat that could benefit habitat for running buffalo clover in the short-term, and if areas are burned on a rotational basis the benefit may be long-term in providing habitat and perpetuating populations if successful seedset and germination occurred.
- **Utility corridor construction** is similar in impacts to habitat as road and trail construction, since vegetation will be removed and soil compaction from heavy machinery use may occur. Forest-wide Standards and Guidelines provide guidance in protecting riparian areas during construction activities. Filterstrip requirements would protect riparian habitat. Over the long-term, these semi-permanent breaks in the canopy could create running buffalo clover habitat along corridor edges.

### Cumulative Effects of the Selected Alternative

Partial or filtered light is important to this species. Researchers believe that the action area was primarily forested, but about 10 percent of the area was disturbed each decade by weather-related events or by forest pests and diseases (Runkle, 1982). These disturbances ranged in size from canopy gaps to larger blowdowns, and were scattered across the landscape. In the central hardwood forest, the climate warmed and became drier 5,000 to 8,000 years ago, and an increase in fire occurred. Based on written accounts of early settlers in the Ohio River valley, the forest was described as being park-like with large, widely spaced trees and relatively little undergrowth of woody vegetation.

Forest cover has increased across Ohio from about 15 percent in 1940 to almost 30 percent today (Ohio Division of Forestry, 2004). Almost 80 percent of the lands (public and private) within the action area are forested (Ohio Land Use Cover, based on Landsat TM 1994). Riparian corridors within are primarily forested (i.e., 72.5%) (National Landcover Database, 1992).

These reforestation trends are beneficial to the running buffalo clover, however researchers suggest that today's forest is denser than that reported for old growth hickory forests and for presettlement forests (Sutherland et al., 2003; Yaussy et al. 2003).

Activities that occur on non-federal lands within the WNF proclamation boundary include private oil and gas development, surface mining of coal, clay, and limestone, construction of buildings and other structures, road construction and maintenance, and timber harvest. There is a chance that any of these activities may impact suitable habitat, or existing populations of the running buffalo clover. Management of non-federal lands are under the discretion of the landowner and conservation measures applied on NFS lands may not be used on these other ownerships.

A description of forest management on non-Federal lands during the past 20 years through today is presented in the cumulative effects section for the Indiana bat. Similarly, estimates of future forest management activities are presented in the cumulative effects section for the Indiana bat.

Various management projects are projected to occur on the WNF over the next ten years, including projects that could adversely affect the running buffalo clover (RBC). Cumulatively, the Forest Service could implement about 74,000 acres of projects that could adversely affect the species or its habitat (Table 28). These disturbances would be distributed across the WNF and over the decade. The actual disturbance is less since many activities would occur on the same acreage of land, however that would be analyzed in detail at the project-level. In comparison, the no action alternative could affect 71,564 acres.

**Table 28. Activities with potential adverse effects on the RBC.**

Management Activity	Alternative E <sub>mod</sub>
Even-aged Management	1,925
Prescribed Fire	69,169
Permanent Road Construction	74
Permanent Road Reconstruction	318
Temporary Road Construction	146
Skid Trails & Landings	740
Recreation Facilities	60
OHV Trail construction	150
Hiking Trail Construction	18
Horse Trail Construction	61
Mountain Bike Trail Construction	36
Utility Corridor Development	50
Surface Coal Mining	1,250
Reclamation of Depleted/Orphan Wells	70
Oil and Gas Exploration and Development	121
<b>Total</b>	<b>74,188</b>
<b>Percent of NFS lands affected</b>	<b>31%</b>
<b>Percent of action area affected</b>	<b>7%</b>

Any potential adverse cumulative effects would be minimized through the implementation of Forest-wide standards and guidelines (refer to the references to these in the analysis of direct and indirect effects). Prescribed fire accounts for the largest acreage; it may result in short-term adverse effects that can be mitigated, but can offer long-term benefits to the species. Prescribed fire is a tool that can be used to create open understories, much like that which was present historically.

Surface mining is an activity which could adversely affect the second largest acreage of land. The Forest Service can use the project-level planning process to consider in detail whether or not this activity will affect the specie or its habitat. When prescribed fire and surface coal mining are eliminated from the equation, only 3,769 acres could be adversely affected, or 0.3 percent of the action area.

### Determination of Effect and Rationale

Table 29 presents a summary of the effects of the Selected Alternative on running buffalo clover and its habitat.

A **Likely to Adversely Affect** determination is made for the running buffalo clover. The running buffalo clover was discovered on the Wayne National Forest in June 2005. Although some management activities associated with the Selected Alternative could potentially cause adverse impacts to the clover or its habitat, implementing the Selected Alternative

is not likely to impede recovery of this species. The Forest service has incorporated both proactive conservation actions as well as protective measures into the Selected Alternative to aid in the recovery of this species.

1. The Selected Alternative incorporates conservation approaches or measures to proactively protect and conserve existing running buffalo clover populations and suitable habitat.
  - A Conservation Plan for Federally Listed species was developed and included in the revised Forest Plan (see Appendix 1 of this Biological Assessment). This Conservation Plan summarizes the strategy the Forest service will use during revised Forest Plan implementation to aid in the recovery of this species. The WNF Conservation Plan addresses the following recovery objectives in the Agency Draft recovery plan (USFWS, 2005b): (1) invasive species control; (2) reducing habitat succession; (3) ensuring viability of protected populations; and (4) promoting public understanding of the species.
  - Alternative E<sub>mod</sub> incorporates habitat management tools to provide a diversity of forest habitats, including those that provide partial shading or filtered light to the forest floor. The DCF, DCFO, HF, and HFO management areas will use uneven-aged management to open the canopy. The HF and HFO management areas rely on the use of prescribed fire, which could be adverse to the clover, but there is guidance to encourage mosaic burning (GFW-WLF-2).
2. Forest-wide direction has been incorporated into the Selected Alternative to ensure known populations are protected. A Forest-wide goal (5.1.4) encourages active management of the occupied habitat, with an objective to maintain partial to filtered sunlight (5.1.4a). Forest-wide standards and guidelines protect individuals from prescribed fire activities (SFW-TES-27 and SFW-TES-28), herbicide application (GFW-TES-29), and road and trail management (SFW-TES-30). Surveys for the species in suitable habitat would be implemented prior to any ground or canopy disturbing activity (GFW-TES-31).
3. Activities which may directly or indirectly affect the running buffalo clover and its habitat would likely be distributed across the landscape and over time. Second-level project analysis would occur and at that time, any additional protective measures needed to minimize or eliminate adverse effects would be identified.

**Table 29. Summary of effects determinations for running buffalo clover.**

<b>Projected Management Activity</b>	<b>Alternative E<sub>mod</sub></b>
<b>Vegetation Management</b>	
Even-aged Hardwood Timber Harvest	A
Even-aged Pine Timber Harvest	A
Uneven-aged Timber Harvest	A
Thinning	I
Crop Tree Release	B
Grape Vine Control	B
Site Prep for Native Pine	N
Reforestation	B
Prescribed Fire	A
Herbicide Application	I
Development of Permanent Forest Openings	D
Maintenance of Permanent Forest Openings	N
Control of Non-Native Invasive Species-Mechanical	B
Control of Non-Native Invasive Species-Biological	B
Wetland Restoration & Enhancement	N
Waterhole Construction	D
Fishing Pond/Lake Construction	D
Restoration & Improvement of Aquatic/Riparian Habitat (Lentic)	N
Restoration & Improvement of Aquatic/Riparian Habitat (Lotic)	B
Installation of Bat-Friendly Gates on Mines	D
<b>Recreation Management</b>	
OHV Trail Construction	A
Hiking Trail Construction	A
Horse Trail Construction	A
Mountain Bike Trail Construction	A
Recreation Facility & Parking Lot Construction	A
<b>Transportation Management</b>	
Temporary Road Construction	A
Permanent Road Construction	A
Permanent Road Reconstruction	A
Road Decommissioning	A
Disturbance related to Timber (Skid Trails, Landings)	A
<b>Energy Minerals Management</b>	
Surface Coal Mining Activities	A
Reclamation of Depleted or Orphan Wells	A
Oil & Gas Well Development	A
<b>Special Uses Management</b>	
Utility Corridor Development & Maintenance	A
Agricultural Crop Production & Grazing	D/N
<b>Watershed Management</b>	
Treatment of AMD	I
Surface Mine Reclamation	B
Closure of Open Mine Portal/Subsidence	I
Stabilization of Disturbed Areas	B
<b>Fire Management</b>	
Reduction of Hazardous Fuels - Mechanical	I
<b>Lands Acquisition Management</b>	
Land Acquisition	B
Land Exchange	D
<b>N = No Effect; B = Not Likely to Adversely Affect, Beneficial Effects; I = Not Likely to Adversely Affect, Insignificant Effects; D = Not Likely to Adversely Affect, Discountable Effects; A = Likely to Adversely Affect</b>	

---

## List of Preparers

Cheryl Coon, Forest Botanist – M.S. in Plant Biology, University of Maryland, 1998;  
B.A. in Biology, Hiram College, Hiram, Ohio, 1995.

Rebecca Ewing, Forest Biologist – M.S. in Wildlife and Fisheries Sciences, South Dakota  
State University, 1989; B.S. in Zoology, Eastern Illinois University, 1984.

---

## List of Reviewers

Ted King, Ph.D., Wayne National Forest NEPA Coordinator – Ph.D. in Forestry  
(Operations Research), University of Wisconsin-Madison, 1989; M.S. in Forestry  
(Resource Policy), University of Wisconsin-Madison, 1985; M.S. in Wildlife  
Science, New Mexico State University, 1977; B.S. in Natural Resources, The  
Ohio State University, 1971.

Stephen R. Mighton, Endangered Species Specialist - Region 9, USDA Forest Service,  
Milwaukee, Wisconsin.

Katrina Schultes, Wayne National Forest Biological Technician – M.S. in Wildlife  
Management (Ecology Option), Eastern Kentucky University, 2002; B.S. in  
Biology (Zoology Option), Ball State University, 1993.

---

## Literature Cited

Abrams, M. D. 1992. Fire and the development of oak forests. *Bioscience* 42:346-353.

Abrams, M. D. 1998. The red maple paradox. *Bioscience* 48(5): 355-364.

Ball, R. L., and B. M. Schoenung. 1996 Status of mussel populations in the primary  
harvest areas. 1995 Final Report. Division of Fish and Wildlife, Indiana  
Department of Natural Resources, Indianapolis. 72 pp.

Barbour, R. W. and W. H. Davis. 1969. *Bats of America*. University of Kentucky Press,  
Lexington, Kentucky. 286pp.

Barnhart, M. C., F. A. Riusech, and A. D. Roberts. 1997. Fish hosts of the federally  
endangered pink mucket, *Lampsilis abrupta*. Triannual Unionid Report No. 13.  
Accessed from the web May 2004.

(BCI) Bat Conservation International. 2001. *Bats in Eastern Woodlands*. Austin, Texas.  
311 p.

- Bedick, J. C., B. C. Ratcliffe, W. W. Hoback, and L. G. Higley. 1999. Distribution, ecology, and population dynamics of the American burying beetle [*Nicrophorus americanus* Olivier (Coleoptera, Silphidae)] in south-central Nebraska, USA. *Journal of Insect Conservation* 3:171-181.
- Berg, D. J., W. R. Haag, D. W. Garton, and J. L. Farris. 1993. Responses of native unionids to encrustation of zebra mussels. Page 178 in K. S. Cummings, A. C. Buchanan, and L. M. Koch, editors. *Conservation and Management of Freshwater Mussels. Proceedings of a UMRCC symposium, 12-14 October 1992, St. Louis, Missouri.* Upper Mississippi River Conservation Committee, Rock Island, Illinois.
- Boerner, R. 2000. Effects of fire on the ecology of the forest floor and soil of central hardwood forests. Pages 56-63 in *Proceedings: Workshop on Fire, People, and the Central Hardwoods Landscape.* USDA Forest Service General Technical Report NE-274.
- Bookhout, T., and M. J. Lacki. 1981. A survey of bats in Wayne National Forest. Final Report, The Ohio State University Research Foundation, Columbus. 70 p.
- Boyle, R. 1996. Survey notes for a small whorled pogonia survey on selected tracts within the Wayne National Forest.
- Brack, V., and D. Little. 2001. An Autumn Survey for the Endangered Indiana Bat (*Myotis sodalis*) at Mine Portals along Alternate Corridors for U.S. Route 33 Nelsonville Bypass (HOC/ATH – 33-17.00/0.00), Hocking and Athens Counties, Ohio. Prepared for the Ohio Dept. of Transportation.
- Brack, V. Jr., C. W. Stihler, R. J. Reynolds, C. M. Butchkoski, and C. S. Hobson. 2002. Effect of climate and elevation on distribution and abundance in the Mideastern United States. Pages 21-28 in A. Kurta and J. Kennedy, editors. *The Indiana bat: biology and management of an endangered species.* Bat Conservation International, Austin, Texas.
- Britzke, E. R., M. J. Harvey, and S. C. Loeb. 2003. Indiana bat, *Myotis sodalis*, maternity roosts in the southern United States. *Southeastern Naturalist* 2(2):235-242.
- Callahan, E. V., R. D. Drobney, and R. L. Clawson. 1997. Selection of summer roosting sites by Indiana bats (*Myotis sodalis*) in Missouri. *Journal of Mammalogy* 78:818-825.
- Carter, T. C., W. M. Ford, and M. A. Menzel. 2000. Fire and bats in the southeast and Mid-Atlantic: more questions than answers? Pages 139- 143 in *Proceedings of a Special Workshop (The Role of Fire in Nongame Wildlife Management and Community Restoration: Traditional Uses and New Directions.* USDA Forest Service GTR-NE-288.
- Carter, T. C., S. K. Carroll, J. E. Hofmann, J. E. Gardner, and G. A. Feldhamer. 2002. Landscape analysis of roosting habitat in Illinois. Pages 160-164 in A. Kurta and J. Kennedy, editors. *The Indiana bat: biology and management of an endangered species.* Bat Conservation International, Austin, Texas.

- Chalfoun, A. D., F. R. Thompson, and M. J. Ratnaswamy. 2002. Nest predators and fragmentation: a review and meta-analysis. *Conservation Biology* 16(2):306-318.
- Clawson, R. L. 2002. Trends in population size and current status. Pages 2-8 in A. Kurta and J. Kennedy, editors. *The Indiana bat: biology and management of an endangered species*. Bat Conservation International, Austin, Texas.
- Cochrane, K. E., J. L. Windus, and A. W. Cusick. 1995. Monitoring and restoration of known populations and survey for potential sites for the northern monkshood (*Aconitum noveboracense*) in Ohio. A report for the U. Fish and Wildlife Service, Reynoldsburg Field Office. 10 pp. + appendices.
- Cope, J. B., A. R. Richter, and R. S. Mills. 1974. A summer concentration of Indiana bat, *Myotis sodalis*, in Wayne County, Indiana. *Indiana Academy of Science* 83: 482-484.
- Creighton, J. C., and G. D. Schnell. 1998. Short-term movement patterns of the endangered American burying beetle, *Nicrophorus americanus*. *Biological Conservation* 86(1998):281-187.
- Cummings, K. S., and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.
- Cusick, A. 1989. Running buffalo clover fact sheet. Available at: <http://www.dnr.oh.us/dnap/abstracts/trifstol.htm>. Accessed January 27, 2004.
- Easterla, D. A. and L. C. Watkins. 1969. Pregnant *Myotis sodalis* in northwestern Missouri. *Journal of Mammalogy* 50:372-373.
- (ESI) Ecological Specialists, Inc. 2000. Final report: freshwater mussels of the upper Ohio River. Final report for the Mussel Mitigation Trust Fund Committee and U. S. Fish and Wildlife Service. 99 pp.
- Evans, J. E. 1984. Element stewardship abstract for *Aconitum noveboracense* Northern monkshood. 7 pp.
- Ewing, R. 2003a. Indiana bat species data collection form. Species Viability Evaluation Report completed for the revision of the Wayne National Forest Land and Resource Management Plan. 36 pp.
- Ewing, R. 2003b. Analysis of the management situation for wildlife and fisheries resources and management indicator species. Unpublished report. 32 p.
- Ewing, R. 2003c. Species viability evaluation species data collection form for the yellow-breasted chat. Prepared for the Wayne National Forest revision process. 27 p.
- Ewing, R. 2003d. Species viability evaluation species data collection form for the ruffed grouse. Prepared for the Wayne National Forest revision process. 36 p.

- Ewing, R. 2003e. Bald eagle species data collection form. Species Viability Evaluation Report completed for the revision of the Wayne National Forest Land and Resource Management Plan. 26 pp.
- Ewing, R. 2003f. American burying beetle species data collection form. Species Viability Evaluation Report completed for the revision of the Wayne National Forest Land and Resource Management Plan. 21 pp.
- Farmer, A. H., B. S. Cade, and D. F. Stauffer. 2002. Evaluation of a habitat suitability index model. Pages 172-179 in A. Kurta and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Fralish, J. S. 2004. The keystone role of oak and hickory in the central hardwood forest. Pages 78-87 in Upland oak ecology symposium: history, current conditions, and sustainability. USDA Forest Service General Technical Report SRS-73.
- Gardner, J. E., and E. A. Cook. 2002. Seasonal and geographic distribution and quantification of potential summer habitat. Pages 9-20 in A. Kurta and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Gardner, J. E., J. D. Garner, and J. E. Hofman. 1991. Summer roost selection and roosting behavior of *Myotis sodalis*, Indiana bat, in Illinois. Final report submitted to the Illinois Natural History Survey, Champaign, Illinois. 56 pp.
- Gordon, M. E., and J. B. Layzer. 1989. Mussels (Bivalvia: Unionidae) of the Cumberland River: Review of life histories and ecological relationships. USDI Fish and Wildlife Biological Report 89(15). 98 pp.
- Hoggarth, M. A. 1993. Population status of Ohio endangered unionidae, 1993. Report for the U. S. Fish and Wildlife Service. 23 pp.
- Hoggarth, M. A. 1994. The unionidae of the Walhonding River, Coshocton County, Ohio, including a survey for the catspaw (*Epioblasma obliquata obliquata*) and the fanshell (*Cyprogenia stegaria*). Final Report to the Ohio Department of Natural Resources and U. S. Fish and Wildlife Service (Project E-2-1, Study No. 203). 36 pp.
- Hoggarth, M. A. 2001. The unionidae of the Little Muskingum River watershed in Monroe and Washington Counties, Ohio. Final Report to the Wayne National Forest, Nelsonville. 20 p.
- Horn, D. J. 1998. Report on the reintroduction of the American burying beetle in Ohio. Final Report to the Ohio Division of Wildlife. 1 pp.
- Horn, D. J., and G. D. Keeney. 1999. Report on the reintroduction of the American burying beetle in Ohio. Final Report to the Ohio Division of Wildlife. 2 pp.
- Horn, D. J., and G. D. Keeney. 2000. Report on the reintroduction of the American burying beetle in Ohio. Final Report to the Ohio Division of Wildlife. 1 pp.

- Horn, D. J., and G. D. Keeney. 2002. Report on the reintroduction of the American burying beetle in Ohio. Final Report to the Ohio Division of Wildlife. 1 pp.
- Humphrey, S. R., and J. B. Cope. 1977. Survival rates of the endangered Indiana bat, *Myotis sodalis*. *Journal of Mammalogy* 58:32-36.
- Humphrey, S. R., A. R. Richter, and J. B. Cope. 1977. Summer habitat and ecology of the endangered Indiana Bat, *Myotis sodalis*. *Journal of Mammalogy* 58: 334-346.
- Hutchinson, T., and S. Sutherland. 2000. Fire and understory vegetation: a large-scale study in Ohio and a search for general response patterns in central hardwood forests. Pages 64-74 in *Proceedings: Workshop on Fire, People, and the Central Hardwoods Landscape*. USDA Forest Service General Technical Report NE-274.
- Hutchinson, T. F., D. Rubino, B. C. McCarthy, and E. K. Sutherland. 2003. History of forests and land-use. Pages 17-27 in E. K. Sutherland and T. F. Hutchinson, eds. *Characteristics of mixed-oak forest ecosystems in southern Ohio prior to the reintroduction of fire*. USDA Forest Service GTR NE-299.
- Jones, J. W., and R. J. Neves. 2001. Life history and propagation of the endangered fanshell pearly mussel, *Cyprogenia stegaria* Rafinesque (Bivalvia: Unionidae). *Journal of the North American Benthological Society* 21(1): 76-88.
- Kiser, J. D., and H. D. Bryan. 1997. A survey for the federally endangered Indiana bat (*Myotis sodalis*) on the Athens and Ironton Ranger Districts, Wayne National Forest. Final Report for the USDA Forest Service, Wayne National Forest. 24 p.
- Kiser, J. D., and C. L. Elliot. 1996. Foraging habitat, food habits, and roost tree characteristics of the Indiana bat, *Myotis sodalis*, during autumn in Jackson County, Kentucky. Final Report for the Kentucky Department of Fish and Wildlife Resources. 65 pp.
- Kiser, J. D., H. D. Bryan, and G. W. Libby. 1998. A survey for the federally endangered Indiana bat (*Myotis sodalis*) in the Bluegrass Ridge and Markin Fork areas of the Ironton Ranger District, Wayne National Forest. Final Report for the USDA Forest Service, Wayne National Forest. 7 p. + appendices.
- Kiser, J. D., R. R. Kiser, B. W. Sumner, and K. Schultes. 1999. A mist net survey and radio-telemetry study for the federally endangered Indiana bat (*Myotis sodalis*) on the Athens and Ironton Ranger Districts, Wayne National Forest. Final Report for the USDA Forest Service, Wayne National Forest. 36 p. + appendices.
- Kiser, J. D., R. R. Kiser, K. E. Brock, and J. Beverly. 2000. A mist net survey and radio-telemetry study for the federally endangered Indiana bat (*Myotis sodalis*) on the Athens and Ironton Ranger Districts, Wayne National Forest. Final Report for the USDA Forest Service, Wayne National Forest. 42 p. + appendices.
- Kuchenreuther, M. A. 1996. The natural history of *Aconitum noveboracense* Gray, a federally threatened species. *Journal of the Iowa Academy of Science* 103(3-4):57-62.

- Kurta, A., and S. W. Murray. 2002. Philopatry and migration of banded Indiana bats (*Myotis sodalis*) and effects of radio transmitters. *Journal of Mammalogy* 83(2):585-589.
- Kurta, A., and J. O. Whitaker, Jr. 1998. Diet of the endangered Indiana bat (*Myotis sodalis*) on the northern edge of its range. *American Midland Naturalist* 140:280-286.
- Kurta, A., and K. Williams. 1992. Roosting habitat, microclimate, and behavior of the endangered Indiana bat (*Myotis sodalis*) in southern Michigan. Final report to the Michigan Department of Natural Resources. 17 pp.
- Lauritsen, D. 1986. Element Stewardship Abstract for Pink Mucket Pearly Mussel. The Nature Conservancy, Midwest Regional Office, Minneapolis. 6 pp.
- Lauritsen, D., and G. T. Watters. 1986. Element Stewardship Abstract for General Unionid Mussel. The Nature Conservancy, Midwest Regional Office, Minneapolis. 10 pp.
- Lomolino, M. V., J. C. Creighton, G. D. Schnell, and D. L. Certain. 1995. Ecology and conservation of the endangered American burying beetle (*Nicrophorus americanus*). *Biological Conservation* 77(1996):235-241.
- Lomolino, M. V., and J. C. Creighton. 1996. Habitat selection, breeding success and conservation of the endangered American burying beetle, *Nicrophorus americanus*. *Biological Conservation* 77(1996):235-241.
- Madarish, D. and T. Schuler. 2002. Effects of forest management on the Federally Endangered running buffalo clover (*Trifolium stoloniferum* Muhl. ex. A. Eaton). *Natural Areas Journal* 22:120-128.
- MacGregor, J. R., J. D. Kiser, M. W. Gumbert, and T. O. Reed. 1999. Autumn roosting habitat of male Indiana bats (*Myotis sodalis*) in a managed forest setting in Kentucky. Pages 169-170 in J. W. Stringer and D. L. Loftis, eds. Proceedings of the 12<sup>th</sup> central hardwood forest conference, Lexington, Kentucky. USDA Forest Service General Technical Report SRS-24.
- McCarthy, B. C. 1995. Eastern old-growth forests. *The Ohio Woodland Journal* 2:8-10.
- McClenahan, J. R., D. B. Houston, and E. N. Norland. 1999. Evaluation of logging best management practices on private forest lands in Ohio. Report by The School of Natural Resources, The Ohio State University and Sylvancare Forestry Consulting. 35 p. + appendices.
- Meade, L. 2004. Bat survey of selected sites on the Ironton and Marietta Units of the Wayne National Forest. Final Report. 28 pp. + maps.
- Menzel, J. M., W. M. Ford, M. A. Menzel, T. C. Carter, J. E. Gardner, J. D. Gardner, and J. E. Hofmann. 2005. Summer habitat use and home-range analysis of the endangered Indiana bat. *Journal of Wildlife Management* 69(1):430-436.

- Miller, N. E., R. D. Drobney, R. L. Clawson, and E. V. Callahan. 2002. Summer habitat in northern Missouri. Pages 165-171 in A. Kurta and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Murray, S. W., and A. Kurta. 2002. Spatial and temporal variation in diet. Pages 182-192 in A. Kurta and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Murray, S. W., and A. Kurta. 2004. Nocturnal activity of the endangered Indiana bat (*Myotis sodalis*). *Journal of Zoology* 262:197-206.
- NatureServe Explorer: an online encyclopedia of life [web application]. 2004. Version November 2003. Arlington, Virginia, USA: NatureServe. Available at: <http://www.natureserve.org/explorer>.
- NatureServe Explorer: an online encyclopedia of life [web application]. 2005. Version 4.5. Arlington, Virginia, USA: NatureServe. Available at: <http://www.natureserve.org/explorer>.
- (ODNR) Ohio Department of Natural Resources. 2003a. Revised Indiana Bat Management Strategy. Ohio Division of Wildlife publication. 22 p.
- (ODNR) Ohio Department of Natural Resources. 2003b. Bald eagle. Ohio Division of Wildlife Life History Notes. Available from: <http://www.dnr.state.oh.us/wildlife/resources/wildnotes/pub383.htm>. Accessed on July 2, 2004.
- (ODNR) Ohio Department of Natural Resources. 2003c. American burying beetle. Update on the reintroduction and distribution of the species. Available at: <http://www.dnr.state.oh.us/wildlife/Hunting/2003report/americanburyingbeetle.pdf>. Accessed on July 2, 2004.
- (ODNR) Ohio Department of Natural Resources. 2004a. Bald eagle production update. Available from: <http://www.dnr.state.oh.us/wildlife/resources/Eagle/eagle.htm>. Accessed on July 2, 2004.
- (ODNR) Ohio Department of Natural Resources. 2004b. Ohio's eagles begin 2004 nesting season. Available from: <http://www.dnr.state.oh.us/wildlife/News/eaglenest0204.htm>. Accessed on July 2, 2004.
- (ODNR) Ohio Department of Natural Resources. 2004c. Record numbers of bald eagles observed during the state's mid-winter survey. Available from: <http://www.dnr.state.oh.us/wildlife/Feature/ResourcesF/eagleresults04.htm>. Accessed on July 2, 2004.

- (ODNR) Ohio Department of Natural Resources. 2005. Bald eagle resources. Available from: <http://www.dnr.state.oh.us/wildlife/Resources/Eagle/default.htm>. Accessed August 15, 2005.
- Ogle, D. W. 1991. *Spiraea virginiana* Britton: I. Delineation and distribution. *Castanea* 56(4):287-296.
- Ohio Division of Forestry. 2004. History of Ohio's Forests. Available at: <http://www.dnr.state.oh.us/forestry/forest/ohiogreen.htm> .
- Ohio Division of Geological Survey. No Date. Geologic map and cross section of Ohio. Accessed from <http://www.dnr.state.oh.us/geosurvey/gen/map/map.htm> on June 10, 2004.
- Ohio Division of Natural Areas and Preserves. 1992. Small whorled pogonia abstract. Accessed from <http://www.dnr.state.oh.us/dnap/Abstracts/I-J/isotmede.htm> on January 27, 2004.
- Ohio EPA. 2004. Watershed assessment unit summaries. 2004 Integrated Report, Appendix D2.
- O'Shea, T. J., and D. R. Clark, Jr. 2002. An overview of contaminants and bats, with special reference to insecticides and the Indiana bat. Pages 237-253 in A. Kurta and J. Kennedy, editors. *The Indiana bat: biology and management of an endangered species*. Bat Conservation International, Austin, Texas.
- Pope, P. E., B. C. Fischer, and D. L. Cassens. No date. Timber harvesting and logging practices for private woodlands. Purdue University Forestry and Natural Resources Woodland Management Note FNR-101. Available at: <http://www.ces.purdue.edu/extmedia/FNR/FNR-101.html>.
- Racey, P. A. 1982. Ecology of bat reproduction. Pages 57-104 in T. H. Kunz, editor. *Ecology of Bats*. Plenum Press, New York, New York.
- Rawinski, T. 1986. Element stewardship abstract for *Isotria medeoloides* (small whorled pogonia). 16 pp.
- Richter, A. R., S. R. Humphrey, J. B. Cope, and V. Brack, Jr. 1993. Modified cave entrances: thermal effect on body mass and resulting decline of endangered Indiana bats (*Myotis sodalis*). *Conservation Biology* 7(2):407-415.
- Ritter, D. F., R. C. Kochel, and J. R. Miller. 1995. *Process Geomorphology*, Third Edition. Wm. C. Brown Publishers, Dubuque. 546 p.
- Rommé, R. C., K. Tyrell, and V. Brack, Jr. 1995. Literature summary and habitat suitability index model – components of summer habitat for the Indiana bat, *Myotis sodalis*. Final Report for the Indiana Department of Natural Resources; Federal Aid Project E-1-7, Study No. 8. 39 p.
- Runkle, J. R. 1982. Patterns of disturbance in some old-growth mesic forests of eastern North America. *Ecology* 63(5):1533-1546.

- Schmidt, A. C., K Tyrell, and T. Glueck. 2002. Environmental contaminants in bats collected from Missouri. Pages 228-236 in A. Kurta and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Schultes, K. L. 2002. Characteristics of roost trees used by Indiana bats (*Myotis sodalis*) and Northern bats (*Myotis septentrionalis*) on the Wayne National Forest, Ohio. Master's thesis. Eastern Kentucky University.
- Schultes, K. L. 2003. Monitoring results for an Indiana bat hibernaculum. Monitoring Notes. 2 pp.
- Schultes, K. L. 2005. Indiana bat priority III hibernaculum census. Monitoring Notes. 2 p.
- Sparks, D. W., M. T. Simmons, C. L. Gummer, and J. E. Duchamp. 2003. Disturbance of roosting bats by woodpeckers and raccoons. *Northeastern Naturalist* 10(1):105-108.
- Sparks, D. W. J. O. Whitaker, Jr., and C. M. Ritzi. 2004. Foraging ecology of the endangered Indiana bat. (In Press) Proceedings of the Indiana bat and coal mining: A Technical Interactive Forum, Louisville, Kentucky.
- Stephens, S. E., D. N. Koons, J. J. Rotella, and D. W. Willey. Effects of habitat fragmentation on avian nesting success: a review of the evidence at multiple spatial scales. *Biological Conservation* 115:101-110.
- Stine, S. J. 1993. Inventory for Virginia spiraea (*Spiraea virginiana* Britton) in Ohio. Final report for the U. S. Fish and Wildlife Service. Project No. E-2-1, study No. 204. 25 pp.
- Sutherland, E. K., T. F. Hutchinson, and D. A Yaussy. 2003. Introduction, study area description, and experimental design. Pages 1-16 in Characteristics of mixed-oak forest ecosystems in southern Ohio prior to the reintroduction of fire. USDA Forest Service General Technical Report NE-299.
- (TABS) Tennessee Animal Biogeographic System. 2002. Life history of the pink mucket pearly mussel. Available at <http://fwie.fw.vt.edu/TN/TN00194h.htm>. (Accessed: May 2004).
- Tuttle, M. D., and J. Kennedy. 2002. Thermal requirements during hibernation. Pages 68-78 in A. Kurta and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Tuttle, M. 2005. Caution regarding placement of wind turbines on wooded ridgetops. Memo to Wind energy Production and Wildlife Conservation Planners. 1 p.
- USDA Forest Service. 2001. Pine Creek ecosystem analysis. Wayne National Forest, Ohio.

USDA Forest Service. 2002. Little Muskingum River ecosystem analysis and hydrologic condition analysis, Wayne National Forest, Ohio.

(USFWS) USDI Fish and Wildlife Service. No date-a. Bald eagle pairs, 1963-2000. Available at: <http://www.fws.gov/midwest/eagle/population/2000chtofprs.html>. Accessed on August 27, 2005.

(USFWS) USDI Fish and Wildlife Service. No date-b. Driftless Area National Wildlife Refuge. Available at: <http://www.fws.gov/refuges/profiles/index.cfm?id=32596>. Accessed on August 3, 2005.

(USFWS) USDI Fish and Wildlife Service. 1983a. Indiana bat recovery plan. U. S. Fish and Wildlife Service, Fort Snelling, Minnesota.

(USFWS) USDI Fish and Wildlife Service. 1983b. Northern States Bald Eagle Recovery Plan.

(USFWS) USDI Fish and Wildlife Service. 1983c. Recovery plan for northern monkshood (*Aconitum noveboracense*). 81 pp.

(USFWS) USDI Fish and Wildlife Service. 1985. Recovery plan for the pink mucket pearly mussel (*Lampsilis orbiculata*). 47 pp.

(USFWS) USDI Fish and Wildlife Service. 1989. Running Buffalo Clover (*Trifolium stoloniferum*) Recovery Plan. 26pp.

(USFWS) USDI Fish and Wildlife Service. 1990a. Final listing rules for fanshell mussel. Endangered Species Technical Bulletin XV (7):6.

(USFWS) USDI Fish and Wildlife Service. 1990b. Virginia spiraea (*Spiraea virginiana*). Species Account, Endangered and Threatened Species of the Southeastern United States (The Red Book). Accessed from <http://endangered.fws.gov/i/q/saq64.html> on May 29, 2004.

(USFWS) USDI Fish and Wildlife Service. 1991a. American Burying Beetle (*Nicrophorus americanus*) Recovery Plan. 81 pp.

(USFWS) USDI Fish and Wildlife Service. 1991b. Recovery plan for the fanshell (*Cyprogenia stegaria* (= *C. irrorata*)).

(USFWS) USDI Fish and Wildlife Service. 1992a. Small whorled pogonia (*Isotria medeoloides*) recovery plan. First Revision. 78 pp.

(USFWS) USDI Fish and Wildlife Service. 1992b. Virginia Spiraea (*Spiraea virginiana* Britton) Recovery Plan. 47pp.

(USFWS) USDI Fish and Wildlife Service. 1992c. Running Buffalo Clover (*Trifolium stoloniferum*). Species Account, Endangered and Threatened Species of the Southeastern United States (The Red Book). Accessed from <http://endangered.fws.gov/i/q/saq4a.html> on May 28, 2004.

- (USFWS) USDI Fish and Wildlife Service. 1994a. Endangered Species Fact Sheet. Accessed from <http://eelink.net/EndSpp.old.bak/monkshood.html> on May 27, 2004.
- (USFWS) USDI Fish and Wildlife Service. 1994b. Final Rule to Reclassify the Plant *Isotria medeoloides* (Small Whorled Pogonia) From Endangered to Threatened. Accessed from <http://endangered.fws.gov/r/fr94556.html> on May 29, 2004.
- (USFWS) USDI Fish and Wildlife Service. 1995. Endangered and threatened species; bald eagle reclassification – final rule. Federal Register July 12, 1995.
- (USFWS) USDI Fish and Wildlife Service. 1996a. Endangered Species Bulletin. Volume XXI (1). 4 pp.
- (USFWS) USDI Fish and Wildlife Service. 1996b. Small whorled pogonia (*Isotria medeoloides*) species account. Endangered and Threatened Species of the Southeastern United States (The Red Book). Accessed from <http://endangered.fws.gov/i/q/saq1q.html> on May 28, 2004.
- (USFWS) USDI Fish and Wildlife Service. 1999. Agency draft. Indiana bat (*Myotis sodalis*) revised recovery plan. U. S. Fish and Wildlife Service, Fort Snelling, Minnesota.
- (USFWS) USDI Fish and Wildlife Service. 2003a. An American success story: bald eagle recovery. Available at: <http://www.fws.gov/r3pao/eagle/success/qandas.html>. Accessed on April 10, 2003.
- (USFWS) USDI Fish and Wildlife Service. 2004. County distribution lists for federally endangered, threatened, proposed, and candidate species in Ohio. 7 pp.
- (USFWS) USDI Fish and Wildlife Service. 2005a. Biological opinion on the construction, operation, and maintenance of the U. S. 33 Nelsonville Bypass for the federally endangered Indiana bat. 60 p. + appendices.
- (USFWS) USDI Fish and Wildlife Service. 2005b. Running buffalo clover draft recovery plan: first revision. 56 p.
- Vitz, A. C. 2003. Use of regenerating clearcuts by mature-forest birds during the post-breeding period. M. S. Thesis, The Ohio State University, Columbus. 132 p.
- Walton, D. 1995. Element Stewardship Abstract for *Spiraea virginiana* (Virginia spiraea). 6 pp.
- Watters, G. T. 1988. The naiad fauna of selected streams in Ohio: (I) Stillwater River of Miami River; (II) stream systems of south central Ohio from the Little Miami River to the Hocking River, excluding the Scioto River proper. Final report to the Ohio Department of Natural Resources, Division of Wildlife, Columbus. 439 pp.
- Watters, G. T. 1995. A Guide to the Freshwater Mussels of Ohio. Ohio Division of Wildlife, Division of Wildlife.

- Watters, G. T., and H. L. Dunn. 1993-1994. The unionidae of the lower Muskingum River (RM 34.1-0), Ohio, USA. *Walkerana* 7(17/18): 225-263.
- West Virginia Natural Heritage Program. 1990. Running Buffalo Clover, *Trifolium stoloniferum* Eat. Natural Heritage Notes, Number 1, Endangered Plants. 5pp.
- West Virginia Division of Natural Resources. 2000. Endangered freshwater mussels. Available at: <http://www.dnr.state.wv.us/wvwildlife/mussel.2.htm>. Accessed on August 22, 2005.
- Williams, J. D., M. L. Warren, Jr., K. S. Cummings, J. L. Harris, and R. J. Neves. 1992. Conservation status of freshwater mussels of the United States and Canada. *Fisheries* 18(9): 6-22.
- Yaussy, D. A., T. F. Hutchinson, and E. K. Sutherland. 2003. Structure, composition, and condition of overstory trees. Pages 99-111 in E. K. Sutherland and T. F. Hutchinson, eds. Characteristics of mixed-oak forest ecosystems in southern Ohio prior to the reintroduction of fire. USDA Forest Service GTR NE-299.

---

## References

- Wayne National Forest Fish Database developed for the 2002 Watershed Integrity Analysis for the Wayne National Forest.
- March 1, 2004 memo from Forest Supervisor Mary Reddan to Fish and Wildlife Service Field Supervisor Mary Knapp regarding reinitiation of formal consultation on the 1988 Forest Plan.
- Ohio Land Use Cover (LandSat TM). 1994.
- National Land Cover Database. 1992.

---

## Personal Communications

- Ann Acheson, Air Quality Specialist. USDA Forest Service Eastern Region, Milwaukee, Wisconsin
- Lynda Andrews, District Wildlife Biologist. Wayne National Forest, Athens Ranger District.
- Judy Dumke, Taxonomic expert with input into Species Viability Evaluations.
- Ryan Evans, Database Administrator. Western Pennsylvania Conservancy, 209 Fourth Avenue, Pittsburgh, PA 15222

Mike Freidhof, Timber Program Manger. Wayne National Forest, Ironton Ranger District.

Rick Gardner, Heritage Botanist. Ohio Department of Natural Resources, Department of Natural Areas and Preserves. 2045 Morse Rd. Building F-1, Columbus, Ohio.

Andy King, Endangered Species Biologist. U. S. Fish and Wildlife Service, Ecological Services Field Office, Bloomington, Indiana.

Kevan Moore, Fire Management Officer. Wayne National Forest.

Phil Perry, Forest Silviculturist (now retired). Wayne National Forest.

Francis Rothwein, District Wildlife Biologist. Ouachita National Forest, Cold Springs Ranger District.

Ted Schenck, Regional Planning Biologist. USDA Forest Service Eastern Region, Milwaukee, Wisconsin – transferred to the Rocky Mountain Regional Office.

Sarena Selbo, Endangered Species Biologist, U. S. Fish and Wildlife Service, Division of Ecological Services. 6950 Americana Parkway, Suite H, Reynoldsburg, OH 43068-4127.

Angela Zimmerman, Endangered Species Biologist. U. S. Fish and Wildlife Service, Division of Ecological Services. 6950 Americana Parkway, Suite H, Reynoldsburg, OH 43068-4127.

---

## Appendix 1. Conservation Plan for Federally Listed Species

The Forest Service is committed to conserving, protecting, and maintaining habitat for federally listed species. As a Federal agency, it has defined responsibilities in supporting recovery objectives for federally listed species. Populations of these species will receive individualized attention. Management activities that may affect federally listed species occur in consultation with the U.S. Fish and Wildlife Service. If additional species that occur on the Wayne National Forest become listed, we will consult with the USFWS as appropriate (50 CFR 402.16).

A major purpose of the WNF's Revised Forest Plan is fulfillment of the Forest's obligations under the Endangered Species Act, Section 7(a)(1), to conserve Federally listed species. Section 7(a)(1) of the Act mandates Federal agencies to take a proactive approach in the conserving of endangered species:

“All other Federal agencies shall, in consultation with and with the Secretary, utilize their authorities in furtherance of the purposes of this Act, by carrying out programs for the conservation of endangered species and threatened species pursuant to Section 4 of this Act.”

The foundation of the conservation plan is the allocation of NFS lands into management areas that contain the ecological conditions needed by particular species. These management area allocations are also intended to conserve the biodiversity that will promote the recovery and maintenance of federally listed species.

- The prescriptions for the Diverse Continuous Forest and Diverse Continuous Forest with OHVs management areas call primarily for the use of uneven-aged vegetation management to create structurally diverse forest stands. The prescriptions for the Historic Forest and Historic Forest with OHVs management areas call primarily for the use of uneven-aged vegetation management combined with prescribed fire to create oak and hickory dominated forest communities with more open conditions. These management areas were formulated, in part, to provide habitat conditions beneficial for the Indiana bat, American burying beetle, and running buffalo clover.
- The River Corridor and Timbre Ridge Lake management areas were developed, in part, with the bald eagle in mind and should provide long-term direct benefits to this species as it expands its range in Ohio. The purpose of the River Corridor Management Area is to retain, restore, and enhance the inherent ecological processes and functions associated with riverine systems on the Forest. The desired future condition of the Timbre Ridge Lake Management Area is excellent water quality in the 100-acre lake where a self-sustaining bass-bluegill fishery is encouraged. A landscape of wooded character surrounds the lake and provides feeding opportunities as well as suitable roosting or nesting habitat for the bald eagle.

Together, these and all other management areas provide well-distributed and diverse habitat for native and desired non-native plants and animals, including federally listed species.

## Species List

The U.S. Fish and Wildlife Service identified nine federally listed species as occurring on or near the Wayne National Forest:

Species	Status
American burying beetle ( <i>Nicrophorus americanus</i> )	Endangered
Bald eagle ( <i>Haliaeetus leucocephalus</i> )	Threatened
Fanshell ( <i>Cyprogenia stegaria</i> )	Endangered
Indiana bat ( <i>Myotis sodalis</i> )	Endangered
Northern monkshood ( <i>Aconitum noveboracense</i> )	Threatened
Pink mucket pearly mussel ( <i>Lampsilis abrupta</i> )	Endangered
Running buffalo clover ( <i>Trifolium stoloniferum</i> )	Endangered
Small whorled pogonia ( <i>Isotria medeoloides</i> )	Threatened
Virginia spiraea ( <i>Spiraea virginiana</i> )	Threatened

## Conservation Plan Relationship to Other Documents

Section 7(a)(2) of the Endangered Species Act states that Federal agencies shall consult with the U.S. Fish and Wildlife Service.

“Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such an agency is granted an exemption for such action by the committee pursuant to subsection (h) of this section. In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available.”

To meet the consultation requirements under Section 7(a)(2) of the Act, the Forest Service completed a Programmatic Biological Assessment for the Wayne National Forest Land and Resource Management in March 2001. It included a list of management activities with amounts expected to occur by September 2006. The U.S. Fish and Wildlife Service responded with a Biological Opinion on the Wayne National Forest Land and Resource Management Plan on September 20, 2001.

The Biological Opinion provided “non-discretionary, reasonable, and prudent measures” as well as terms and conditions that would minimize the potential for incidental take of federally listed species. It also recommended conservation measures that the WNF could implement to meet its responsibilities under Section 7(a)(1) for the Indiana bat, bald eagle and American burying beetle.

The non-discretionary, reasonable and prudent measures along with the recommended terms and conditions were incorporated into the 1988 Forest Plan (Amendment 13) as

Forest-wide goals and standards, respectively. The discretionary conservation recommendations were also incorporated into the 1988 Forest Plan (Amendment 13) as conservation recommendations. During the Forest Plan revision process, these Forest-wide goals and standards, and conservation recommendations were reviewed with the Fish and Wildlife Service, and slight modifications were made to incorporate the best available scientific information into the revised Forest Plan and to ensure clarity of revised Forest Plan direction.

Species-specific recovery plans provide additional guidance to conserve and recover each threatened or endangered species throughout its range. Each recovery plan has been developed by a team of scientists who are considered experts on the affected species. Not all recovery objectives may be applicable to the WNF since it encompasses only a portion of the range of nine endangered and threatened species.

### **Format of the Conservation Plan**

This Conservation Plan is arranged into two sections: (1) Section I displays direction and guidance that is applicable to all nine federally listed species; and (2) Section II outlines the direction and guidance specific for the Indiana bat, bald eagle, American burying beetle, and running buffalo clover. These are species that occur on the WNF, or are likely to be reintroduced to the WNF in the near future.

Each section is arranged into four categories: Administrative & Technical Information; Protection of Individuals; Habitat Protection & Improvement; Education & Awareness; and Inventory, Analysis & Monitoring.

### **Implementation of the Conservation Plan**

Responsibilities for implementation of the Conservation Plan rest primarily with personnel of the Wayne National Forest. Some work, however, will be done cooperatively with the U. S. Fish and Wildlife Service, Ohio Division of Wildlife, or other conservation partners.

### **Conservation Plan Accomplishments**

All management accomplishments related to the conservation, protection, and recovery of federally listed species will be disclosed in the annual WNF Forest Plan monitoring and evaluation report.

## I. Conservation Direction and Guidance for all Federally Listed Species

### Administrative & Technical Information

Consult with the Fish and Wildlife Service to ensure activities planned and implemented on the WNF are in accordance with the Endangered Species Act.

To ensure that the exemption of incidental take is appropriately documented, the Fish and Wildlife Service will implement a tiered programmatic consultation approach. As individual projects are proposed under the Forest Plan, the Forest Service shall provide project-specific information to the Fish and Wildlife Service that:

- a. describes the proposed action and the specific area to be affected;
- b. identifies the species that may be affected;
- c. describes the manner in which the proposed action may affect Federally listed species, and the anticipated effects;
- d. specifies that the anticipated effects from the proposed action are similar to those anticipated in the programmatic Biological Opinion for the revised Forest Plan;
- e. a cumulative total of incidental take that has occurred to date under the Tier I Biological Opinion; and
- f. describes any additional effects, if any, not considered in the Tier I consultation.

The Fish and Wildlife Service will review the information for each proposed project and this project-specific review is appropriately documented. If it is determined that an individual proposed project is not likely to adversely affect federally listed species, the Fish and Wildlife service will complete its documentation with a standard concurrence letter that refers to the Biological Opinion for the revised Forest Plan, the Tier I programmatic document (i.e., it “tiers” to it), and specifies that the Fish and Wildlife Service concurs that the proposed project is not likely to adversely affect listed species or critical habitat. If it is determined that the proposed project is likely to adversely affect listed species or designated critical habitat, then the Fish and Wildlife Service will complete a Tier II Biological Opinion with a project-specific incidental take statement.

### Protection of Individuals

For all federal oil and gas lease projects, the Forest Service is responsible for assuring that the area to be disturbed is examined prior to allowing any surface disturbing activities on lands covered by this lease type. The examination is to determine effects upon any plant or animal species listed, or proposed for listing, as Federally endangered or threatened and their habitats. If the findings of this examination determine that the operation(s) may have a detrimental effect on a species covered by the Endangered Species Act, the operator's plans may be denied or restrictions added.

The Forest Service has the responsibility to conduct the required examination. In cases where the Forest Service time frames cannot meet the needs of the lessee/operator, the lessee/operator may, at his discretion and cost, conduct the examination on the lands to be disturbed. This examination must be done by or under the supervision of a qualified resource specialist approved by the Forest Service. An acceptable report must be provided to the Forest Service identifying the anticipated effects of the proposed action on Federally endangered and threatened species, or their habitats. **[Appendix H - Oil & Gas Leasing Notification 3]**

### Inventory, Analysis and Monitoring

Coordinate and cooperate with the U.S. Fish and Wildlife Service and experts from other agencies, universities, and organizations to conserve, protect, recover, and monitor populations and habitats of Federally listed species.

### Education and Awareness

Provide training opportunities for employees on the identification, biology, and habitat requirements of Federally listed species along with monitoring techniques.

## II. Species-specific Conservation Direction and Guidance

### A. Indiana Bat

Additional resource management direction and guidance found in the Forest Plan and should be considered during project planning and implementation, as needed, to promote recovery of this species.

#### Administrative & Technical Information

Preferred Indiana bat roost trees include the following species: shagbark hickory, shellbark hickory; bitternut hickory; silver maple; green ash; white ash; eastern cottonwood; northern red oak; post oak; white oak; slippery elm; American elm; black locust; pignut hickory; red maple; sugar maple; and black oak. This list of trees is based on review of literature and data on Indiana bat roosting requirements. Other species may be added, as identified.

When identifying existing Indiana bat roosting habitat (SFW-TES-10(a)), the trees that are hollow, have major splits, or have broken tops need to have characteristics that provide maternity habitat for one or more Indiana bats. In other words, these trees must possess crevices into the hollow area or where the split or broken top occurred for it to provide habitat for this species. Furthermore, trees with broken tops should be 6 inches dbh or greater where the broken top occurs.

Discovery of dead bats of undetermined species on the WNF should be reported immediately to the U.S. Fish and Wildlife Service, Reynoldsburg Field Office, and the remains transported on ice to that office. The USFWS will make the final species determination of any dead or moribund bats found on the WNF. If an Indiana bat is identified, the USFWS will contact the appropriate USFWS law enforcement office.

No attempt should be made to handle any live bat, regardless of its condition. This does not apply to individuals who are permitted, as agents of the State, to conduct work on Federally listed bat species.

Report bats that appear to be sick or injured to USFWS Reynoldsburg Field.

## Protection of Individuals

**Goal 5.1.1** – Retain or develop Indiana bat roosting and foraging habitat; protect all known Indiana bat hibernacula.

**Objective 5.1.1a** – If additional Indiana bat hibernacula are discovered on NFS land, install bat-friendly gates to prevent unauthorized entry.

**SFW-TES-1** – Deter human access to areas surrounding known hibernacula by closing or relocating trails that lead to, or pass within easy viewing distance of hibernacula.

**SFW-TES-2** – Establish a one-quarter mile buffer around all known hibernacula. Within this one-quarter mile buffer:

- a. Prohibit new trail and road construction;
- b. Do not conduct prescribed burning during the fall swarming period (generally mid-August to mid-October) or during the hibernation period (September 15th through April 15th);
- c. Do not permit surface occupancy for exploration or development of Federally owned minerals;
- d. Implement vegetation management only to maintain or improve Indiana bat roosting, swarming, or foraging habitat.

**GFW-TES-3** – Establish a one-quarter mile buffer around all mine openings that are known Indiana bat fall swarming sites, but where actual Indiana bat hibernation has not been established. Reduce or eliminate

human disturbances within the buffer. Implement vegetation management only to maintain or improve Indiana bat roosting, swarming, or foraging habitats.

**SFW-TES-4** – Develop prescribed burning plans that specify weather conditions that would prevent smoke dispersal into known hibernacula.

**SFW-TES-5** – Before backfilling any mine openings, such as portal entrances or subsidence depressions with developed openings, conduct surveys for potential bat presence during the fall swarming period (generally mid-August to mid-October).

**GFW-TES-6** – Conduct pre-gating and post-gating mist net surveys at mines where bat-friendly gates are installed.

**SFW-TES-13** – Prohibit the cutting of standing dead trees for firewood.

**SFW-MIN-10 (Appendix H, Stipulation 10)** – Within management areas where surface occupancy is generally permitted, apply the No Surface Occupancy stipulation for Federal leases where the following conditions occur:

- Areas within ¼ mile of Indiana bat hibernacula

**Appendix H, Stipulation 12 (Controlled Surface Use on USA oil and gas leases – Known locations of Federally listed species)** – No cutting of snags (trees with less than 10% live canopy), shagbark or shellbark hickories, or trees that are hollow and/or have major splits or broken tops, except during the bat hibernation season (September 15<sup>th</sup> – April 15<sup>th</sup>). If such trees are a safety hazard, they may be cut anytime they pose an imminent threat to human safety, but if cut in the non-hibernation season, the Forest Service biologist must be notified in advance. This stipulation applies only to trees over six inches in diameter.

## Habitat Protection & Improvement

**Goal 5.1.1** – Retain or develop Indiana bat roosting and foraging habitat; protect all known Indiana bat hibernacula.

**Objective 5.1.1a** – If additional Indiana bat hibernacula are discovered on NFS land, install bat-friendly gates to prevent unauthorized entry.

**SFW-TES-7** – When even-aged regeneration methods are used, retain forested flight corridors within and between early successional habitat patches. These flight corridors may include forested corridors along ephemeral, intermittent, and perennial streams; and where present, clumps of snags and trees of varying size classes in the early successional habitat. When present, leave larger-sized trees on the edges of early successional patches for future maternity roosts.

**SFW-TES-8** – Within hardwood cutting units with uneven-aged vegetation management prescriptions, maintain an average of at least 60 percent canopy cover.

**GFW-TES-9** – Retain all shagbark and shellbark hickory trees greater than or equal to 6 inches dbh, unless removal is necessary to protect human safety or to avoid adverse impacts to steep slopes, erodible soils, floodplains or wetlands (e.g., cut a hickory rather than relocating a skid trail onto a steep slope).

**SFW-TES-10** – During the non-hibernation season (April 15<sup>th</sup> – September 15<sup>th</sup>), do not cut, unless they are a safety hazard:

- a. Trees of any species 6 inches dbh or greater that are hollow, have major splits, or have broken tops that provide maternity habitat.
- b. Snags 6 inches dbh or greater that have Indiana bat roost tree characteristics. Consider any tree with less than 10 percent live canopy to be a snag.

When removal of hazard trees is necessary in a recreation area during the non-hibernation season (e.g., developed recreation sites, access roads, trails), conduct emergence surveys at the identified hazard trees that possess the characteristics identified above, and at any hazard trees that possess large areas of loose bark providing maternity habitat.

**SFW-TES-11** – Schedule any summer prescribed burning after August 15<sup>th</sup> to reduce potential effects on Indiana bat reproduction.

**SFW-TES-12** – With all hardwood timber harvests, retain a minimum of 12 live trees per acre (averaged over the cutting unit) of any species that are 6 inches dbh or greater with large areas of loose bark, unless they pose a safety hazard.

In addition to these, retain live preferred roost trees, when present to provide a supply of future roost trees (i.e., large, overmature trees) as shown in the following table. Refer to the Administrative & Technical Information section above for a list of tree species preferred as roost trees by Indiana bats. Consult with the U. S Fish and Wildlife Service regarding exceptions that may be needed to minimize adverse effects to other resources or human health and safety.

Indiana Bat Preferred Roost Tree Size Class	Number of live trees to retain (average per acre over the cutting unit)
>20 inches (dbh)	3*
>11 in (dbh) and < 20 in (dbh)	6

\*If there are few or no live Indiana bat roost trees > 20 inches dbh in the stand, retain three live trees > 16 inches dbh and < 20 inches dbh per acre (averaged across the cutting unit). If there are no live trees > 16 inches dbh, retain nine additional live trees > 11 inches dbh and < 16 inches dbh per acre (averaged across the cutting unit).

**SFW-TES-13** – Prohibit the cutting of standing dead trees for firewood.

**GFW-TES-14** – Provide water sources that promote aquatic insect production and provide drinking sources for Indiana bats along suitable flight paths, especially in upland areas, and off/away from recreation sites, and designated trails and roads.

**Appendix H, Stipulation 12** – No cutting of snags (trees with less than 10% live canopy), shagbark or shellbark hickories, or trees that are hollow and/or have major splits or broken tops, except during the bat hibernation season (September 15<sup>th</sup> – April 15<sup>th</sup>). If such trees are a safety hazard, they may be cut anytime they pose an imminent threat to human safety, but if cut in the non-hibernation season, the Forest Service biologist must be notified in advance. This stipulation applies only to trees over six inches in diameter.

### Education & Awareness

Provide refresher training to employees, as needed, to ensure proper identification of Indiana bat roosting habitat. Such training should include how to recognize potentially suitable maternity roosts from other non-maternity roost trees.

Provide training to employees on the proper methods for conducting emergence surveys.

### Inventory, Analysis & Monitoring

Emphasis will be placed on collecting information that supports Indiana bat recovery objectives. This may include, but is not limited to, monitoring population trends of known hibernacula; monitoring of microclimate conditions in known hibernacula, and assessing our understanding of Indiana bat winter and summer distributions on the WNF, including any maternity colonies.

Monitor annually and report every five years the answers to the following monitoring questions, as required in Chapter 4 of the Forest Plan:

- a. How many acres of potentially suitable Indiana bat habitat were protected or improved?
- b. How many bat-friendly gates were installed on known Indiana bat hibernacula?

## B. Bald Eagle

Additional resource management direction and guidance found in the Forest Plan and should be considered during project planning and implementation, as needed, to promote recovery of this species.

## Administrative & Technical Information

By June 1 of each year, provide an annual report to the U.S. Fish and Wildlife Service and the Ohio Division of Wildlife, which includes the following:

- a. Results of any winter searches for communal bald eagle night roosts and concentrations, including mid-winter bald eagle surveys conducted in cooperation with the USFWS and the Ohio Division of Wildlife;
- b. Discovery of any bald eagle nesting territories on the WNF. If no surveys have been conducted and no territories discovered on the WNF during an annual reporting period, an annual report should be submitted with a statement to this effect;
- c. Documented cases of a prescribed fire that behaved contrary to predicted movement patterns and which resulted in a confirmed adverse impact to bald eagles.

For any prescribed fire that could potentially impact bald eagles, provide the USFWS with the opportunity to review burn plans with the WNF Fire Management Officer prior to the burn plan's approval.

## Protection of Individuals

**Goal 5.1.2** – Protect bald eagle communal night roosts, daytime concentration sites, and occupied breeding territories.

**SFW-TEs-16** – Protect any bald eagle communal night roosts and concentrations (including nests) discovered during winter surveys or during any additional field surveys or proposed project areas, following guidelines outlined in the Northern States Bald Eagle Recovery Plan.

**SFW-TEs-17** – Report discovery of bald eagle nests immediately to the U. S. Fish and Wildlife Service and the Ohio Department of Natural Resources, Division of Wildlife.

**SFW-TEs-19** – Allow no prescribed fire within one-half mile of occupied bald eagle sites. Consider all bald eagle communal night roosts, daytime concentration sites, or occupied breeding territories as occupied sites. To prevent smoke inversion from occurring at occupied bald eagle sites, and to minimize smoke drifting toward them from prescribed fires outside the one-half mile radius of occupied sites, require burn plans to take into account of wind direction, speed, and mixing height as well as transport winds.

**Appendix H, Stipulation 12** – Protect known nests and roosts as described in the Bald Eagle Recovery Plan, or as directed by the U. S. Fish and Wildlife Service.

## Habitat Protection & Improvement

**SFW-TES-18** – Protect supercanopy trees, or other identified congregation roost trees, along major river corridors and lakes in addition to following Forest-wide riparian area standards and guidelines.

**Appendix H, Stipulation 12** – Protect all supercanopy trees or other identified congregation roost trees for bald eagles along major river corridors and lakes.

## Education & Awareness

Provide field training for new employees so they will be able to recognize bald eagle signs at night roosts, even when eagles are absent.

## Inventory, Analysis & Monitoring

**Objective 5.1.2a** – Conduct a minimum of three annual winter searches to locate any previously unknown communal night roosts or bald eagle concentrations.

**SFW-TES-15** – Focus winter bald eagle searches in areas that eagles are known to frequent or where concentrated food sources occur near NFS land. Conduct searches during early-, mid-, and late-winter. Follow search criteria outlined in the Northern States Bald Eagle Recovery Plan.

**SFW-TES-20** – If the bald eagle is found nesting on the Wayne National Forest, monitor populations according to the recovery plan. At such time as the bald eagle is de-listed, use the de-listing monitoring plan.

In addition to these Forest-wide objectives and standards, monitor annually and report every five years the answers to the following monitoring questions, as required in Chapter 4 of the Forest Plan:

- a. How many winter bald eagle searches were conducted?
- b. How many bald eagles were observed?

## C. American Burying Beetle

Additional resource management direction and guidance found in the Forest Plan and should be considered during project planning and implementation, as needed, to promote recovery of this species.

## Protection of Individuals

**Goal 5.1.3** – Cooperate in efforts to reintroduce the American burying beetle.

**GFW-TES-21** – Discourage the use of bug zappers by campers in dispersed or developed recreation sites within 10 air miles of known occupied American burying beetle habitat.

**GFW-TES-23** – During the American burying beetle activity period, use bait-away methods prior to and during the implementation of major earth disturbing activities that occur in known occupied American burying beetle habitat.

**GFW-TES-26** – Restrict the use of insecticides within known occupied American burying beetle habitat.

### Habitat Protection & Improvement

**GFW-TES-22** – Limit ground compaction to the minimum area possible during major earth disturbing activities (including, but not limited to new road and trail construction, mineral resource exploration and development, or new facilities) that occur in suitable American burying beetle habitat within 10 air miles of known occupied American burying beetle habitat.

**GFW-TES-24** – In occupied American burying beetle habitat, design new roads with the minimum safe width necessary for planned use of the road.

**GFW-TES-25** – Within 10 air miles of known occupied American burying beetle habitat, keep ground disturbance to a minimum during the reconstruction and maintenance of existing roads. Limit width of road, ditches, and surface materials to the minimum necessary for the planned use.

### Inventory, Analysis & Monitoring

Cooperate in efforts to determine the extent of occupied habitat on the WNF as reintroduction efforts continue on NFS lands and non-Federal lands.

Monitor annually and report every five years the answers to the following monitoring question, as required in Chapter 4 of the Forest Plan:

- a. What cooperative efforts were accomplished to achieve the reintroduction of the American burying beetle?

## D. Running Buffalo Clover

Additional resource management direction and guidance found in the Forest Plan and should be considered during project planning and implementation, as needed, to promote recovery of this species.

### Protection of Individuals

**Goal 5.1.4** – Actively manage known populations of running buffalo clover to maintain appropriate habitat conditions.

**SFW-TES-27** – Implement measures to protect known running buffalo clover populations during prescribed fire activities. These may include, but are not limited to wetting down the occupied area, raking off fuels from the occupied area, or constructing firelines around the occupied area.

**SFW-TES-28** – Avoid mechanical construction of firelines in known occupied RBC habitat. Mechanical fireline construction adjacent to known RBC populations must maintain appropriate light conditions in known occupied habitat.

**GFW-TES-29** – Restrict the application of herbicides within 25 feet of known running buffalo clover populations.

### Habitat Protection & Improvement

**Objective 5.1.4a** – Maintain partial to filtered sunlight over and adjacent to occupied habitat.

**SFW-TES-30** – Protect and maintain known RBC populations during road and trail construction, reconstruction, and maintenance by locating ground disturbance outside the occupied habitat. The appropriate light conditions must be maintained in the occupied habitat during such activities.

**GFW-TES-31**: Conduct surveys for running buffalo clover in suitable habitat prior to implementing ground or canopy disturbing activities.

### Education & Awareness

Ensure employees are familiar with locations of known running buffalo clover populations on the WNF.

Conduct annual refresher training on running buffalo clover identification for all field-going employees.

## Inventory, Analysis and Monitoring

**Objective 5.1.4b** – Conduct annual monitoring of known running buffalo clover populations and adjacent areas to identify potential risks or management needs.

Monitor annually and report every five years the answers to the following monitoring question, as required in Chapter 4 of the Forest Plan:

- a. What running buffalo clover population and habitat monitoring efforts were accomplished?

Appendix F2  
to the  
Final Environmental Impact Statement  
for the  
Wayne National Forest 2006 Land and Resource  
Management Plan

Final Biological Opinion  
on the  
Wayne National Forest Land and Resource Management  
Plan

issued by

USDI, Fish and Wildlife Service  
November 22, 2005



# **BIOLOGICAL OPINION**

on the

## **Wayne National Forest Land and Resource Management Plan**

for the

### **Federally-listed Endangered Indiana Bat (*Myotis sodalis*) and Running Buffalo Clover (*Trifolium soloniferum*)**

**Submitted to the Wayne National Forest**

**November 22, 2005**

Prepared by:

Sarena M. Selbo  
U.S. Fish and Wildlife Service  
Ohio Ecological Services Field Office  
6950 Americana Parkway, Suite H  
Reynoldsburg, Ohio 43068

This Page Intentionall left blank

## TABLE OF CONTENTS

INTRODUCTION .....	3
CONSULTATION HISTORY .....	3
BIOLOGICAL OPINION .....	10
<i>I. DESCRIPTION OF THE PROPOSED ACTION</i> .....	10
<u>Action Area</u> .....	22
<i>II. STATUS OF THE SPECIES</i> .....	23
<u>Indiana bat</u> .....	23
<u>Running buffalo clover</u> .....	31
<i>III. ENVIRONMENTAL BASELINE</i> .....	34
<i>IV. EFFECTS OF THE ACTION</i> .....	46
<i>V. CUMULATIVE EFFECTS</i> .....	75
<i>VI. CONCLUSION</i> .....	75
INCIDENTAL TAKE STATEMENT .....	77
<i>AMOUNT OR EXTENT OF TAKE ANTICIPATED</i> .....	77
<i>EFFECT OF THE TAKE</i> .....	78
<i>MONITORING</i> .....	79
REINITIATION NOTICE.....	79
LITERATURE CITED .....	80
Appendix A. Revised Forest Plan Conservation Plan for Federally Listed Species .....	87
<u>Conservation Direction and Guidance for all Federally Listed Species</u> .....	87
<u>Species-specific Conservation Direction and Guidance</u> .....	88
A. <b>Indiana Bat</b> .....	88
B. <b>Bald Eagle</b> .....	91
C. <b>American Burying Beetle</b> .....	92
D. <b>Running Buffalo Clover</b> .....	93
Appendix B. Documentation of Indiana bat on the WNF.....	95

## TABLES

Table 1. Management Area allocation by acres of WNF land.....	15
Table 2. Anticipated outputs for management activities for the first decade.....	21
Table 3. Acres of forest types by age class on National Forest System lands.....	35
Table 4. Comparison of mature hardwood forest age classes in 1985 and in 2003.....	35
Table 5. Effects analysis for Indiana bat.....	58
Table 6. Effects analysis for running buffalo clover.....	69
Table 7. Management activities rising to the level of take over ten years.....	78

## **INTRODUCTION**

This document transmits the U.S. Fish and Wildlife Service's (Service) Programmatic Biological Opinion (PBO) based on our review of the implementation of the Wayne National Forest (WNF) Revised Land and Resource Management Plan (Forest Plan) and projects predicated upon it, and its effects on the Indiana bat (*Myotis sodalis*) and running buffalo clover (*Trifolium stoloniferum*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). This biological opinion is based on information provided in the August 31, 2005 Wayne National Forest Programmatic Biological Assessment Land and Resource Management Plan; the Draft Environmental Impact Statement Proposed Land and Resource Management Plan, Wayne National Forest; the Proposed Revised Land and Resource Management Plan, Wayne National Forest, numerous meetings, phone conversations, and e-mail exchanges between the Service and the WNF. A complete administrative record of this consultation is on file at the Service's Reynoldsburg, Ohio Field Office (ROFO).

The Service will implement a tiered programmatic consultation approach to the WNF Revised Forest Plan. Tier I analyzes the Forest Plan as a whole at the program level. No specific projects are analyzed at this level. As individual projects are proposed under the Forest Plan, WNF will provide the Service with project-specific information that describes: 1) a description of the proposed action and the area to be affected including latitude and longitude information, 2) the species that may be affected and their known proximity to the project area, 3) a description of how the action may affect the species, 4) a determination of effects, 5) a cumulative total of incidental take that has occurred to date under the PBO, 6) a description of any additional actions or effects, if any, not considered in the tier I consultation. The Service will review the information provided by the WNF for each proposed project. During the review if it is determined that an individual project is not likely to adversely affect listed species, the Service will complete its documentation with a concurrence letter that refers to the PBO and specifies that the Service concurs that the project is not likely to adversely affect listed species. If it is determined that a project is likely to adversely affect listed species, the Service and Forest Service will engage in formal consultation for the project. Formal consultation culminates with the Service providing a tier II biological opinion with a project-specific incidental take statement if take is reasonably certain to occur.

## **CONSULTATION HISTORY**

The discovery of the Indiana bat on NFS land in 1997, along with reports of other federally listed species occurring near the WNF, prompted the Forest Service to begin amending the Forest Plan. Formal consultation was completed on September 20, 2001, when the Service issued its Programmatic Biological Opinion (PBO). The PBO set up a tiered consultation approach where the effects of the overall Forest Plan goals were analyzed, and the effects of future specific projects would be reviewed and analyzed and tiered back to the PBO (USFWS 2001). Forest Plan Amendment 13 incorporated all of the PBO terms and conditions into the Forest Plan. Since issuance of the PBO forty-two tier II BOs have been issued to the WNF, encompassing the alteration of 1,455.5 acres of potentially suitable habitat for the Indiana bat and the permanent loss of 21.08 acres.

The WNF and Service signed a Consultation Agreement on January 23, 2003 to address early coordination on the revision of the Forest Plan, which tiered to the national *Memorandum of Agreement on Section 7 Programmatic Consultations and Coordination among Forest Service, Bureau of Land Management, Fish and Wildlife Service, and National Marine Fisheries Service* signed August 30, 2000.

On September 19, 2003, the WNF and the Service discussed the draft Species Data Collection Forms (the products of the species viability evaluations) for the Indiana bat, American burying beetle, and bald eagle. Comments about the drafts, as well as conservation approaches, were incorporated into the final Species Data Collection Forms for these three species.

The WNF held three collaborative learning workshops during October and November 2003 in which the public was invited to develop themes for the revision alternatives. The Service attended the Athens workshop and participated in the development of themes.

The WNF and Service conducted their annual coordination meeting on January 6, 2004, at which time the preliminary management areas and alternatives were displayed.

On March 1, 2004, the WNF made a request to reinstate formal consultation to modify the incidental take statement in the 2001 PBO for the Forest Plan to encapsulate the effects of the 2003 ice storm and other unanticipated forest health improvements on the WNF. The Service amended the 2001 Biological Opinion on March 8, 2004.

The WNF met with the Service on March 23, 2004 to describe in detail alternatives for the revised Forest Plan.

The WNF requested an updated list of species to include in the Forest Plan revision and biological evaluation on February 25, 2004. The Service responded on March 24, 2004 with a list of nine federally endangered or threatened plants and animals that should be addressed in the revision. In addition, the Service recommended that the WNF address the cerulean warbler, sheepnose mussel, and rayed bean mussel in the revision of the Forest Plan. On April 14, 2004, the WNF informed the Service that the rayed bean mussel is found outside the WNF proclamation boundary in the Scioto Brush drainage, and that no NFS lands or any lands within the WNF proclamation boundary drain into this watershed. The Service responded via email that no direct, indirect, or cumulative effects are expected to the rayed bean mussel from management actions on the WNF. The cerulean warbler is a Regional Forester sensitive species and the sheepnose mussel is proposed for Regional Forester sensitive species designation; both were addressed during the revision process.

Several informal reviews of the draft Forest-wide direction occurred between the WNF and Service during April-June 2004.

The Consultation Agreement was amended on May 17, 2004 to reflect new employee contacts and a revised timeline for the Forest Plan revision.

The Service informed the WNF on June 21, 2004 that the agency was working on a candidate assessment for the eastern hellbender, and they recommended the WNF consider this species in the revision. The WNF responded on June 22, 2004 that the eastern hellbender is one the WNF Regional Forester Sensitive Species and was included in the species viability evaluation process, and would be included in the revision.

The draft biological evaluation for the Forest Plan revision was developed by the WNF and reviewed by the Service multiple times between June and November 2004.

The Consultation Agreement was amended on April 18, 2005 to reflect a revised timeline for the Forest Plan revision.

The WNF requested an updated list of federally listed or proposed species to address in the biological assessment on July 7, 2005. The Service responded on July 11, 2005 that the species list was the same as that noted in the March 24, 2004 letter received from the Service. The Service noted in our July 11, 2005 response that the biological assessment would not have to include the sheepnose mussel or the cerulean warbler (as noted in the March 24, 2004 letter) as these species have not been proposed for listing at this time.

A population of running buffalo clover was found on the Ironton Ranger District in June 2005. The Service was notified of the population on August 9, 2005 and verified the finding on August 23, 2005.

The WNF and Service met informally on August 16, 2005 to discuss effects of the Selected Alternative on federally listed species, as well as clarifications of Revised Forest Plan standards and guidelines.

The WNF prepared a Biological Assessment to disclose the effects of the Selected Alternative (Alternative E<sub>mod</sub>) on the nine federally listed species. It was completed in August 2005.

In their request for formal consultation received by the Service on September 1, 2005, the WNF determined that the Forest Plan is likely to adversely affect the endangered Indiana bat (*Myotis sodalis*) and running buffalo clover (*Trifolium stoloniferum*) and is not likely to adversely affect the endangered American burying beetle (*Nicrophorus americanus*), fanshell mussel (*Cyprogenia stegaria*), pink mucket pearly mussel (*Lampsilis abrupta*), and the threatened bald eagle (*Haliaeetus leucocephalus*), Virginia spiraea (*Spiraea virginiana*), northern monkshood (*Aconitum noveboracense*), and small whorled pogonia (*Isotria medeoloides*).

WNF requested our concurrence on these effect determinations. In a letter dated September 22, 2005, we concurred with WNF's determinations and indicated that the initiation package associated with the request for formal consultation was complete in accordance with 50 CFR §402.14.

The Service concurred with WNF's effect determination of "not likely to adversely affect" for the **American burying beetle** based on the following: (1) suitable habitat for this species occurs in the action area but no individuals have been detected in the area during past surveys, (2) the Forest Plan will not significantly reduce suitable habitat for the species in the landscape; the

Historic Forest management area was developed, in part, to provide open to semi-open mature woodlands for species like the American burying beetle, and (3) the following standards and guidelines will be applied during project planning and implementation to protect individuals and protect and improve potential habitat.

**GFW-~~TES-21~~** – Discourage the use of bug zappers by campers in dispersed or developed recreation sites within 10 air miles of known occupied American burying beetle habitat.

**GFW-~~TES-22~~** – Limit ground compaction to the minimum area possible during major earth disturbing activities (including, but not limited to new road and trail construction, mineral resource exploration and development, or new facilities) that occur in suitable American burying beetle habitat within 10 air miles of known occupied American burying beetle habitat.

**GFW-~~TES-23~~** – During the American burying beetle activity period, use bait-away methods prior to and during the implementation of major earth disturbing activities that occur in known occupied American burying beetle habitat.

**GFW-~~TES-24~~**– In occupied American burying beetle habitat, design new roads with the minimum safe width necessary for planned use of the road.

**GFW-~~TES-25~~** – Within 10 air miles of known occupied American burying beetle habitat, keep ground disturbance to a minimum during the reconstruction and maintenance of existing roads. Limit width of road, ditches, and surface materials to the minimum necessary for the planned use.

**GFW-~~TES-26~~** – Restrict the use of insecticides within known occupied American burying beetle habitat.

At this time the Forest Plan is not likely to adversely affect the Americana burying beetle due to the beetle's lack of presence. The WNF is working towards reintroducing the American burying beetle on the Forest. Once introduced, potential adverse effects to the American burying beetle from the WNF's Forest Plan, as proposed, will be undetectable or unlikely due to the standards and guidelines above.

The Service concurred with WNF's effect determination of "not likely to adversely affect" for the **fanshell mussel** based on the following: (1) no individuals occur within the action area, (2) suitable habitat for host fish occur within the action area, but no currently suitable habitat for the fanshell occurs, (3) ground disturbance activities that impact water quality will be minimized by integrating Forest-wide standards and guidelines (USFS 2005), and (4) habitat improvements may occur due to management that emphasizes retaining, restoring, and enhancing riparian corridors and riverine systems. Based upon this information, any potential adverse effects to the fanshell mussel from the WNF's Forest Plan, as proposed, are expected to be beneficial.

The Service concurred with WNF's effect determination of "not likely to adversely affect" for the **pink mucket pearly mussel** based on the following: (1) no individuals occur within the action area, (2) no currently suitable habitat for the pink mucket pearly mussel occurs, and (3)

habitat improvements may occur due to management that emphasizes retaining, restoring, and enhancing riparian corridors and riverine systems. Based upon this information, potential effects to the fanshell mussel from the WNF's Forest Plan, as proposed, are anticipated to be beneficial, as it may improve habitat for future recolonization.

The Service concurred with WNF's effect determination of "not likely to adversely affect" for the **bald eagle** based on the following: (1) suitable habitat for this species occurs in the action area, but there are no nesting or summering populations of bald eagles, (2) the Forest Plan will not significantly reduce suitable habitat for the bald eagle on the landscape and will protect and improve nesting and roosting habitat in the long term, and (3) the following forest-wide standards and guidelines will prevent risks to individual eagles and their habitat should they appear.

**SFW-TES-15** – Focus winter bald eagle searches in areas that eagles are known to frequent or where concentrated food sources occur near NFS land. Conduct searches during early-, mid-, and late-winter. Follow search criteria outlined in the Northern States Bald Eagle Recovery Plan.

**SFW-TES-16** – Protect any bald eagle communal night roosts and concentrations (including nests) discovered during winter surveys or during any additional field surveys or proposed project areas, following guidelines outlined in the Northern States Bald Eagle Recovery Plan.

**SFW-TES-17** – Report discovery of bald eagle nests immediately to the U. S. Fish and Wildlife Service and the Ohio Department of Natural Resources, Division of Wildlife.

**SFW-TES-18** – Protect supercanopy trees, or other identified congregation roost trees, along major river corridors and lakes in addition to following Forest-wide riparian area standards and guidelines.

**SFW-TES-19** – Allow no prescribed fire within one-half mile of occupied bald eagle sites. Consider all bald eagle communal night roosts, daytime concentration sites, or occupied breeding territories as occupied sites. To prevent smoke inversion from occurring at occupied bald eagle sites, and to minimize smoke drifting toward them from prescribed fires outside the one-half mile radius of occupied sites, require burn plans to take into account of wind direction, speed, and mixing height as well as transport winds.

**SFW-TES-20** – If the bald eagle is found nesting on the Wayne National Forest, monitor populations according to the recovery plan. At such time as the bald eagle is de-listed, use the de-listing monitoring plan.

The WNF will protect all supercanopy trees or other identified congregation roost trees for bald eagles along major river corridors and lakes and will protect known nests and roosts as described in the Bald Eagle Recovery Plan, or as directed by the Service. The WNF will provide field training for new employees so they will be able to recognize bald eagle signs at night roosts, even when eagles are absent. In addition by June 1 of each year the WNF will provide an annual report to the Service which includes the following:

- a. Results of any winter searches for communal bald eagle night roosts and concentrations, including mid-winter bald eagle surveys conducted in cooperation with the Service;
- b. Discovery of any bald eagle nesting territories on the WNF. If no surveys have been conducted and no territories discovered on the WNF during an annual reporting period, an annual report should be submitted with a statement to this effect;
- c. Documented cases of a prescribed fire that behaved contrary to predicted movement patterns and which resulted in a confirmed adverse impact to bald eagles.

Based upon the above information, potential adverse effects to the bald eagle from the Forest Plan, as proposed, are anticipated to be insignificant and discountable.

The Service concurred with WNF's effect determination of "not likely to adversely affect" for the **Virginia spiraea** based on the following: (1) suitable habitat exists within the action area but no individuals have been detected, (2) while ground disturbance will occur during management implementation, Forest-wide standards and guidelines are incorporated to minimize erosion, stabilize disturbed areas, and minimize adverse effects from non-native invasive species, (3) Forest-wide standards and guidelines ensure proper pesticide use on the Forest, (4) surveys will be conducted on lands affected by land exchange, surface-disturbing activities and vegetation removal, and (5) the Forest Plan incorporates beneficial management activities that would protect, restore, and create suitable habitat for the species. Based upon the above information, potential adverse effects to Virginia spiraea from the Forest Plan, as proposed, are insignificant and discountable and potentially beneficial.

The Service concurred with WNF's effect determination of "not likely to adversely affect" for the **northern monkshood** based on the following: (1) suitable habitat exists within the action area but no individuals have been detected, (2) Forest-wide standards and guidelines protect streams and rock shelters, a preferred habitat of northern monkshood, (3) while ground disturbance will occur during management implementation, Forest-wide standards and guidelines are incorporated to minimize erosion, stabilize disturbed areas, and minimize adverse effects from non-native invasive species, (4) Forest-wide standards and guidelines ensure proper pesticide use on the Forest, (5) surveys will be conducted on lands affected by land exchange, surface-disturbing activities and vegetation removal, and (6) the Forest Plan incorporates beneficial management activities that would protect, restore, and create suitable habitat for the species. Based upon the above information, potential adverse effects to northern monkshood from the Forest Plan, as proposed, are discountable and potentially beneficial.

The Service concurred with WNF's effect determination of "not likely to adversely affect" for the **small whorled pogonia** based on the following: (1) suitable habitat for this species occurs in the action area but no individuals have been detected during surveys, (2) while ground disturbance will occur during management implementation, Forest-wide standards and guidelines are incorporated to minimize erosion, stabilize disturbed areas, and minimize adverse effects from non-native invasive species, (3) Forest-wide standards and guidelines ensure proper pesticide use on the Forest, (4) surveys will be conducted on lands affected by land exchange,

surface-disturbing activities and vegetation removal, and (5) the Forest Plan incorporates beneficial management activities that would protect, restore, and create suitable habitat for the species. Based upon the above information, potential adverse effects to small whorled pogonia from the Forest Plan, as proposed, are insignificant and potentially beneficial.

Consultation on the American burying beetle, bald eagle, fanshell mussel, pink mucket pearly mussel, Virginia spiraea, northern monkshood, small whorled pogonia for this project, as proposed, has concluded. These species will not be considered further in this Biological Opinion. Should, during the term of this action, additional information on listed or proposed species or their critical habitat become available, or if new information reveals effects of the action that were not previously considered, the WNF should contact the Service to determine whether these determinations are still valid.

## **BIOLOGICAL OPINION**

This tier I programmatic biological opinion will evaluate the project at two scales: 1) at the program level—how the overall goals of the Forest Plan will affect the species across the landscape and over the long-term, and 2) at the management level – how specific future actions may affect species. For the management level review, we identify the specific elements associated with each management action, identify the environmental consequences associated with each project element, identify the listed species that may be exposed to these environmental consequences, and assess how exposed individuals, populations and species will respond in terms of individual fitness and population and species level viability.

### **I. DESCRIPTION OF THE PROPOSED ACTION**

The WNF proposes to revise the 1988 Forest Land and Resource Management Plan. The 2005 Forest Plan is used to guide all natural resource management activities on the WNF to meet the objectives of federal law, regulations, and policy. No project level decisions have been considered or made during the revision process.

The goals of the Revised Forest Plan are to improve watershed health, provide plant and animal habitat to support viability of all native species, provide a variety of recreation opportunities matched to the capabilities of the Forest and public demand, lease federally-owned oil and gas resources, continue to consolidate National Forest ownership through land acquisition, and contribute to the economies of local communities.

Management Areas (MA) are the foundation of the Forest Plan and provide the framework from which land management decisions are made. To achieve the desired future conditions for each MA and the reach the above stated goals, various management activities will be applied. The MAs for the WNF Forest Plan are listed below with a description of the overall resource goals and desired future conditions they represent and the amount of land allocated to that MA. Following the landscape level discussion is a description of the specific activities/actions needed to reach those management goals, and the standards and guidelines for the Indiana bat and running buffalo clover that apply to each action.

#### **Management Areas**

##### *Diverse Continuous Forest (DCF)*

Large blocks of mature forest that contain a variety of tree species of diverse ages and sizes characterize this management area. These features provide habitat for interior-forest wildlife species. Shade tolerant/fire intolerant species such as maple and beech are becoming more predominant in the forest understory and canopy on the more mesic sites in this management area. The effects of low-intensity ground fire are evident, generally on ridges and drier slopes where efforts to perpetuate oak and hickory species are emphasized. The goal is to manage these areas to reflect a variety of mature forest conditions maintained over time using predominately uneven-aged timber harvest and occasional prescribed fire. Moderate amounts of dispersed,

non-motorized recreational opportunities are offered in this management area. Examples of dispersed recreational activities that occur in these areas include hiking, mountain bike riding, horseback riding, hunting, fishing, viewing scenery and wildlife, and gathering forest products.

#### *Diverse Continuous Forest with Off-Highway Vehicles (DCFO)*

This management area emphasizes trails for motorized recreation and mature forest habitat for conservation of forest interior species. Vegetation conditions and management are similar to the Diverse Continuous Forest MA. Off-highway vehicle trails are developed and maintained to provide safe trail riding. Moderate amounts of non-motorized recreation are also available. Hiking, horse, and mountain bike trails may be created to connect an existing trail system as long as these do not interfere with the ATV/OHM trails.

#### *Historic Forest (HF)*

The emphasis of this management area is restoration and maintenance of the mixed oak ecosystem through a combination of mostly uneven-aged timber harvest, frequent prescribed fire and herbicide use (to remove competing maples in the understory). Forest conditions have always varied over space and time, due to natural processes and changes in climate as well as natural and man-made disturbances. Forest ecologists believe current conditions of the central hardwood forests lie outside the historic range of variability. The desired future condition of this management area is a mix of vegetation more nearly resembling the historic range that existed prior to 18<sup>th</sup>/19<sup>th</sup> century settlement and development.

A variety of wildlife habitat is provided with emphasis on habitat for species dependent on large oak and hickory trees and a near-continuous canopy. The open nature of the forest and the hard mast produced by the oaks and hickories would provide habitat for many animals. Moderate amounts of non-motorized recreation opportunities are provided. These include viewing wildlife and scenery, hunting, horseback riding, fishing, trapping, and hiking. In some areas, trails may provide access for non-motorized activities.

#### *Historic Forest with Off-Highway Vehicles (HFO)*

This management area emphasizes providing trails for motorized recreation and the restoration and maintenance of the mixed oak ecosystem through a combination of mostly uneven-aged timber harvest and frequent prescribed fire. Vegetation conditions and management are similar to the Historic Forest MA. Motorized recreation opportunities are also emphasized. Off-highway vehicle trails are developed and maintained to provide safe trail riding. Moderate amounts of non-motorized recreation are also available. Hiking, horse, and mountain bike trails may be created to connect an existing trail system as long as they do not interfere with the ATV/OHM trails.

#### *Forest and Shrubland Mosaic (FSM)*

Early successional habitat patches of various sizes are distributed throughout a forested landscape. Shrub and seedling/sapling forest habitats, along with associated species, flourish and contribute to overall landscape biodiversity and conservation. As shrub and seedling/sapling forest habitats grow into stands of pole-sized trees, new shrub and seedling/sapling forest habitat are created by even-aged timber harvest. The mix of forest communities runs from oak and hickory in the uplands and on drier hillsides to yellow poplar, beech, maples, oaks, hickories and other mesic species on moist slopes and in bottomlands. Native pine communities occur in

portions of this area. The future desired condition of this MA is a combination of early, mid, and late successional forest. Prescribed fire plays a role in the maintenance of some forest communities and species, ensuring the continued presence of fire-adapted ecosystems. Trails for hiking, mountain biking, and horseback riding may be provided. Hiking, mountain biking, horseback riding, hunting, fishing, viewing scenery and wildlife, and gathering forest products are examples of recreational activities that may occur in these areas.

#### *Grassland-Forest Mosaic (GFM)*

This management area emphasizes habitat for grassland-dependent wildlife species on reclaimed coalmine lands. Dispersed, non-motorized recreation opportunities are offered in this management area. A mosaic of large grassland areas edged with shrub and various-aged forest habitat is provided. Recurrent application of prescribed fire and mowing retards succession to shrubs and trees, promotes growth of grasses and forbs and a diversity of grassland habitats. This provides habitat for grassland-dependent species such as Henslow's sparrow and bobwhite quail. The forested areas surrounding these grasslands are managed as a mosaic of early successional habitat patches of various sizes that intersperse the predominately forested landscape. To replace areas growing out of this habitat condition, new early successional forest habitat is created using predominately even-age timber management. This provides habitat for shrubland-dependent species such as the prairie warbler and yellow-breasted chat. Hiking, mountain biking, horseback riding, hunting, fishing, viewing scenery and wildlife, and berry picking are examples of the recreational activities that occur in these areas.

#### *Future Old Forest (FOF)*

Mostly old forest that changes only as a result of natural disturbances and natural succession characterizes this management area. These areas offer Forest visitors opportunities to experience solitude and closeness to nature. Natural processes will eventually change the forest composition of this management area. Over time, shade tolerant/fire intolerant tree species, such as maple and beech, will dominate the understory and canopy. Conversely, the amount of oaks and hickories will decline. Rare communities and associated species not dependent on disturbances will continue to exist, but disturbance-dependent communities will generally decline across this management area. Terrestrial wildlife associated with this area includes area-sensitive forest interior species such as the worm-eating warbler, Louisiana waterthrush, cerulean warbler, and wood thrush as well as species sensitive to human disturbance, such as black bear. Forest Service roads will be closed and decommissioned where they are no longer needed, except for access to private oil and gas developments or similar specific uses. Use of roads that access privately held sub-surface rights or existing federal leases are restricted to only those users or their agents to access, develop, or maintain their property. In some portions of the area, access for hiking, horseback riding, viewing wildlife and scenery, fishing, and other non-motorized forms of recreation is provided by trails. Interaction among users is low to moderate. There is subtle evidence of other users except in the vicinity of oil and gas developments. The target recreation experience is semi-primitive, non-motorized.

#### *Future Old Forest with Mineral Activity (FOFM)*

This management area is located on the Marietta Unit of the Athens Ranger District. Similar to the Future Old Forest (FOF) Management Area, a primarily custodial regime of vegetation management is implemented. This will promote mostly old forest that changes only as a result of natural disturbance and succession, and will provide opportunities for relatively primitive

recreation experiences. Unlike the FOF Management Area, however, surface occupancy of federal oil and gas leases is permitted here. Many oil and gas wells are already present within this management area, both on lands in private surface ownership and on NFS land where the subsurface minerals are privately owned (outstanding and reserved rights).

#### *River Corridor (RC)*

This management area emphasizes retaining, restoring, and enhancing the inherent ecological processes and functions associated with riverine systems. Management will protect or enhance the scenic quality of these areas to provide high-quality recreation opportunities. This management area includes linear-shaped corridors along Symmes Creek, the Hocking River, the Little Muskingum River, and the Ohio River. National Forest System land along streams and rivers is predominantly forested; however, some floodplain wetlands or herbaceous-shrub communities may occur. Vegetative conditions are maintained over time using mostly uneven-aged techniques. The floodplains function as storage areas for floodwaters, sources of organic matter for the streams and rivers, and habitat for riparian wildlife species. Aquatic communities are maintained or are returning to their historic compositions and distributions. Aquatic habitat conditions contribute to the conservation of species that reside in these mainstem streams and rivers. Roads within and on the perimeter of this management area are used for a variety of recreation activities. In some areas, boat ramps provide access for motorized and non-motorized boating. Viewing scenery and wildlife, fishing, hunting, trapping, canoeing, hiking, picnicking, and camping are key recreation activities. Trails in this management area are open only to non-motorized use.

#### *Developed Recreation (DR)*

This management area emphasizes management of existing recreation facilities and the future needs of the highly developed sites that serve large numbers of people. This management area includes both existing and potential developed recreation sites and vicinities on the Forest. The landscape in and around these developed recreation areas varies from park-like to mature forest. Waterbodies are often associated with these areas. A variety of native wildlife is present, ranging from species accustomed to campgrounds and high human use to those that inhabit mature forest habitats. Ponds and lakes in developed recreation areas generally contain game fish such as largemouth bass, bluegill, and channel catfish. A variety of wildlife and nature viewing opportunities are available within and near developed recreation sites. Roads and trails provide access within the more developed areas. Trails lead to lakesides, riverbanks, and undeveloped areas. Roads and trails accommodate the high-density recreation use and related activities associated with the area. Facilities include campgrounds, picnic areas, boat ramps, interpretive sites, overlooks, swimming areas, and trailheads. Universal access is available to some existing and all newly constructed facilities and structures. Because this is an area of high public use and visibility with major public investments in facilities and structures, priority is given to acquisition of private in-holdings and subsurface mineral rights. Such acquisition consolidates NFS surface and subsurface ownership.

### *Timbre Ridge Lake (TRL)*

This management area is located in eastern Lawrence County on the Ironton Ranger District. Timbre Ridge Lake provides quality fishing opportunities in a natural setting. Boating is limited to small watercraft powered manually or by electric motors. In addition to fishing, visitors may participate in low-impact, dispersed recreational activities, such as hiking, mountain biking, backcountry camping, hunting, wildlife viewing, and picnicking. Water quality in Timbre Ridge Lake and its feeder streams contributes to the recreational fishing experience. Water quality parameters meet or exceed state standards throughout the life of the Forest Plan. Recreation facilities intended for use by low numbers of people are present but do not diminish the scenic value of the area. Universal access is provided to some existing and all newly constructed facilities and structures. Natural site characteristics dominate the development. Rustic facilities of informal design are available. Road access to the boat launch facility, the dam, and to private land in-holdings is maintained. Secondary emergency road access to the dam is also maintained. The landscape around the lake is mostly a closed-canopy hardwood forest, with especially colorful views in the spring and fall. Over time, the forest will change as a result of natural succession and disturbances (similar to the Future Old Forest Management Area).

### *Special Areas (SA)*

This management area emphasizes the preservation, management, and study of unique natural areas. These areas are regionally or locally significant and have been formally designated upon recommendation by a review committee and approval by the Regional Forester.

These areas meet one or more of the following criteria:

- Be representative of unique geological, ecological, cultural or other scientific values
- Be an appropriate area for scientific research
- Have potential to be a regional or national landmark based on natural or cultural values.

Areas allocated to this management area are scattered throughout the WNF. Sizes vary, ranging from a few acres to several hundred acres. These areas are individually unique and generally not connected to each other. All activities in these areas are to be consistent with the protection or maintenance of the unique characteristics for which an area was designated (e.g., protecting and perpetuating populations of rare plants or communities). Recreation activities are also limited to those consistent with the purpose for which an area was designated. A system of hiking trails may provide access for administrative and recreational purposes.

### *Research Natural Areas (RNA)*

Research Natural Areas are nationally significant areas with unique ecosystems deemed worthy of preservation for scientific purposes. Research is conducted in these areas to better understand their natural processes. An RNA must meet one or more of the following criteria:

- Contributes to the protection of diversity of vegetation communities and wildlife habitat
- Typifies important forest, shrubland, grassland, alpine, aquatic, and geologic types
- Represents special or unique characteristics of scientific interest and importance

- Helps legal requirements, such as providing habitat for endangered species
- Protects or maintains special aquatic, geologic or potential natural vegetation and faunal communities or protects cultural resources.

*Candidate Areas (CA)*

This management area emphasizes the preservation of potential RNAs and special areas. Management is directed at protecting the potentially unique characteristics of an area until it can be studied for designation as an RNA or Special Area. Management activities are limited to those necessary for maintaining public health and safety or for treating non-native invasive species.

Table 1. Management Area allocation by acres of WNF land

<b>MA</b>	<b>Acreage</b>
Candidate Areas	981
Developed Recreation	4,078
Diverse Continuous Forest	55,267
Diverse Continuous Forest with OHVs	22,626
Forest and Shrubland Mosaic	54,580
Future Old Forest	16,478
Future Old Forest with Mineral Activity	10,154
Grassland and Forest Mosaic	5,334
Historic Forest	26,278
Historic Forest with OHVs	21,274
Research Natural Areas	117
River Corridors	12,544
Special Areas	7,546
Timbre Ridge Lake	796
<b>Total</b>	<b>238,053</b>

**Management Actions**

To help achieve the desired conditions for each MAs, WNF proposes to implement the following types of management actions. In addition to the general description, WNF identified specific standards and guidelines (S&G) to protect listed species. S&Gs that apply to a specific action are listed below the action and fully described in Appendix A.

*Even-aged harvest*

Even-aged harvests including clearcut, shelterwood, thinning, and two-aged methods result in the removal of most trees in areas 2-30 acres in size. Even-aged prescriptions are on a 120 year rotation. Even-aged management allows for various aged stands across the landscape and is used in the DCF, DCFO, FSM, GFM, and RC management areas. Even-aged harvests can occur any

time of year. The WNF anticipates that the maximum amount of even-aged management to occur within the next ten years to be 1,725 acres of hardwoods and 200 acres of pine. The following S&Gs will protect listed species and their habitats when this activity is conducted: SFW-~~TES-2~~, GFW-~~TES-3~~, SFW-~~TES-7~~, GFW-~~TES-9~~, SFW-~~TES-10~~, and SFW-~~TES-12~~.

#### *Uneven-aged harvest*

Uneven-aged management removes individuals or groups of trees and opens a portion of the canopy. Uneven-aged forest stands are those which have three or more age classes. This management activity would occur in the DCF and DCFO management areas, but would also occur to a lesser degree in the FSM, FSMO, GFM, and RC management areas. Uneven-aged timber harvests can occur any time of the year at varying frequencies. Forest stands are entered about every third decade to create an all-aged stand structure. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-~~TES-2~~, GFW-~~TES-3~~, SFW-~~TES-8~~, GFW-~~TES-9~~, SFW-~~TES-10~~, and SFW-~~TES-12~~.

#### *Prescribed fire and fire suppression*

Prescribed fire is used on the WNF to control hazardous fuel build-up, to promote oak-hickory regeneration, to maintain barrens and grassland habitats, and to control non-native invasive species. Prescribed fire activities include the creation of fire lines using bulldozers or hand tools and the removal of hazard trees. Prescribed fire management is particularly important in the HF and HFO management areas, but will also be used in DCF, DCFO, and FSM. Prescribed fire occurs frequently across the above management areas, with a rotation schedule of 5-10 years at a given site. Prescribed fire on the WNF and other eastern hardwood forests usually consists of low intensity ground-level fire. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-~~TES-2~~, GFW-~~TES-3~~, SFW-~~TES-4~~, SFW-~~TES-11~~, SFW-~~TES-27~~, and SFW-~~TES-28~~. Fire suppression will take place when a wildfire occurs on the WNF. Suppression actions may include creating fire breaks with bulldozers or hand tools, applying foam, and applying water with hoses or by helicopter.

#### *Hazardous fuels reduction – mechanical methods*

Hazardous fuels reduction will occur primarily in stands where fuels are greatest, often in pine stands. The work would involve the lopping and scattering of woody material on the ground. It is possible that a leaning or standing tree would be felled, either as part of the fuels reduction work or to protect workers from a potential hazard tree. The purpose of this management activity is to reduce wildfire in areas damaged by the 2003 ice storm. Frequency and intensity of this activity will be high for the next couple years, and then will reduce once the areas damaged by the ice storm are addressed. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-~~TES-2~~ and GFW-~~TES-3~~.

#### *Crop tree release and grape vine control*

Crop tree release and grape vine control involve the manual treatment of individual vines and trees in young, even-aged stands. Trees cut during crop tree release are small in diameter (sapling stage). If feasible, cut trees are not felled, but are left standing through girdling and may provide future snags. These management activities will occur in the DCF, DCFO, FSM, and GFM management areas. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-~~TES-2~~, GFW-~~TES-3~~, GFW-~~TES-9~~, SFW-~~TES-10~~, and SFW-~~TES-12~~.

### *Construction of waterholes, ponds, lakes and restoration of wetlands*

Construction of ponds, lakes and waterholes will occur in already disturbed areas in conjunction with other activities (e.g. timber harvest, oil and gas development) for the benefit of fish and wildlife. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-TES-2, GFW-TES-3, and GFW-TES-14.

### *Riparian and aquatic habitat restoration*

Riparian and aquatic habitat restoration includes activities that decrease the input of sediment into streams and activities that results in direct improvements. These activities include bank stabilization, culvert repairs, tree planting, placement of large woody debris in streams, and reconstruction of the natural dimension, pattern, and profile of streams.

### *Development of permanent forest openings*

Forest openings are generally 1-5 acres in size and on the periphery of larger tracts of forested land. Development of new forest openings primarily would occur by designating existing open land on acquired properties to serve as permanent forest openings. Similarly, development of agreements with utility companies would be pursued to manage utility corridors as quality permanent forest openings. While it could occur, the probability is low that forested area would be converted to a permanent forested opening. For example, log landings have been designated as openings after a timber harvest was completed, and then maintained. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-TES-2, GFW-TES-3, SFW-TES-7, GFW-TES-9, SFW-TES-10, and SFW-TES-12.

### *Land exchange and acquisition*

Land acquisition and exchange is a management action used to consolidate federal ownership. Land acquisition creates larger, more contiguous areas of protected land. High priority is given to exchanges or acquisitions that protect or enhance endangered species habitat.

### *Road decommissioning*

Road decommissioning allows roads to revert back to natural vegetative cover and eliminates unneeded stream crossings.

### *Permanent roads and trails – construction and reconstruction*

Construction of permanent roads occurs in association with timber harvest, while trails are constructed for recreational uses such as OHV, hiking, horseback riding, and mountain biking. Roads and trails vary in size from a clearing width of 30 feet to 5 feet. The majority of roads have a clearing width of 22 feet and a road surface of 12 feet. Silvicultural prescriptions for uneven-aged and even-aged management require multiple entries into the same stand to attain, and then maintain, the desired future habitat conditions. The road system in areas treated with uneven-aged management methods is generally larger than that needed in areas treated with even-aged management methods. While some road construction may be necessary in both situations, existing roads can be reconstructed and used in the future, keeping the road system footprint basically the same over time. To bring roads up to the appropriate standard, trees are removed from the road bed and drainage structures are repaired or improved during reconstruction. Some of these reconstructed roads may be gated and closed to vehicle use, or may be converted to recreational trails until they are needed once again to conduct timber

harvesting or other management activities. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-~~TES-1~~, SFW-~~TES-2~~, GFW-~~TES-3~~, GFW-~~TES-9~~, SFW-~~TES-10~~, SFW-~~TES-12~~, and SFW-~~TES-30~~.

#### *Temporary roads, skid trails, and log landings*

Temporary roads are necessary to accomplish various projects. The clearing width can be as wide as 22 feet, with a surface width of at least 10 feet. The road is revegetated and after a period of a few years, trees are likely to be present again. The same is true for skid trails and log landings used in timber harvesting operations. These activities may involve soil compaction, erosion and increased susceptibility of areas to non-native plant invasion and establishment. Construction of temporary roads will increase over the next couple years as timber activities are initiated, but over time will decrease as all the necessary roads are constructed. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-~~TES-2~~, GFW-~~TES-3~~, GFW-~~TES-9~~, SFW-~~TES-10~~, SFW-~~TES-12~~, and SFW-~~TES-30~~.

#### *Oil and gas development and reclamation of orphan wells*

Oil and gas exploration and development is on-going throughout the WNF. Activities associated with mineral development include removal of vegetation and topsoil required for the construction of access roads, well pads, and pipeline corridors. Once depleted, the operators are required to restore the disturbed areas. No Surface Occupancy (NSO) restrictions for USA-owned minerals are in place in the FOF, CA, SA, RNA, DR and TRL management areas. Reclamation of depleted or orphan wells have the same initial impacts as mineral development, however these areas are closed and rehabilitated. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-~~TES-2~~, GFW-~~TES-3~~, GFW-~~TES-9~~, SFW-~~TES-10~~, SFW-~~TES-12~~, SFW-~~TES-30~~, and Forest Plan Appendix H: Notification 3, Stipulation 10, Stipulation 12.

For outstanding private minerals, a minerals operation plan will be negotiated. In the process of reviewing the plan of operation for reserved rights, or when negotiating the terms and conditions of a plan of operation for outstanding minerals, the WNF will request a voluntary adherence to Forest Plan S&G that protect endangered species and their habitat. Outstanding mineral rights and reserved rights are non-discretionary actions that cannot be considered during this programmatic consultation.

#### *Surface coal mining*

Surface coal mines would alter and remove surface soils and vegetation. Permanent removal of forested habitat would occur. On the Ironton District, one company holds valid existing rights to strip mine coal on approximately 1,200 acres of land. The company is planning to conduct coal exploration drilling to determine the quality and quantity of the coal with the possibility of strip-mining in the future. Because of legal problems, it is unclear at this point if the company will actually proceed with the coal operations in the next ten years. If they do, it will severely disturb approximately 1,200 acres of NFS lands.

The Forest Service has no control over this projected activity since private mineral rights are involved, however the Forest Service would work closely with the operator to incorporate Forest-wide S&G into the operation plan.

### *Utility corridors*

Utility companies apply for a special use permit to construct corridors for transmission of water, electricity, or other utilities to private lands across NFS lands. Utility corridors are linear and vary in width. Most are narrow and placed in road right of ways, but a few could be larger transmission lines that transverse the forest and leave a permanent linear canopy gap. Vegetation is periodically removed along utility lines and soils may become compacted. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-~~TES-2~~, GFW-~~TES-3~~, GFW-~~TES-9~~, SFW-~~TES-10~~, and GFW-~~TES-29~~.

### *Construction of recreation facilities and parking lots*

Construction of recreation facilities and parking lots may involve clearing and grading and the use of heavy machinery. Such sites are usually kept in park-like roadside settings and are small (about 5 acres). The following S&G will protect listed species and their habitats when this activity is conducted: SFW-~~TES-2~~, GFW-~~TES-3~~, GFW-~~TES-9~~, SFW-~~TES-10~~, and SFW-~~TES-13~~.

### *AMD projects and closure of mine portals*

Areas targeted for acid mine drainage (AMD) treatment often have a history of underground and surface mining that has restricted or altered natural water flows. Often these mine drainages result in barren soils unable to support vegetation due to highly acidic soils. AMD treatments consist of active and passive methods including doser systems, construction of wetlands, open limestone channels, and anoxic limestone drains and often involve closing mine portals. AMD projects may involve large amounts of soil movement and disturbance to restore surface drainage. The construction and heavy equipment involved may require some tree removal and soil compaction. Subsidence and mine portals are not only a public safety concern, they are points where surface water can enter underground chambers and recharge acid mine drainage. The WNF proposes to close a portion of the hundreds of subsidences and open portals that currently exist. Closing them could involve backfilling or installation of bat-friendly gates. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-~~TES-2~~, GFW-~~TES-3~~, SFW-~~TES-5~~, GFW-~~TES-9~~, SFW-~~TES-10~~, and GFW-~~TES-14~~.

### *Installation of bat-friendly gates*

Installation of bat friendly gates involves the removal of soils around mine openings in order to sink gates below ground surface. Soils are returned to pre-installation conditions to avoid changing airflows and micro-environments. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-~~TES-2~~, GFW-~~TES-3~~, SFW-~~TES-5~~, GFW-~~TES-6~~, GFW-~~TES-9~~, and SFW-~~TES-10~~.

### *Reforestation*

Reforestation occurs on open lands, such as agricultural fields or reclaimed strip mines. When available, native trees from known seed sources will be planted.

### *Special use permits for agricultural practices and collection*

Issuance of special use permits for agricultural crop production or grazing may include use of pesticides and fertilizers. Issuance of special use permits for collection include stipulations to avoid sensitive habitats and federally listed species. The following standards will protect listed

species and their habitats when this activity is conducted: SFW-TES-2, GFW-TES-3, SFW-TES-13, SFW-VEG-19.

#### *Control of non-native invasive species (NNIS)*

Control of NNIS will occur by mechanical, biological (when available) and/or chemical methods. Mechanical methods include pulling, grubbing, grazing, and mowing. Biological methods include the release of *Galerucella* beetles on purple loosestrife. Chemical control through use of herbicides for invasive plants has not historically occurred on the WNF, but will be implemented under the new Forest Plan. In addition to these control measures the WNF implements a program that emphasizes education, early detection, and prevention. These activities include project design features and mitigation in all management areas to limit NNIS introduction and spread. Control of NNIS is an on-going activity that can occur year around and is anticipated to increase in intensity as invasive species encroach the action area. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-TES-2, GFW-TES-3, and GFW-TES-29.

#### *Herbicide use*

Herbicides would be used by WNF to eliminate shade-tolerant tree species to promote oak/hickory forests, to control non-native invasive species, and to control nuisance plants (e.g. poison ivy) around recreation sites. Use of herbicides for these activities will primarily involve selective, spot spraying to avoid affecting non-target vegetation. Although selective vegetation management is preferred for utility or other rights-of-way or easements, broadcast use of herbicides may only be permitted with written Forest Supervisor approval. Aerial spraying of herbicides is conducted on utility corridors that have outstanding rights on the Forest. Herbicides have rarely been used on the WNF in the past, but will play a much larger role in NNIS control under the Revised Forest Plan. The following S&G will protect listed species and their habitats when this activity is conducted: SFW-TES-2, GFW-TES-3, and GFW-TES-29.

#### *Hazard tree removal*

An activity that is common to all management areas on the WNF is the management of hazard trees. Periodically, a hazard tree will be present within a work site and will need to be removed to ensure safety. The WNF has a record of trying to plan ahead and remove such trees in the winter, but there is a chance that these trees will not be noticed during the Indiana bat hibernation period. Forest Service directives require that trees, with a crown that is greater than 50% dead, be removed from developed recreation sites. These directives also require such trees to be removed at dispersed recreation concentration points. These areas include trail intersections or sign information areas. Along trail corridors, trees that are leaning over the trail are removed. The following standard will protect listed species and their habitats when this activity is conducted: SFW-TES-10.

#### *Hickory tree removal*

The WNF recognizes the importance of hickory trees as potential Indiana bat roost sites by incorporating a Forest-wide guideline to retain all shellbark and shagbark hickories (GFW-TES-9). This differs from existing direction in the 1988 Forest Plan, as amended, that allows the removal of shagbark and shellbark hickory trees during the hibernation season. During the implementation of the projected management activities, many of which would result in long-term benefits to the Indiana bat and its habitat, some hickory trees may need to be removed to enable

the project to proceed without causing adverse effects to other resources important to the Indiana bat. Removal of such trees would be done during the hibernation season, when possible.

*Education, awareness, inventory, and monitoring for Federally listed species*

The WNF proposes to implement a conservation plan for federally listed species. Parts of the plan are included in Appendix A. This plan emphasizes the WNF’s commitment to conserving, protecting, and maintaining habitat for federally listed species. The conservation plan outlines how S&G will protect individuals and their habitat, what education and awareness measures will be implemented for the benefit of the WNF staff, and inventory and monitoring activities that will be conducted.

Table 2. Anticipated outputs for management activities for the first decade

<b>Activity</b>	<b>Acreage</b>
Even-aged Hardwood Timber Harvest	1,725
Even-aged Pine Timber Harvest	200
Uneven-aged Timber Harvest	14,556
Thinning	1,460
Crop Tree Release	2,113
Grape Vine Control	2,683
Site Prep for Native Pine	200
Reforestation	500
Prescribed Fire	
Oak Regeneration	46,215
NNIS	200
Herbaceous Habitat	1,500
Hazardous Fuels	21,904
Herbicide Application	
Oak Regeneration	10,994
NNIS	600
Development of Permanent Forest Openings	500
Maintenance of Permanent Forest Openings and other Herbaceous Habitats (Mechanical)	5,000
Control of Non-Native Invasive Species	
Mechanical	1,000
Biological	100
Wetland Restoration & Enhancement	150
Waterhole Construction	15
Fishing Pond/Lake Construction	15
Restoration & Improvement of Aquatic/Riparian Habitat	
Lentic	150
Lotic	20 miles
Installation of Bat-Friendly Gates on Mines	20-30 gates

<b>Activity</b>	<b>Acreage</b>
OHV Trail Construction	150
Hiking Trail Construction	18
Horse Trail Construction	61
Mountain Bike Trail Construction	36
Recreation Facility Construction & Parking Lots	60
Temporary Road Construction	146
Permanent Road Construction	74
Permanent Road Reconstruction	318
Road Decommissioning	29
Skid Trails and Landings (outside harvest areas)	740
Surface Coal Mining Activities	1,250
Reclamation of Depleted or Orphan Wells	128 wells (70 acres)
Oil & Gas Well Development (federal leases)	80 wells (42 acres)
Utility Corridor Development & Maintenance	50
Agricultural Crop Production & Grazing	50
Treatment of AMD	270
Surface Mine Reclamation	20
Closure of Open Mine Portal/Subsidence	232
Stabilization of Disturbed Areas	100
Reduction of Hazardous Fuels - Mechanical	10,181
Land Acquisition	Up to 40,000 acres
Land Exchange	400

### **Action Area**

The action area includes all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area is defined by measurable or detectable changes in land, air and water or to other measurable factors that will result from the proposed action. The action area is not limited to the “footprint” of the action, but rather encompasses the biotic, chemical, and physical impacts to the environment resulting directly or indirectly from the action.

The action area for the Forest Plan is the area that encapsulates the reach of all the direct and indirect environmental impacts of the project. That is, the area in which the biotic, chemical, and physical impacts to the environment that are anticipated to occur. The action area for the Forest Plan will encompass the entire WNF proclamation boundary plus lands one mile outside of the proclamation boundary for WNF lands that abut the boundary. A total of 1,108,199 acres in Ohio, Kentucky, and West Virginia encompass the action area.

The area directly affected by the action is the WNF property where all management activities will occur. The WNF is comprised of 238,053 acres within a 853,531 acre proclamation boundary in 12 southeastern Ohio counties: Athens, Gallia, Hocking, Jackson, Lawrence, Monroe, Morgan, Noble, Perry, Scioto, Vinton, and Washington.

The area indirectly affected by the action includes the area affected by noise, smoke and sediment transport from upland areas into streams that occur in response to activities on the WNF property. Activities such as timber harvest and road construction will generate noise. The level of noise generated will vary depending upon the methods and equipment being used or operated, but is not expected to reach outside the project boundary. As an example bulldozers and chainsaws run at full throttle are expected to produce low frequency noise, that at a half mile away is detected at the decibel level of normal conversation (de Hoop and Lalonde 2003). Prescribed fire will generate smoke that may drift short distances from the project area. Smoke dissipates into the air column and detectable levels are minimal at a distance of one mile from the fire. Similarly, sediment originating on WNF lands and entering an aquatic system is likely to be deposited a certain distance downstream, depending on velocity and mean particle size (Ritter et al. 1995). Based on channel morphology and velocity of streams on the WNF, sediment particles would be expected to be deposited within one mile of the origination point under normal flow conditions. Thus, the action area encompasses the entire proclamation boundary and extends out 1 mile.

## **II. STATUS OF THE SPECIES**

### **Indiana bat**

The Indiana bat is a species that continues to decline since being listed as an endangered species in 1967. Recovery of this species faces several challenges and there are multiple biological reasons why the outlook for this species may be unfavorable. The well-documented philopatric behavior of Indiana bats suggests that loss of roosting habitat alone can have adverse consequences (Kurta and Murray 2002; Gumbert et al. 2002). Healthy female bats start breeding their first fall and can produce one pup per year for up to 14-15 years (Humphrey et al. 1977). However, this current reproductive capacity has been insufficient to offset mortality rates over the last 40+ years. Indiana bat populations have plummeted.

### **Description and Distribution**

The Indiana bat is a medium-sized bat, closely resembling the little brown bat (*Myotis lucifugus*) but differing in coloration. There are no recognized subspecies. The Indiana bat has been found in 27 states throughout much of the eastern United States (USFWS 1999). More specifically, NatureServe (2004) describes its range as going from eastern Oklahoma, north to Iowa, Wisconsin, and Michigan, east to New England and south to western North Carolina, Virginia, and northern Alabama. It is virtually extirpated in the northeastern United States. The Indiana bat is migratory, and the above described range includes both summer and winter habitat. Major populations of this species hibernate in Indiana, Kentucky, and Missouri, with smaller populations reported in Alabama, Arkansas, Georgia, Illinois, Maryland, Mississippi, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Virginia, and West Virginia. The majority of maternity colonies are located in the glaciated Midwest.

### Previous Incidental Take Authorizations

All previously issued Service biological opinions involving the Indiana bat have been non-jeopardy. These formal consultations have involved (a) the Forest Service for activities implemented under various Land and Resource Management Plans on National Forests in the eastern United States (b) the Federal Highway Administration for various transportation projects, (c) the U.S. Army Corps of Engineers (Corps) for various water-related projects, and (d) the Department of Defense for operations at several different military installations. Additionally, an incidental take permit has been issued under section 10 of the Endangered Species Act to an Interagency Taskforce for expansion and related development at the Indianapolis Airport in conjunction with the implementation of a Habitat Conservation Plan.

It is important to note that in many of these consultations, survey information was lacking. As Federal agencies are not required to conduct surveys, often the Service relied on a host of valid factors in helping the Federal agency determine whether Indiana bats may be present. To ensure the Federal agency and the Service met the mandate of the section 7(a)(2), if the best available data indicated that Indiana bats may be present, the assumption was made that a maternity colony (in most instances) occurred within the action area. Although this approach, we believe, fully accords with the intent of Congress and the Endangered Species Act of 1973, it likely resulted in an over-estimate of the number of individuals or colonies that may have been impacted by Federal actions.

*National Forests-* Within the past several years, nearly all National Forests within the range of the Indiana bat have requested formal consultation at the programmatic level. Consultation under Section 7 of the Act is necessary to ensure agency actions do not jeopardize the continued existence of listed species. These consultations have led to non-jeopardy biological opinions with associated incidental take statements. Although some of these incidental take statements anticipated the take of reproductive females, we have not yet confirmed the loss of a maternity colony on a National Forest. The reasons for this are likely two-fold. First, the conservation measures (i.e., standard and guidelines) and the project-specific reasonable and prudent measures were designed to minimize maternity colony exposure to the environmental impacts of Forest Plan actions. Secondly, these measures ensured an abundance of suitable Indiana bat habitat on the National Forests, and protected all known or newly discovered maternity colonies.

*Other Federal Agencies or Non-federal Entities-* Several incidental take statements have been issued to other Federal agencies. Unlike those issued for the National Forest Land and Resource Management Plans, some of these projects were certain to impact known occupied habitat. To minimize the effect of these projects, the action agencies agreed to implement various conservation measures. These included: seasonal clearing restrictions to avoid disturbing female Indiana bats and young; protection of all known primary and alternate roost trees with appropriate buffers; retention of adequate roosting and foraging habitat to sustain the maternity colony into the future; and permanent protection of areas and habitat enhancement or creation measures to provide future roosting and foraging habitat opportunities.

With the exception of three (Fort Knox, Great Smoky Mountains National Park, and Laxare East and Black Contour Coal Mining projects), none of these biological opinions and associated incidental take statements anticipated the loss of a maternity colony. Required monitoring for 3

of these consultations (Camp Atterbury, Newport Military Installation, and Indianapolis Airport) has confirmed that the affected colonies persisted through the life of the project and continues to exist today. We recognize that given the philopatric nature of Indiana bats and the long life-span, the full extent of the anticipated impacts may not yet have occurred. Nonetheless, these monitoring results and the lack of data to suggest otherwise for the other projects, indicate that the conservation measures to avoid and minimize the impacts of Federal projects appear to be effective. Only with long-term monitoring will we definitively be able to determine the true effectiveness of our conservation measures.

In summary, we believe the take exempted to date via section 7 consultation has resulted in short-term effects to Indiana bat habitat and, in limited circumstances, on Indiana bat maternity colonies. As many of these consultations necessarily made assumptions about Indiana bat presence, we are confident that the number of maternity colonies actually exposed to the environmental impacts of the Federal actions is far less than we have anticipated. Furthermore, although not definitive, monitoring of several maternity colonies pre- and post-project implementation preliminarily suggests that our standard conservation measures, when employed in concert, appear to be effective in minimizing adverse effects on the affected maternity colonies.

#### Range-wide Status

Historically and currently, the Indiana bat geographic range encompasses 27 states, with the majority of records from the Midwest. Although there is no administrative record, it is believed that the species was listed because of observed declines in numbers. The data regarding Indiana bat abundance prior to Federal listing are limited, but the information suggests that they were once far more abundant than they were in the 1960s. Tuttle and colleagues, for example, believe the overall abundance of Indiana bats likely rivaled that of the now extinct passenger pigeon (Tuttle et al. 2004). The basis for Tuttle's and others estimates of millions of Indiana bats prior to European settlement is primarily based on historic accounts, extensive staining left on the ceilings of several historic hibernacula, and other paleontological evidence (Toomey et al. 2002). There is also other evidence indicating that Indiana bat numbers were once much higher. Based on a deposit of bones, it is estimated that a minimum of 300,000 Indiana bats were killed by a flood in Bat Cave, Edmonson County, Kentucky in 1937 (Hall 1962). Although we are never likely to know the true historical abundance of Indiana bats, it seems clear from the evidence above that Indiana bats were much more abundant than observed in 1960.

Hibernacula counts at a sample of known hibernacula began in 1960 and were repeated at approximately 10-year intervals. Beginning in the early 1980s, biennial counts at several known hibernacula were conducted, and in 2001, a concerted effort to track numbers at all known and accessible Priority 1 and 2 and most of Priority 3 hibernacula began. In 2002, the recovery team leader, using these data and host of assumptions (e.g., similar methodologies over time and among hibernacula, using current densities to estimate past numbers at newly found caves, assuming unchanged densities at hibernacula no longer accessible, etc.) compiled population estimates at 10-year intervals. Despite the many limitations associated with the dataset, Clawson's (2002) compilation shows a marked decline in estimated numbers over time. Estimated Indiana bat numbers declined each decade since 1960: ~883,300 Indiana bats in 1960/1970; 678,700 in 1980; 473,500 in 1990; and 382,300 in 2000/2001. Upon further analysis, Clawson found that the decline was not evenly distributed across the winter range.

The population in the southern portion of the range decreased an estimated 80% in the 40 years from 1960 to 2001, with the largest declines observed in Kentucky and Missouri hibernacula. In contrast, the population in the northern Midwest and Northeast increased by 30%. Clawson also indicated that the last estimated inter-decadal hibernation count suggests that the rate of decline has slowed. From 1960/1970 to 1980, the estimated population numbers decreased by 23 percent; from 1980 to 1990 by 30 percent; and from 1990 to 2001 by 19 percent.

The results from the 2001 to 2005 biennial counts suggest that at least for this 5-year period, the extreme decreases observed in each previous decade may not occur this decade. From 2001 to 2003 and 2003 to 2005, increases (4.2% and 16.7%, respectively) in the estimated numbers were observed. These are the first calculated increases in the range-wide population estimate since the Indiana bat was listed and monitoring began. Although the observed increases are encouraging, we are uncertain of what the future population trend will be and vulnerability of the current population.

### Life History and Population Dynamics

The lifespan for Indiana bats is generally between 5 and 10 years (Thomson 1982), but individuals may live much longer, with the oldest known bat captured 20 years after it was first banded (LaVal and LaVal 1980). Based on a 13-year study, Humphrey and Cope (1977) found that the adult period of life is characterized by two distinct survival phases. The first is a high and apparently constant rate from 1 to 6 years after marking with 76% and 70% annual rates of survival for females and males, respectively. The second phase is a lower, constant rate after 6 years, with annual survival rates of 66% for females up to 10 years and 36% for males. In one study in Indiana, survival of pups was found to be very high at 92% from birth to weaning (Humphrey et al. 1977). Post-weaning to age 1 survival is unknown, but believed to be low.

The key stages in the annual cycle of Indiana bats are: hibernation, spring staging, pregnancy, lactation, volancy/weaning, migration, and swarming. While varying with weather and latitude, generally bats begin winter torpor in mid-September through late October and begin emerging in April. Females depart shortly after emerging and are pregnant when they reach their summer area. Birth of young occurs between mid-June and early July and then nursing continues until weaning, which is shortly after young become volant in mid to late July. Migration back to the hibernacula may begin in August and continue through September. Males depart later from the hibernacula in the spring and begin migrating back earlier than females in the fall.

### *Hibernation*

Generally, Indiana bats hibernate from October through April depending upon local weather conditions. Bats cluster on cave ceilings during hibernation and are capable of clustering in dense groups typically ranging from 300-484 bats per square foot. Hibernation facilitates survival during winter when prey are unavailable. However, the bat must store sufficient fat to support metabolic processes until spring. Substantial risks are posed by events during the winter that interrupt hibernation and increase metabolic rates.

Temperature and relative humidity are important factors in the selection of hibernation sites. During the early autumn, Indiana bats roost in warm sections of caves and move down a temperature gradient as temperatures decrease. A recent study of highly populated hibernacula documented a temperature range of 3-7.2°C (Tuttle and Kennedy 2002). Relative humidity in

Indiana bat hibernacula is usually above 74% but below saturation (Hall 1962; Humphrey 1978; LaVal et al. 1976), although relative humidity as low as 54% has been observed (Myers 1964).

After hibernation ends in late March or early April, most Indiana bats migrate to their traditional summer areas. Female Indiana bats emerge from hibernation in late March or early April, followed by the males. The period after hibernation but, prior to migration, is referred to as staging. Most individuals leave their hibernacula by late April. Migration is stressful for the Indiana bat, particularly in the spring when their fat reserves and food supplies are low. As a result, adult mortality may be the highest in late March and April.

#### *Female Maternity Colony and Summer Habitat*

Upon emergence from the hibernacula in the spring, females migrate to their traditional maternity colony areas. Coloniality is a requisite behavior for reproductive success. Females usually start grouping into larger maternity colonies by mid-May and give birth to a single young between late June and early July (Humphrey et al. 1977). These colonies are typically located under the sloughing bark of live, dead and partially dead trees in upland and lowland forest (Humphrey et al. 1977; Gardner et al. 1991). Colony trees are usually large-diameter, standing dead trees with direct exposure to sunlight. The warmer temperature from sunlight exposure helps development of fetal and juvenile young (Racey 1982). A maternity roost may contain 100 or more adult females and their pups.

Roost trees often provide suitable habitat as a maternity roost for only a short period of time. Roost trees are ephemeral in nature; suitable trees fall to the ground or lose important structural characteristics such as bark exfoliation (Gardner et al. 1991; Britzke et al. 2003). Dead trees retain their bark for only a certain period of time (about 2-8 years). Once all bark has fallen off a tree, it is unsuitable to the Indiana bat for roosting. Gardner et al. (1991) found that 31% of Indiana bat occupied roost sites were unavailable the summer following their discovery; 33% of the remaining occupied roost sites were unavailable by the second summer. For this reason, an area must provide a continual supply of suitable roost trees in order to support a colony over the long-term.

Female Indiana bats have shown strong site fidelity to both their summer maternity grounds and specific roost trees, and will use suitable roost trees in consecutive years, if they remain standing and have sloughing bark (Gardner et al. 1991; Callahan et al. 1997; Kurta and Murray 2002). Traditional summer areas are essential to the reproductive success of local populations. It is not known how long or how far female Indiana bats will search to find new roosting habitat if their traditional roost habitat is lost or degraded. If they are required to search for new roosting habitat, it is assumed that this effort places additional stress on pregnant females at a time when fat reserves are low or depleted and they are already stressed from the energy demands of migration.

It is unknown how many roosts are critical to the survival of a colony, but the temporary nature of the use of the roost trees dictates that several must be available in an area if the colony is to return to the same area and raise their young successfully. Indiana bats require many roost trees to fulfill their needs during the summer (Callahan et al. 1997). In Michigan, Indiana bats used two to four different roost trees during the course of one season (Kurta and Williams 1992). In Missouri, each colony used between 10-20 roost trees, and these were not widely dispersed (all

within a circle ranging in size from 0.81 to 1.48 km (0.5-.92 miles)) (Miller et al. 2002). The important factor associated with roost trees is their ability to protect individuals from the elements, and to provide thermal regulation of their environment. Maternity colonies have at least one primary roost, which is generally located in an opening or at the edge of a forest stand. Maternity colonies also use multiple alternate roosts which are located in the open or in the interior of forest stands. Exposure to sunlight is important during development of fetal and juvenile young. In Missouri, use of dead trees in the forest interior increased in response to unusually warm weather (i.e., shading provided a cooler thermal environment), and use of live trees and snags in interior forest increased during periods of precipitation (Miller et al. 2002). Maternity colonies in North Carolina and Tennessee used roosts located above the surrounding canopy (Britzke et al. 2003).

Indiana bats have been found roosting in several different species of trees, and it appears that they choose roost trees based on their structural composition. Therefore, it is difficult to determine if one particular species of tree is more important than others. However, 12 tree species have been listed in the Habitat Suitability Index Model as primary species (class 1 trees) (Rommé et al. 1995). These trees include silver maple (*Acer saccharinum*), shagbark hickory (*Carya ovata*), shellbark hickory (*C. laciniosa*), bitternut hickory (*C. cordiformis*), green ash (*Fraxinus pennsylvanica*), white ash (*F. americana*), eastern cottonwood (*Populus deltoides*), red oak (*Quercus rubra*), post oak (*Q. stellata*), white oak (*Q. alba*) slippery elm (*Ulmus rubra*), and American elm (*Ulmus americana*). In addition to these species, sugar maple (*A. saccharum*), shingle oak (*Q. imbricaria*), and sassafras (*Sassafras albidum*) are listed as class 2 trees (Rommé et al. 1995). These tree species are favored by the Indiana bat, since as these trees age, their bark will slough.

#### *Male Roosting Habitat*

Some adult males use mature forests around and near their hibernacula for roosting and foraging from spring through fall. Others have been found migrating far from their hibernacula area (Hobson and Holland 1995; Timpone 2004). Male Indiana bats also exhibit summer habitat philopatry.

Roosting habitat for male Indiana bats appears similar to female bats, and males and females have been caught using the same general area (e.g., Fishhook Creek, Illinois, Gardner et al. 1991). However, there are often notable gender differences in roost tree size and the juxtapositioning of roosting and foraging areas. Male Indiana bats have been found roosting in trees as small as 6.4 cm (2.5 inch) dbh (Gumbert 2001), although the average diameters reported in literature are much larger: 38.1 cm (15 inches) in Indiana (n=14, Brack et al. 2004) and 28.6 cm (11.26 inches) in Kentucky (n=41, Gumbert 2001). As male bats roost solitarily or in small groups, the size of the roost tree in terms of its available roosting space, is not likely a limiting factor. Male bats must thermoregulate, thus roost tree size and other characteristics affecting the microclimate of the roost site are still germane. The connectivity between roosting and foraging sites may not be as critical for males as it is for maternity colonies because the latter must have prey close to their roost trees for nursing females and newly volant bats.

During a 1999 radio telemetry survey on the Athens District of the WNF, males were found roosting in American elm, red maple, shagbark hickory, and sugar maple trees. The average dbh of these trees was 11.8 inches and the average length of time within one year each tree was used

was 2.3 days (Schultes 2002). In 2000, two male Indiana bats were found roosting in American elm, red maple, black oak (*Quercus velutina*), white oak, pignut hickory and shagbark hickory. The average dbh of these trees was 11.9 inches and the average length of time each tree was used was 1.9 days (Schultes 2002).

### *Foraging*

Indiana bats feed exclusively on flying aquatic and terrestrial insects. Although there are no consistent trends, diet appears to vary across their range, as well as seasonally and with age, sex and reproductive-status (Murray and Kurta 2002; Belwood 1979). Murray and Kurta (2002) found that diet is somewhat flexible across the range and that prey consumed is potentially affected by regional and local differences in bat assemblages and/or availability of foraging habitats and prey. For example, Lee and McCracken (2004) and Murray and Kurta (2002) found that adult aquatic insects (Trichoptera and Diptera) made up 25-81% of Indiana bat diets in northern Indiana and Michigan, respectively. However, in the southern part of the species range terrestrial insects (Lepidoptera) were the most abundant prey items (as high as 85%) (Brack and LaVal 1985; LaVal and LaVal 1980; Belwood 1979). Kiser and Elliot (1996) found that Lepidopterans (moths), Coleopterans (beetles), Dipterans (true flies) and Homopterans (leafhoppers) accounted for the majority of prey items (87.9% and 93.5% combined for 1994 and 1995, respectively) consumed by male Indiana bats in their study in Kentucky. Diptera, Trichoptera, Lepidoptera, and Coleopterans also comprised the main prey of Indiana bats in Michigan (Murray and Kurta 2002), however, Hymenopterans (alate ants) were also taken when abundant.

The function of foraging habitat is to provide a source of food, but it also provides night roosts for resting and digesting meals between forays and shelter from predators. The few studies conducted to date indicate that (1) Indiana bats appear to be solitary foragers (2) individuals establish several foraging areas, likely in response to varying insect densities, and (3) individuals are faithful to their foraging areas (Kiser and Elliot 1996, Murray and Kurta 2004). Foraging areas may or may not overlap with day or night roosting areas, but individual foraging ranges commonly overlap (Menzel et al. 2001). Indiana bats generally prefer foraging in wooded areas (LaVal et al. 1976, Brack 1983, Gardner et al. 1991, Butchkoski and Hassinger 2002, and Murray and Kurta 2002), and are frequently associated with streams, floodplain forests, forested wetlands, and impounded water bodies (Garner and Gardner 1992, Murray and Kurta 2002). Woody vegetation with a width of at least 100 ft (30 m) on both sides of a stream has been characterized as excellent foraging habitat (Cope et al. 1974). Indiana bats forage and fly within air space from 6 to 100 ft (2-30 m) above ground level (Humphrey et al. 1977), typically in and around tree canopy and in openings (Humphrey et al. 1977, LaVal et al. 1976, Brack 1983, Gardner and Gardner 1992, Gardner et al. 1996, Murray 1999).

Indiana bats will forage in small openings, but generally appear to avoid foraging over large open expanses and prefer forested areas (Humphrey et al. 1977, Brack 1983, Brack & LaVal 1985, Gardner and Gardner 1992, Murray and Kurta 2004). In Michigan, Murray and Kurta (2004) found that Indiana bats used wooded corridors for traveling and foraging, even when this required them to significantly increase their nightly commuting distance.

Another important aspect of Indiana bat habitat is mid-story cover. It is important to discuss forest clutter for two reasons. First, when foraging in clutter, bats must detect targets amid the

echoes from non-target objects (Fenton 1990). The greater the density of non-target items the more noise bats must decipher. Second, the greater the physical and acoustical clutter, the more difficult it is for Indiana bats to maneuver to avoid collisions. Indiana bats navigate and forage on the wing. Foraging in less spatially complex habitats is likely to be less energetically expensive. Hence, it is acknowledged that a relatively open mid-story (<40% of trees are 2-4.7 in (5-12 cm) dbh) (Rommé et al. 1995) is an important feature of high quality Indiana bat foraging habitat.

Connectivity of the foraging area to the roosting area is also an important feature. Murray and Kurta (2002) suggested that within a home area, bats appear to be faithful to their travel corridors as they observed Indiana bats using the same corridors for more than 5 years. There have been reports of bats traveling through relatively open areas (e.g., bats documented crossing over or under bridges on I-70 in Indiana) to reach foraging habitat (USFWS 2002; Butchkoski and Hassinger 2002). As explained previously it is unknown whether bats in these instances are specifically choosing to use the open areas or whether they have no other option. For lactating females and newly volant pups, the distance between foraging and roosting sites should be minimized to the extent possible. Murray and Kurta (2004) found that lactating females returned 2-4 times/night to their day roosts, presumably to nurse their young, while non-lactating females did not return to their day roosts. Barclay (1991) and MacGregor (1999) have found that female bats chose roost sites based on high insect abundance in the area (along with other roost suitability criteria), so that foraging doesn't come at too high an energetic cost.

The maximum distance that Indiana bats will travel to forage is unknown and studies have revealed a considerable range of movement capabilities. Foraging distances reported range between 1 and 7.8 km (0.62-4.85 miles) for females and 1 and 3 km (0.62-1.87 miles) for males (Gardner et al. 1991., Garner and Gardner 1992; Kiser and Elliot 1996). This great variability likely reflects differences in habitat quality and/or prey availability. Although the ideal configuration of a colony's or individual bat's home-range is unknown, it is reasonable to assume the closer the essential habitat elements are located, the better. Contiguous habitat elements reduce the travel time between foraging and day roosting areas, which will decrease exposure time to predation and reduce energetic costs of foraging.

#### *Fall Swarming and Mating*

From late-August to mid-October, prior to entering the hibernacula, large numbers of Indiana bats fly in and out of cave or mine openings from dusk till dawn in a behavior called swarming. Swarming usually lasts for several weeks and mating occurs toward the end of this period. Male Indiana bats tend to be active for a longer period of time than females during swarming and will enter the hibernacula later than the females (LaVal and LaVal 1980). Adult females store sperm through the winter thus delaying fertilization until early May.

#### Threats to the Species

The causes for the population decline of the Indiana bat have not yet been definitively determined. However, the documented and suspected reasons for decline include disturbance and vandalism; improper cave gates and structures; natural hazards; microclimate changes; adverse land use practices; and chemical contamination.

Human disturbance of hibernating bats led to a decline in Indiana bat populations from the 1960s to the 1980s (USFWS 1999). Disturbance from recreational cavers and researchers entering hibernacula can cause bats to expend crucial fat reserves before they are able to forage in the spring. If disturbance occurs too often, fat reserves can be depleted before the species can begin foraging in the spring.

Changes in the microclimate of a cave or mine can affect temperature and moisture level, thereby affecting suitability of the hibernaculum or affecting bat physiology (Richter et al. 1993; Tuttle and Kennedy 2002). Blockage of entry points can alter airflow in a cave or mine. This poses serious consequences when a hibernaculum is on the warm edge of the species hibernating tolerance, or has less stable temperatures. In northern areas, changes in airflow could lead to areas of the mine or cave being too cold for the bat. In either case, changes in airflow and the microclimate could result in individuals having to use less optimal locations in the hibernaculum. This could leave them vulnerable to predation, freezing, or exhaustion of fat reserves. Improper gates have either rendered hibernacula unavailable to the Indiana bat, or have altered air flow causing hibernacula temperatures to be too high for bats to retain fat reserves through the winter (Richter et al. 1993). Cave entrances essential to proper cooling of key hibernating sites must be identified and protected from inadvertent closures, including those that may occur naturally (Tuttle and Kennedy 2002).

Land use practices, fire suppression, and agricultural development have reduced available roosting and foraging habitat as well as reduced the abundance of insects for bat prey across its range. Ongoing research and monitoring is helping to enhance the understanding of habitat use and characteristics. When done properly, experts consider forestry practices to be compatible with Indiana bat conservation; however silvicultural methods need to maintain structural features important for roosting and foraging (BCI 2001).

Bioaccumulation of environmental contaminants is suspected as a potential factor in the decline of the Indiana bat. Organochlorine insecticides became widely used after World War II; they are neurotoxic, synthetic chemicals of which many are resistant to metabolism in mammals (O'Shea and Clark 2002). Organochlorine insecticides may have resulted in chronic mortality of Indiana bats (O'Shea and Clark 2002). For example, guano collected from an Indiana bat roost in Indiana, in the 1970s, had concentrations of dieldrin in their guano comparable to the levels found in colonies of gray bats that suffered mortality from dieldrin poisoning (O'Shea and Clark 2002). Schmidt et al. (2002) measured levels of Polycyclic Aromatic Hydrocarbons (PAH) and organochlorine pesticides in surrogate bat species to ascertain potential effects to the Indiana bat. At low concentrations, these chemicals cause cancer and cellular mutations in mammals, and may affect reproductive success by reducing viability of gametes or offspring.

### **Running buffalo clover**

Running buffalo clover is a species that has shown great recovery potential if habitat is protected and managed. Listed in 1987 when only one population was known, today 120 populations of running buffalo clover exist. Many of these populations are very small and vulnerable and display a cyclic pattern of decline and increase over time. The Recovery Team for this species has indicated that even small populations are valuable for the continued existence of running buffalo clover due to high genetic diversity.

### Distribution

Running buffalo clover occurs in mesic habitats with partial to filtered sunlight, where there is a prolonged pattern of moderate, periodic disturbance, such as mowing, trampling, or grazing. It is most often found in regions underlain with limestone or other calcareous bedrock, but not exclusively. It has been reported from a variety of habitats, including mesic woodlands, savannahs, floodplains, stream banks, sandbars (especially where old trails cross or parallel intermittent streams), grazed woodlots, mowed paths (e.g. in cemeteries, parks, and lawns), old logging roads, jeep trails, skidder trails, mowed wildlife openings within mature forest, and steep ravines.

Running buffalo clover has been collected historically from Arkansas, Illinois, Indiana, Kansas, Kentucky, Missouri, Ohio and West Virginia. There were very few reports rangewide between 1910 and 1983. Prior to 1983, the most recent collection had been made in 1940 in Webster County, West Virginia (Brooks 1983). Although thought to be extinct (Brooks 1983), running buffalo clover was rediscovered in 1983 in West Virginia. At the time of listing only one population was known to exist. Soon after being listed in 1987, several additional populations were discovered in Indiana, Ohio, Kentucky, and West Virginia. Populations were not rediscovered in the wild in Missouri until 1994.

### Rangewide Status

Extant populations of running buffalo clover are known from 120 populations in three ecoregions: Hot Continental, Hot Continental Mountainous, and Prairie Division (Bailey 1998). For recovery purposes, the populations are divided into three regions based on proximity to each other and overall habitat similarities. These regions are Appalachian (West Virginia, and southeastern Ohio), Bluegrass (southwestern Ohio, central Kentucky and Indiana), and Ozark (Missouri). The majority of populations occur within the Appalachian and Bluegrass regions. Kentucky has the most populations of running buffalo clover, followed by West Virginia, Ohio, Indiana and Missouri. The largest populations of running buffalo clover occur on the Monogahela National Forest in West Virginia. In 2005, the total number of ranked populations included: 10 A-ranked, 23 B-ranked, 31 C-ranked, and 58 D-ranked (USFWS 2005a). A-ranked populations are the largest (over a 1,000 individuals) and occur in highly suitable habitat, while D-ranked populations are small (less than 30 individuals) and may occur in somewhat marginal habitat (see Draft Revised Recovery Plan for full discussion of EO rankings).

As of 2005, 17 extant populations are known from Ohio plus an additional seven extirpated populations. Populations have been found primarily in mesic forest and lawn habitats in Hamilton, Clermont, Brown, and Lawrence counties. An estimated 3,138 plants were documented in Ohio during 2005.

### Population dynamics

Running buffalo clover usually acts as a perennial species, forming long stolons that root at the nodes. Plants produce erect flowering stems, 10-30 cm tall that send out long basal runners (stolons). The flowering stems have 2 large trifoliolate leaves below a 9-12 mm round white flower head (Gleason and Cronquist 1991). Running buffalo clover flowers from mid-April to June; fruiting occurs from May to July (Brooks 1983).

Running buffalo clover is reported to be visited by bees (*Apis* sp. and *Bombis* sp.) and is cross-pollinated under field conditions (Taylor *et al.* 1994). Franklin (1998) documented that although running buffalo clover is genetically self-compatible, it cannot self-pollinate. Self-compatibility provides plants reproductive assurance when outcrossing opportunities are limited (such as in small populations).

Genetic studies of running buffalo clover suggested that to conserve maximum levels of diversity in running buffalo clover, as many populations as possible should be preserved across its range because much of the total diversity resides among populations (Crawford *et al.* 1998). Small populations of running buffalo clover contribute as much genetic diversity as large populations and exhibit unique banding patterns, which is important for the species adaptability and genetic stability.

Long-term monitoring data indicates that running buffalo clover populations often display widely fluctuating population sizes. The cause for changes in population size may be due to disturbance, weather patterns, management strategy, or other unknown factors. Ohio's population data indicate that the numbers of rooted crowns in a given sub-population may vary widely over time, including variation within a given growing season (Becus 1993). One population in Ohio had 235 rooted crowns in 1992 and then disappeared for the next 3 years; in 2003, this same population had 1,157 plants. Similarly, a West Virginia sub-population consisting of 31 rooted crowns in 1990 and 1991, disappeared in 1992, and returned the next year. Running buffalo clover has not been observed at this location since 1993 and is now considered extirpated at this site.

### Threats

The primary threat to running buffalo clover is habitat alteration. Factors that contribute to this threat include forest succession, and subsequent canopy closure, competition by invasive plant species, catastrophic disturbance such as development or road construction, and may include the elimination of bison and other large herbivores. Without some level of disturbance, an area will become too shaded to provide enough sunlight for the species (Cusick 1989, Homoya *et al.* 1989).

Various researchers have supported the hypothesis that during pre-settlement time running buffalo clover habitat was likely produced through canopy gaps created by the felling of large, old-growth trees (Madarish and Schuler 2002). Current logging practices may also benefit running buffalo clover. At the Fernow Experimental Forest in north-central West Virginia, running buffalo clover is most often associated with skid roads in uneven-aged silvicultural areas (Madarish and Schuler 2002). A study examining running buffalo clover abundance before and after logging suggests that populations may initially decrease after disturbance, but then rebound to higher than pre-disturbance levels (Madarish and Schuler 2002).

Land development and the consequential loss of habitat is also a serious threat to running buffalo clover. Cusick (1989) notes that running buffalo clover was formerly relatively frequent in central and southwestern Ohio, particularly in the vicinity of Cincinnati prior to urban sprawl. Remnant populations have become even more isolated, persisting in areas maintained by appropriate disturbance. Remnant habitats may lead to small population sizes, inadequate seed dispersal, and poor seed quality. It has been suggested that running buffalo clover has a limited

seed dispersal mechanism (Cusick 1989). Deforestation, farming, and other human activities created many new habitats for the species, but with the loss of bison after European settlement, Cusick (1989) suggested that there were no effective means of dispersal remaining for the species.

Jacobs and Bartgis (1987) suggested that along with the destruction of habitat, the introduction of non-native species may have contributed to the decline of running buffalo clover. Non-native white clover (*Trifolium repens*) may have invaded the habitat of running buffalo clover, out-competing it for available resources (Jacobs and Bartgis 1987). Other invasive plants that currently threaten with running buffalo clover include Japanese stilt grass (*Microstegium vimineum*), garlic mustard (*Alliaria petiolata*), Japanese honeysuckle (*Lonicera japonica*), Amur honeysuckle (*Lonicera maackii*), wintercreeper (*Euonymus fortunei*), and periwinkle (*Vinca minor*). Management of invasive species through manual methods (pulling and mowing) have shown to be effective in minimizing competition with running buffalo clover.

### **III. ENVIRONMENTAL BASELINE**

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in an action, the anticipated impacts of all proposed Federal projects in an action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process (50 CFR 402.02).

The WNF is located in the Southern Unglaciaded Allegheny Plateau and is part of the mixed mesophytic forest region. Approximately 80% of all lands within the WNF proclamation boundary are forested (Ohio Land Use Cover, based on Landsat TM 1994). Just over 94% of WNF lands are forested with the remaining 6% covered by non-forest lands such as roads, water, grasslands and other openland. WNF lands are dominated by hardwood forest types, however some pine is present (Table 3).

Of the forested WNF lands, oak-hickory is the major forest type, comprising 47% of all forested stands. The majority of the WNF has been harvested one or more times since the late 1700s. Cultivation or grazing followed the harvest of many forest stands. Today, many of the forest communities were established after timber harvesting that occurred about 80-140 years ago.

There has been an increasing trend for the amount of older hardwood stands on the WNF since 1985 (Table 4). Hardwood stands greater than 80 years old increased by almost 5% during the time period when the 1988 Forest Plan was being developed.

Table 3. Acres of forest types by age class on WNF lands\*.

Age (years)	Pine	Pine - Hardwood	Oak - Hickory	Yellow Poplar	Lowland Hardwood	Maple-Beech	Upland Hardwood	Total
No Age	52	23	138		74		34	321
0-9	55	279	110	13	275		312	1,044
10-19	953	640	4,632	93	349	74	4,974	11,715
20-29	1,217	532	4,343	614	747	196	4,725	12,374
30-39	4,470	1,811	4,417	1,088	2,297	274	6,962	21,319
40-49	3,539	3,157	3,024	2,129	1,844	189	7,427	21,309
50-59	2,233	3,093	5,724	3,019	1,281	596	9,239	25,185
60-69	1,405	1,986	10,493	2,792	720	443	8,221	26,060
70-79	364	650	13,120	1,691	505	675	6,254	23,259
80-89	85	297	13,722	899	257	755	3,179	19,194
90-99		352	13,628	347	69	347	2,021	16,764
100-109		34	14,131	125	63	360	1,073	15,786
110-119			10,524	93	17	148	574	11,356
120-129			6,625	12		117	172	6,926
130-139		22	1,859		34	70	51	2,036
140-149			988			20	78	1,086
150+			197			15	28	240
<b>Total</b>	<b>14,373</b>	<b>12,876</b>	<b>107,675</b>	<b>12,915</b>	<b>8,532</b>	<b>4,279</b>	<b>55,324</b>	<b>215,974</b>

\*Data in this table do not include the approximately 9,300 acres of WNF lands where a silvicultural examination has yet to be conducted.

Table 4. Comparison of mature hardwood forest age classes in 1985 and in 2003 on WNF lands

Habitat Component	1985 (%)	2003 (%)	Percent Change (1985-2003)
Hardwood-Mast Producing			
(40-79 years)	33.0	35.8	+2.8
(80-99 years)	18.0	15.9	-2.1
(100+ years)	8.7	15.7	+7.0

All streams in the WNF proclamation boundary flow towards the Ohio River. There are more than 280 miles of perennial warm-water streams running through the WNF. Riparian areas, wetlands and floodplains have been affected by extensive disturbance and modifications. Nearly all floodplains and riparian areas, and most of the wetlands on NFS lands were cleared, drained, and farmed in the past. Transportation corridors, including roads and railroads, were developed through these areas by early settlers. Riparian and aquatic resources have also been affected by stream channel alteration (typically by straightening stream channels and the filling in of oxbows), streamside forest clearing, livestock access to streams, cultivation of fields up to the edge of the channel, and more recently from increased development of residential sites in the floodplain on private lands. Such activities have resulted in altered hydrologic regimes, increased erosion and sedimentation within stream channels, degraded water quality and aquatic habitat.

The percent composition of ponds and lakes increased by 0.1 percent between 1985 and 2003. While the Forest Service only constructed 7 new acres of ponds and lakes during this time period, it purchased over 200 acres of waterbodies through its land acquisition program (USFS 2005). Numerous small lakes have been acquired through purchases of extensive tracts of mine lands. Some of these lakes are coal mine strip pits, limestone quarry ponds, or reclaimed coal mine impoundments.

The percent composition of wetlands increased by 0.18 percent between 1985 and 2003 (USFS 2005). The Forest Service acquired several bottomland fields along Pine Creek, Symmes Creek, Monday Creek, Little Muskingum River and the Hocking River between 1988 and 2003. In cooperation with partners, 103 acres of previously tilled and ditched floodplain wetlands have been restored or enhanced since 1994.

The landscape of the Forest, including WNF lands and other ownerships, is fragmented by residences, farms, mines and quarries, industrial developments, and towns. The scattered pattern of WNF lands, including subsurface ownership of minerals, has resulted in the construction of roads and utility corridors across WNF lands to access these private inholdings.

## **Status of the Species Within the Action Area**

### **Indiana bat**

The Indiana bat is present year round within the action area. Indiana bat presence in the action area is well documented as numerous nights of mist netting have been completed over the years to ascertain the species distribution across the WNF (see Appendix B).

#### *Winter Habitat on the WNF*

There is one documented hibernaculum within the action area. This site is an abandoned limestone mine and serves as a Priority III winter hibernaculum (containing 333 Indiana bats). Four limestone mines have been closed with bat friendly gates (including the one currently being used as a hibernacula for Indiana bats). Numerous mines are located on Federal and non-Federal lands in the Athens Unit and the Ironton Ranger District as a result of past underground coal and limestone mining, however the majority of limestone mines are found in the Ironton Ranger District. These limestone mines may provide additional hibernacula for Indiana bats; however, surveys have not yet ascertained whether bats are using these limestone mines. Given the large number of abandoned limestone mines (some of which are protected), it can reasonably be assumed that more than one Priority III hibernacula occurs in limestone mines on the Ironton District.

Less is known in general, about the use of abandoned coal mines as bat hibernacula (versus other mines). Biologists continue to conduct fall swarming surveys, and Indiana bats have been captured at three portals leading to abandoned underground coal mines. Entry into underground coal mines is not permitted because of safety concerns; however, we believe small numbers of Indiana bats may be using these mines as hibernacula. The majority of these mines were abandoned in the mid-1900s as the coal ran out; therefore, an assumption can be made that Indiana bats are likely expanding their winter distribution into the WNF by using some of these mines. It is reasonable to assume at least three Priority III hibernacula occur in the Athens District.

### *Summer Habitat on the WNF*

Female and male Indiana bats use the WNF during the summer, and likely use non-Federal lands in the action area as well. Specific maternity colony roost trees have not been found on WNF lands during telemetry surveys, however, lactating and post-lactating females have been captured during summer surveys. Capture of reproductive females indicate that a maternity colony is likely within 2.5 miles of the capture site. Thus, it is likely that female bats are using the forest for foraging and roosting. Adult males have been captured and radio-tracked to summer roosts within and/or near the WNF.

Range-wide, the majority of recorded Indiana bat roost trees are hardwood species; however, individuals have also been found roosting in pine species (Rommé et al. 1995; Britzke et al. 2003). Ninety-four percent of the WNF is forested, and 93% of these forested lands are comprised of hardwood or hardwood-pine forest communities. Seventy-nine percent of the action area is forested (LandSat 1994). While individual Indiana bats will use smaller diameter trees for roosts, the larger diameter trees (> 8 inches dbh) provide more optimal habitat for maternity colonies. Although dependent on site capability, trees generally increase in diameter as they age. As trees age, they are also more likely to begin exhibiting characteristics of known Indiana bat roost trees, such as broken tops, cavities and areas of sloughing bark.

The tree species found in the hardwood and hardwood-pine communities on the WNF reach physiological maturity at different ages (USFS 2005). For example, scarlet oak, red maple, sassafras, shortleaf pine, and Virginia pine reach physiological maturity as early as 70 years of age, whereas hickory, sugar maple, and white oak are longer-lived species that may not reach physiological maturity until after 120 years or more. A general assumption can be made, based on the physical maturity of trees and experiences in the field by WNF foresters and biologists, that hardwood stands greater than 80 years old, and pine or pine-hardwood stands greater than 60 years old, contain larger trees with suitable roost characteristics.

An analysis of vegetation data for WNF land showed that nearly 40% of all hardwood stands were greater than 80 years old, with another 25% about to recruit into this older age class from the 60-80 year old classes. Pine and pine-hardwood communities are generally younger in age, but 38% of these communities were greater than 60 years old; almost 45% of the pine and pine-hardwood communities are between 40 and 60 years of age and are about to recruit into the older age class. Thus, currently we believe that 40% of the forest provides suitable summer habitat for Indiana bat.

In February 2003, a severe ice storm occurred in southern Ohio and northern Kentucky, including portions of the Ironton Ranger District. In its aftermath, approximately 132,675 forested acres within the Ironton Ranger District boundary were affected. Approximately 71,650 acres were affected on WNF lands. Individual or groups of trees were broken or toppled in these areas, with the severity depending generally on elevation and aspect. This natural disturbance resulted in an increase in potentially suitable Indiana bat roost trees across the western two-thirds of the Ironton Ranger District.

Aquatic habitat is important to the Indiana bat because it provides drinking opportunities and the production of desirable insect prey. Intermittent and perennial streams that provide habitat for aquatic insect production are numerous within the Action Area. Of the 200 miles of perennial

stream that is in contact with WNF lands, 11 percent of those miles met Ohio water quality standards in 1998. About 41 percent of those miles were impaired and 48 percent had not been inventoried. Impairment of streams in this area is due to agriculture and abandoned mine lands (Ohio EPA, 2004). Watershed improvement activities targeting acid mine drainage is helping to improve downstream aquatic production areas. Private lands programs run through the Natural Resources Conservation Service are helping to reduce nutrient and sediment runoff into streams.

### *Summary*

While suitable habitat for the Indiana bat is scattered across the action area, to date survey efforts suggest its distribution may not be random, but instead focused in two parts of the action area. One area is located on the Ironton Ranger District where past limestone mining and quarrying occurred, along with some underground coal mining. This area, nicknamed the Bear Run area, contains a Priority III hibernaculum. In 2005, 333 Indiana bats were censused in this hibernaculum (Schultes 2005). Summer surveys around the hibernacula have detected male and female bats using the area. Although no maternity colony trees have been discovered, a post-lactating female was captured during a summer mist net survey in Bear Run. Capture of a reproductive female indicates a maternity colony is within 2.5 miles of the capture site. A total of 7 Indiana bats (6 males and 1 female) have been captured in summer studies in the Bear Run area of the Ironton District.

The second concentration is in the southwest part of the Athens Unit near the city of Nelsonville, in an area heavily impacted by underground clay and coal mining. Four lactating females and 3 adult males have been detected during summer mist net surveys and 2 adult females and 1 male were captured during fall swarming surveys in the Nelsonville Area of the Athens District (3 different openings). As these 3 Indiana bats were captured at entrances to abandoned coal mines, it is impossible to safely enter these features and it is impossible to know if they are used as hibernacula. The Service assumes that Indiana bats may be hibernating in this area in low numbers. Outside these two concentration areas only two Indiana bats have been captured in the action area, both adult males; one on each District of the WNF.

We have one Priority III hibernacula confirmed in the action area but reason to believe that several more may occur. There are data to support the hypothesis that some Indiana bats will summer near their hibernacula and others will travel far distances to summer roost (Whitaker and Brack 2002, Timpone 2004). We have summer records of 13 males and evidence of at least 2 maternity colonies using the action area.

### **Running buffalo clover**

Running buffalo clover occurs in mesic habitats in partial to filtered sunlight, where there is a pattern of moderate periodic disturbance for a prolonged period, such as mowing, trampling or grazing, and is often found in areas underlain by limestone or other calcareous bedrock (USFWS 2005a). The plant is not found in mature habitats or in areas of severe disturbance (Cusick, 1989). Ohio populations are found in mesic wooded sites and lawn sites (USFWS 2005a). Suitable habitat for running buffalo clover occurs in both the Athens and Ironton Ranger Districts.

A survey for running buffalo clover was conducted in May 1996 on the Ironton Ranger District of the Forest, specifically in Lawrence County, Ohio. A total of 320 acres were surveyed.

Approximately 1,500 acres were surveyed in 2003, in Lawrence, Scioto and Gallia counties. In 2004, approximately 3,500 acres were surveyed in Lawrence County in preparation for ice storm hazardous fuel treatments. About 1,980 acres were surveyed for this species in 2005. The project driven surveys have not resulted in the discovery of running buffalo clover on the WNF (USFS 2005).

Although suitable habitat occurs throughout the action area, no populations of running buffalo clover were known to occur within the action area until this year. Running buffalo clover was first discovered on the WNF (Lawrence County) in June 2005. The population is located along a 20 foot section of an old ATV/skid trail. There are 34 rooted plants (ramets) in this area. Of the 34 individuals, 27 are located on the old road, and 7 are located on the edge of the old road. The total population may be higher or lower based on the fact that it was censused late in the growing season (August). Viability of this population is currently unknown, but will be investigated in the coming years through annual monitoring during the flowering period.

The habitat on the WNF where the species occurs is fairly open with scattered trees. Two large trees, an American elm and bitternut hickory, provide dappled shading. Canopy cover above this old road section averaged 47±% (measured with a spherical densitometer at four points and in the cardinal directions at each point). Japanese stiltgrass is by far the most dominant species at this site, covering over 75% of the running buffalo clover population. Competition by invasive species is a major threat to running buffalo clover and its habitat rangewide (USFWS 2005a) could be a serious concern for this population.

The old road was recently disturbed during a spring 2005 fire suppression operation, but has since received little traffic. It appears that this trail has not received much illegal OHV traffic in recent years. The fire burned on either side of the old road and may have lightly burned over the road, but there was no direct fire evidence four months after the fire occurred. Invasive plant control is proposed for this site to begin in the fall of 2005.

There is a second population of running buffalo clover in Lawrence County, but it is about 8 miles outside the action area north-northeast of the city of Proctorville, Ohio. The potential for other populations to occur within the action area is high as suitable habitat for the species is abundant.

## **Factors Affecting the Species in the Action Area**

### **Indiana bat**

#### *Mining*

The WNF is located in the heart of Ohio's oil, gas and coal deposits. Industrial minerals such as sand, gravel, limestone, clay, shale, sandstone, and salt are also found within the action area. About 40% of the WNF is currently underlain by federally owned minerals, including oil and gas. Reserved and/or outstanding minerals wholly or partially encumber the remaining 60% of the National Forest.

Extraction of coal, clay, limestone and iron ore have occurred in southeastern Ohio during the last 150 years. Today, remnants of this industrial era are present on the WNF in the form of abandoned surface and underground mines. Features associated with these abandoned mine lands affect riparian and water quality.

Acid Mine Drainage (AMD) is water that is affected by passage through, or alteration by, coal or abandoned coal mine environments. The products of AMD formation, acidity and iron, can devastate water resources by lowering the pH and coating stream bottoms with iron hydroxide. Streams in the action area that are impacted from AMD may have a lowered productivity of aquatic biota, including insects that Indiana bats prey upon. Furthermore, waterways severely impacted by AMD may not provide suitable drinking water sources for Indiana bats. Despite the past impacts to surface water within the action area, the area supports a high density of bats including Indiana bats and 7 other species. This indicates that the action area currently provides ample foraging and drinking sources for bats.

#### Land Ownership and Management

Mature forest with canopy gaps and open understories is important to this species, both during the summer and during the swarming period; however forest structure has changed over time. Researchers believe that the action area was primarily forested, but about 10 percent of the area was disturbed each decade by weather-related events or by forest pests and diseases (Runkle 1982). These disturbances ranged in size from canopy gaps to larger blowdowns, and were scattered across the landscape. In the central hardwood forest, the climate warmed and became drier 5,000 to 8,000 years ago, and an increase in fire occurred. Native American people utilized fire to clear forest from around their camps, clear brush for improved hunting and for better visibility for protection against enemy attacks (Fralish 2004). The action area was a mosaic of early-, mid-, and late-successional forest habitats. As European immigrants moved into the action area in the late-1700s, the forest was cleared for home sites, agriculture, lumber and mining. By 1940, only about 15% of the forest cover was still present in Ohio, and this trend was likely similar for the action area (Ohio Division of Forestry 2004). Active fire suppression began in the 1920s.

Today, the Ohio Division of Forestry estimates that almost 30% of Ohio is now covered by forest once again, and the trend is similar for areas of Kentucky and West Virginia within the Southern Unglaciaded Allegheny Plateau. An estimated 79 percent of the lands within the action area are forested today, based on Landsat TM (1994).

While forest cover has increased, it has a different structure and composition than what occurred here before Europeans first started moving into the area. Based on written accounts of early settlers and travelers in the Ohio Valley, forests were described as being park-like with large, widely spaced overstory trees and relatively little undergrowth of woody vegetation. Chestnut-oak forests dominated the landscape until the early 1900s, but these changed to oak-hickory forests after the chestnut blight occurred. An analysis of the structure, composition and condition of overstory trees in research plots located in southeastern Ohio suggests that the today's forest is denser than that reported for old growth oak-hickory forests and for presettlement forests (Sutherland et al. 2003; Yaussy et al. 2003). Changes in disturbance patterns over the past 75 years have been suggested as reasons why an increase in shade tolerant species (e.g., red maple) is occurring in greater abundance in the forest understory and midstory (Abrams 1992; Abrams

1998). There is no scientific information available at this time to know whether the increasing density of forest communities is a contributing factor to the Indiana bat's decline. Forested lands within the action area are managed in a variety of ways, creating a mosaic of habitat conditions across the action area.

#### *Non-Federal Actions*

About 130,000 acres of New Page and Escanaba Timber Lands (i.e., used to be Mead Westvaco) are scattered across southern Ohio, and a paper mill is located in Chillicothe, Ohio. There are about 5,700 acres of New Page/Escanaba lands in the action area, the primary purpose of which is to ensure a long-term supply of fiber for the paper mill. On lands managed for hardwoods, New Page/Escanaba is testing ways to increase the oak component on the lands it will be harvesting, but no operational procedures are in place. The company is increasing the pine component on its lands with a target of approximately 23 percent of the corporate lands in pine. They are also encouraging private land owners to plant pine which could affect the amount of suitable roosting habitat for the Indiana bat. Road construction and reconstruction occur in association with the timber harvesting.

About 25,450 acres of state-owned property is located within the action area. These properties include at least a portion of various state forests (Dean and Zaleski), wildlife management areas (Crown City, Trimble, and Waterloo), and state parks (Strouds Run, Burr Oak, and Jackson Lake). State forests and wildlife areas are generally managed for game and nongame species. To manage these areas, some timber is harvested and some silvicultural work may be conducted (e.g., prescribed fire). In 2003, the Ohio Division of Wildlife completed its *Indiana Bat Management Strategy*, and its guidance is incorporated into forest management on state properties (ODNR 2003). In wildlife areas and state forests suitable roost trees are only cut in the hibernation period. In state parks, vegetation management occurs only in and around recreation facilities for public safety and scenery. Most of the lands in the state park system will continue to grow older. The only record on state lands near the action area is a single male Indiana bat that was detected in a summer mist net survey at Waterloo Wildlife Area.

The Nature Conservancy has recently acquired some land within the Ironton Ranger District. The organization would like to see the land added to the WNF in the future, but for now has entered into a partnership agreement with the Ohio Division of Wildlife to cooperate in management of wildlife populations on their property. About half of their land consists of open reclaimed coal mine land, while the other half consists of hardwoods. At this time, the Nature Conservancy is not actively managing this property, with the exception of trying to reduce trash dumping.

Other private lands in and around the WNF are managed for a wide variety of purposes. Some timber harvesting is occurring on private lands, and these primarily involve high grading. In Ohio, timber harvest on private land is not regulated. Some landowners in the action area may be performing logging operations at any time of the year. Based on knowledge gained by WNF staff, about 50% of the private lands in the Ironton District have been logged over the past 20 years. About 95 percent of the treatments were considered high-grading or diameter-limit cutting. These private lands are now in various stages of regeneration, from sapling to pole sized trees. This scenario is most likely similar for the Athens District. Forest land is being cleared for new home sites and associated improvements. For example, the Pine Creek Watershed

Assessment showed an increase in urbanization of rural areas around Wheelersburg, Ohio that has occurred in recent times (USFS 2001). The same is occurring around other areas of the WNF. Past forestry actions on private land may have impacted the Indiana bat by reducing suitable roosting and foraging habitat.

#### *Federal Actions*

FHA – On April 15, 2005 the Federal Highways Administration completed formal consultation on the Nelsonville Bypass (USFWS 2005b). Construction is not expected to start until 2007 on the 8.5 mile bypass. According to the non-jeopardy Biological Opinion for this project, a 768 acre linear corridor could be impacted, including all staging, waste, and borrow areas, and ancillary connector roads. About 275 acres of this disturbance could occur on WNF lands.

APHIS - The emerald ash borer is an exotic pest that has been introduced to the United States, and several infestations have been reported in Ohio. This insect has the potential to affect the composition of thousands of acres of forest land in the Midwest; the current treatment is to cut down all ash trees within a half mile of an infected tree. Green ash is considered a Class I Indiana bat preferred roost tree. Ash trees are scattered in stands on WNF lands, but are not a predominant species. The USDA (APHIS) is working on an EIS and programmatic Biological Assessment for treatment of emerald ash borer infestations.

A Final EIS was issued for gypsy moth management in 1995. Mating disruption is an ongoing effort on the WNF where pheromone flakes are aerially applied over targeted forest areas. Gypsy moth outbreaks have the potential to defoliate trees (oaks especially) and can kill them.

USFWS - The Service manages the Ohio River Islands National Wildlife Refuge. Six islands within the action area are in the refuge system (Williamson, Wells, Grandview, Grape/Bat, Middle, and Broadback). The Service has developed a management plan for the refuge, and it contains activities that are beneficial to the Indiana bat. These include the reforestation of bottomland hardwoods and wetlands, creating snag habitat, and conducting summer mist net surveys. Implementing the management plan is an ongoing effort.

Forest Service - Since receiving the 2001 Programmatic Biological Opinion, as amended in 2004, for the 1988 WNF Land and Resource Management Plan, the WNF and Service have implemented a tiered consultation approach. The WNF has tracked management activities that have the potential to adversely affect the Indiana bat through permanent loss of habitat or alteration of habitat.

Since 2001, a total of 1455.5 acres of potentially suitable Indiana bat habitat has been altered, while 21.08 acres of potentially suitable Indiana bat habitat has been permanently lost. Some projects that have gone through this consultation process have not been implemented to date (August 2005). For example, projects that could result in the loss of 74.46 acres of potentially suitable habitat have been planned, but projects amounting to only 21.08 acres have been implemented on the ground. Similarly, projects that could alter 7,739.95 acres of potentially suitable habitat have been planned, but only 1,455.50 acres have been affected on the ground. Although the WNF has implemented projects that may have adversely affected the Indiana bat, those actions have been infrequent and spread broadly across the landscape. Less than 5% of the forest on WNF has been impacted since consultation in 2001.

### **Running buffalo clover**

Please refer to **Factors Affecting Species In the Action Area** for the Indiana bat for a description of ongoing activities in the action area that affect forest conditions. Running buffalo clover responds favorably to forest management activities that introduce small canopy gaps. Without a periodic moderate level of disturbance, a site will become too shaded to provide enough sunlight for the species.

For the most part, state and local governments conduct some form of field review prior to implementing projects, but private landowners generally do not. Some activities occurring on private lands could adversely affect potentially suitable habitat or undiscovered populations of running buffalo clover, such as forest conversion, even-aged timber harvesting, road construction, illegal OHV riding, and energy minerals development. These activities are ongoing within the action area.

Within the action area beneficial activities are occurring and will likely continue to occur as the new Forest Plan is implemented. These include plant surveys on WNF lands, state properties and lands administered by The Nature Conservancy; reforestation activities on WNF lands, state properties and on private lands; and watershed improvement activities on WNF lands, state properties and on private lands.

### **Comparison of 1988 Forest Plan to Revised Forest Plan**

The goals of the Revised Forest Plan are to improve watershed health, provide plant and animal habitat to support viability of all native species, provide a variety of recreation opportunities matched to the capabilities of the Forest and public demand, lease federally-owned oil and gas resources, continue to consolidate National Forest ownership through land acquisition, and contribute to the economies of local communities. These goals were identified by the public during the revision process as areas of principle concern. Key changes between the 1988 Forest Plan and the revised Forest Plan for each of these areas is summarized below. Many of the 2001 PBO terms and conditions and conservation measures for the Indiana bat have been incorporated in the Revised Forest Plan as S&G.

#### *Watershed Health*

Current direction for management of streams, riparian areas, and floodplains focuses primarily on protecting water quality from earth disturbing activities. Forest-wide direction on the reclamation of mined areas and revegetation of other disturbed areas is also included.

The revised Forest Plan has placed more emphasis on restoration of watershed integrity, including restoration and maintenance of healthy aquatic and riparian ecosystems. From a coarse scale perspective, the River Corridor MA was developed to retain, restore, and enhance the inherent ecological processes and functions associated with riverine systems. This MA has been placed along the Hocking River, Little Muskingum River, Ohio River and Symmes Creek - streams that provide habitat for a diverse assemblage of aquatic and semi-aquatic species.

The revised Forest Plan includes a goal to maintain and restore water quality and soil productivity by restoring stream morphology where it has been altered and by enhancing water quality in watersheds affected by acid mine drainage and sedimentation. Forest-wide direction on management of disturbed areas, old water wells and cisterns, soil resources, and abandoned mine lands has been updated or added. A second goal promotes healthy riparian and aquatic ecosystems that sustain ecological processes and functions and a variety of plant and animal communities by restoring wetland and streamside habitat, improving passage for aquatic and semi-aquatic organisms at road-stream crossings, and improving aquatic habitat in lakes and ponds. The revised Forest Plan provides clearer definitions and delineation methods for riparian areas and riparian corridors, and gives direction on the use and application of filterstrips. Forest-wide direction for the design and maintenance of road-stream crossings, oil and gas pipeline stream crossings, wetland restoration, and protection of springs, ephemeral wetlands, ponds and lakes has been updated or added.

### *Vegetation Management*

The current Forest Plan, when signed in 1988, emphasized the use of even-aged management (clearcutting) on over 67% of the WNF to produce early successional habitat and timber volume. Emphasis on clearcutting was substantially curtailed after 1990 and no clearcutting at all has occurred on the Wayne since 1994. Consultation with the Service on protection of threatened and endangered species resulted in a 2001 Biological Opinion, and subsequently Forest Plan Amendment 13, each of which were based on continuation of Amendment 11 (i.e. annual average of 500 acres of only thinning and selection harvests); the current Forest Plan has no provisions for creating early-successional habitat. Little direction is provided in the form of desired future condition, objectives, S&G, or monitoring for the maintenance and restoration of the mixed-oak ecosystem, or the control of non-native invasive species. Use of herbicides and prescribed fire are permitted, if necessary to accomplish Forest Plan objectives, but specific objectives for such use are not spelled out.

At the coarse scale, management area prescriptions have been developed for the revised Forest Plan that will provide for a mix of habitats in which late-successional forest predominates (77% of the WNF), while 23% of the WNF is allocated to management areas with an emphasis on early-successional and grassland habitats. The revised Forest Plan incorporates a large increase in the use of prescribed fire for restoration of the oak-hickory ecosystem.

The revised Forest Plan includes goals to promote healthy terrestrial ecosystems that sustain a variety of plant and animal communities, and to use vegetation management methodologies to provide vegetation characteristics that meet the needs of native and desired non-native plant and animal species. Forest-wide direction includes goals, objectives, S&G to further the recovery of federally listed species in the current and revised Forest Plans. However, direction has been added in the revised Forest Plan to retain and develop Indiana bat summer roosting habitat when using timber harvesting methods other than selection or thinning, and for protection of running buffalo clover populations.

### *Recreation*

The current Forest Plan provides direction on dispersed (trails) and developed (campgrounds, picnic areas) recreation management, however the introduction of Off-Highway Vehicle (OHV) management was one of the most important decisions made in the 1988 Forest Plan. OHV use is

restricted to designated trails within specific management areas. Prior to 1988, OHV use was not restricted to designated trails or specific areas of the Wayne National Forest. The 1988 Forest Plan projected that 250 miles of OHV trails would be created by the end of 1995, with 285 miles of trails in existence by 2002. Currently, there are 116 miles of designated OHV trails on the WNF. Direction for development and maintenance of hiking and horseback riding trails is included in the 1988 Plan, but mountain biking is not mentioned. Interpretation and education direction for heritage resources, such as the iron furnaces, the Underground Railroad, and pre-historic sites, received minimal mention in the 1988 Plan.

The revised Forest Plan retains the OHV management direction found in the current Forest Plan, limiting OHV use to designated trails within specific management areas. The footprint of the OHV management areas has remained essentially the same (slight changes in the boundary to make it easier to identify on-the-ground). The capacity to provide semi-primitive non-motorized recreation experiences is limited by its fractured ownership pattern and dense network of roads. Areas managed for semi-primitive non-motorized recreation will increase from the current 8% of the WNF to 11% under the revised Forest Plan. It also provides for modest increases in objectives for construction of hiking, equestrian and biking trails, compared to current objectives. Goals, objectives and Forest-wide direction for heritage resources have been enhanced.

#### *Minerals Management*

Oil and gas exploration and development is recognized as a suitable use of the WNF in the current Forest Plan; the entire federally owned oil and gas mineral estate is administratively available for leasing. This is consistent with law and regulation that direct that federally owned minerals should generally be available for leasing and that administrative availability is to be withdrawn only under special circumstances, such as in designated wilderness. The key stipulation addressed in the Forest Plan is the No Surface Occupancy (NSO) stipulation, which prohibits use or occupancy of the land surface for oil and gas exploration and development. The current Forest Plan uses a three-step process for leasing federally owned oil and gas rights: (Step 1) the Forest Plan, its associated environmental impact statement, and the record of decision – specifically decisions regarding mineral rights availability and surface occupancy permissibility by management area; (Step 2) decisions to authorize leasing of specific tracts of federally owned minerals for oil and gas development; and (Step 3) decisions regarding Applications to Drill (APD) wells, build access roads, and install related structures on specific leases.

The revised Forest Plan requires no surface occupancy on 13% of the Forest, compared to the current Forest Plan, which prohibits surface occupancy on 12% of the Forest. However, the revised Forest Plan will now allow surface occupancy on the Marietta Unit, which is one area of the WNF that has the highest potential for continued oil and gas development.

The revised Forest Plan's FEIS is intended to provide sufficient NEPA analysis to support future consent to lease decisions, moving from the current three-step process to a two-step process. The FEIS/ROD for the revised Forest Plan decides on availability, and which stipulations would be attached to leases, on which parts of the Forest; site-specific NEPA would still occur when the operator presents a plan of operations/application to drill for a specific lease.

### *Land Ownership*

The 1988 Forest Plan decision set an ultimate goal of 322,000 acres in National Forest ownership and estimated that the WNF would contain approximately 250,000 acres by the year 2000. As of March 31, 2003, National Forest System ownership on the Wayne was approximately 233,000 acres. The revised Forest Plan includes Forest-wide goals and objectives to consolidate ownership, but does not alter the goal for the size of the Wayne National Forest.

## **IV. EFFECTS OF THE ACTION**

This programmatic Forest Plan consultation requires two levels of analysis. The first level of the analysis considers how the overall Forest Plan goals and desired conditions will affect listed species. The second level of the analysis will consider how the specific management actions that implement the Forest Plan will affect listed species.

### **Effects of the Forest Plan Goals on Indiana bat and running buffalo clover**

The goals of the Revised Forest Plan are to improve watershed health, provide plant and animal habitat to support viability of all native species, provide a variety of recreation opportunities matched to the capabilities of the Forest and public demand, lease federally-owned oil and gas resources, continue to consolidate National Forest ownership through land acquisition, and contribute to the economies of local communities.

Improving watershed health on the WNF is emphasized through the implementation of the River Corridor MA. This MA was developed to retain, restore, and enhance the inherent ecological processes and functions associated with riverine systems and will provide habitat for a diverse assemblage of aquatic and semi-aquatic species. In addition to this MA, goals, objectives, and S&G that maintain and restore water quality and soil productivity by restoring stream morphology where it has been altered and by enhancing water quality in watersheds affected by acid mine drainage and sedimentation will be implemented forest-wide. Improving watersheds will benefit the Indiana bat by providing clean drinking water, an increased insect prey base, and more intact forested stream corridors. Watershed activities will also be beneficial for running buffalo clover habitat by reducing sedimentation and runoff.

Providing plant and animal habitat to support all native species on the WNF will be accomplished by implementing a diverse array of management areas. Vegetation goals provide for a mix of habitats in which late-successional forest predominates (77% of the WNF), while 23% of the WNF is allocated to management areas with an emphasis on early-successional and grassland habitats. The revised Forest Plan incorporates a large increase in the use of prescribed fire for restoration of the oak-hickory ecosystem. Goals, objectives, S&G are provided to minimize impacts to and further the recovery of federally listed species forest-wide. The WNF will retain and develop Indiana bat summer roosting and foraging habitat, protect hibernacula and swarming sites, and protect running buffalo clover populations. Diverse Continuous Forest, Historic Forest, Future Old Forest, and River Corridor management areas will increase habitats suitable on the WNF for both Indiana bat and running buffalo clover. In particular, detection of Indiana bats in Appalachian forests, such as the WNF, may be higher where canopy cover is greater (Ford et. al 2005), such as is found in older forests. It is estimated that after 100 years of

achieving the proposed MAs, the WNF will have an increase of mature hardwood forest by more than 119,000 acres (USFS 2005), which will likely benefit the Indiana bat and running buffalo clover populations by increasing the quality and quantity of suitable habitat for each species.

Providing recreational opportunities on the WNF includes developed (e.g. campgrounds, lakes) and dispersed (e.g. trails) recreation areas. Although these activities are not usually beneficial for Indiana bat and running buffalo clover, the S&G for maintaining and developing recreation on the forest will avoid or minimize effects to these species. Specifically, the S&G will protect known population concentration sites (hibernacula, swarming areas) and maintain potential suitable habitat (snag retention). Thus, the recreational goals of the proposed action are not likely to cause adverse effects to either the Indiana bat or running buffalo clover populations found within the action area.

Leasing federally-owned oil and gas on the WNF allows for development of energy reserves while maintaining suitable habitat for Indiana bat and running buffalo clover. A no-surface-occupancy rule exists on 13% on the WNF. These areas of scenic, recreational, or wildlife habitat have been identified as having important qualities that will not be disturbed during oil and gas activities. For the rest of the oil and gas development sites, S&G are in place to avoid or minimize habitat loss for the Indiana bat and running buffalo clover.

Land acquisition and exchange are goals in the Forest Plan that allow for consolidation of Federal lands. This goal may provide for more contiguous protected property that is managed with consideration of the Indiana bat and running buffalo clover's habitat requirements.

In totality, the overall goals and objectives of the Revised Forest Plan for the WNF are consistent with the ecological needs of the Indiana bat and running buffalo clover. Suitable foraging, roosting, swarming, and hibernation opportunities will likely be maintained for the Indiana bat across the WNF with the implementation of this plan and protection of running buffalo populations will be protected and managed for viability. After ten years of implementing the Forest Plan, mature forest habitat suitable for the Indiana bat will have increased from 77,793 acres to 108,413 acres (R. Ewing pers.com). Currently, about 40% of the forest stands on the WNF offer suitable habitat for the Indiana bat, implementation of the Forest Plan goals would increase that habitat to 81% of the WNF after 100 years (USFS 2005). Similarly, an increase in forested habitat will also benefit running buffalo clover.

### **Effects of Management Activities on Indiana bat**

Although the overall goals of the proposed action are expected to have beneficial effects for both the Indiana bat and running buffalo clover, the means by which the Forest Service will achieve their goals may unavoidably cause adverse effects to these species. Thus, this section assesses the likelihood and magnitude of impacts that may result directly or indirectly from the management actions proposed. Specifically, we assess the measurable and detectable responses of Indiana bats exposed to the proposed management actions, the environmental impacts associated with the actions, and the likelihoods of the exposure and the consequent responses occurring. To determine if a management action will affect Indiana bats, we first look at whether Indiana bats will be exposed temporally and spatially to the action itself or any environmental consequence of the action. If exposure is likely, we then assess how bats will respond to that exposure. We rely on both Indiana bat-specific, as well as, general bat literature

to make these predictions. Once we anticipate the individual fitness responses, we then look at how these individual responses affect the population or colony in which these individuals belong. Lastly, we assess how the anticipated changes, if any, at the population or colony level will affect the fitness of the species rangewide.

In general, the environmental consequences associated with all management actions proposed include: disturbance from human presence, reduction in foraging habitat, and loss of roost trees. The responses of individuals exposed directly to the management action or these associated environmental consequences will vary depending on the timing and scale of the management action. The analyses below describe how each management activity is expected to affect Indiana bats. Table 5 identifies the proposed management actions and their associated project elements, the environmental impacts resulting from these project elements, and the likely responses of individuals exposed to these environmental impacts. It also describes the anticipated effects to the affected population in terms of reproduction, numbers, and distribution.

The S&G that reduce exposure and responses are described in more detail in Appendix A. It is important to emphasize that this effects analysis is predicated on the fact that all S&G in the Conservation Plan will be fully implemented. If not, this analysis may no longer be valid.

#### *Agriculture*

Special use permits for agricultural activities (see Table 5) could occur on 50 acres of the WNF. Although all life stages could be exposed to these activities, it is not anticipated that the Indiana bat will show a response to these minor actions as they are not likely to affect or reduce roosting or foraging habitat, nor are they likely to disturb individuals.

#### *Timber Management*

Over the next ten years, timber management activities are anticipated to occur on 20,054 acres on the WNF (see Table 2 for breakdown of type). Even-aged harvests will occur on a 120 year rotation, and uneven-aged treatments will occur about every 30 years. No one site will be entered multiple times within the scope of this consultation. For purposes of this effects analysis, timber management is separated into actual timber harvest and other timber management elements (see table 5) that involve construction and maintenance of roads, log landings, and skid trails.

Many S&G are in place to avoid or minimize impacts to Indiana bats during timber harvest activities. The following S&G place buffers around hibernacula and swarming sites and limit human access to these areas (SFW-TES-1, SFW-TES-2, and GFW-TES-3). The following S&G provide protection of roosting and foraging habitat now and into the future (SFW-TES-7, SFW-TES-8, GFW-TES-9, SFW-TES-10, and SFW-TES-12). During all timber prescriptions, hickories, snags, travel corridors, and future roost trees will be retained, unless they are considered a safety hazard. Because all snags and hickories will be marked and avoided, it is extremely unlikely that a roost tree would be removed during actual timber harvesting. The environmental consequences of timber harvest include alteration of foraging habitat and disturbance from noise/human presence.

Timber harvesting can reduce a traditional foraging area used by a colony or male bat. If this occurs, bats respond by searching for a new foraging area if the character of the area has been substantially altered or a substantial portion of the area is cut. The implications of finding a new

site will depend upon the availability of foraging areas nearby. We anticipate if a foraging area is altered, those individuals exposed will be able to locate a new foraging area within their traditional home range or nearby. Although searching for a new foraging area can lead to increased energy expenditure, which if prolonged and severe could lead to lower reproductive success, we do not anticipate the impact to rise to the level of injury or mortality. The S&G require foraging elements to be retained (forested corridors, canopy cover, etc.), and thus, Indiana bats will have additional foraging habitat readily available to them.

Adverse effects to the Indiana bat may occur during timber harvesting due to disturbance from noise/human presence. Indiana bats may elicit a behavioral response to this exposure through temporarily abandoning roost sites. Although they may flee a specific roost during the activity, we anticipate the disturbance will be temporary, and bats will not need to abandon and search for a new roost site.

In addition to the potential adverse effects, we also anticipate beneficial effects to the Indiana bat such as oak regeneration, increased solar exposure, and reduced understory clutter. Indiana bats may respond to these impacts by having increased roosting success (via increase in the diversity of thermal roosting opportunities), improved foraging success, less torpor, and ultimately increased pup and adult fitness. Oak regeneration will improve roosting habitat in the long term for the Indiana bat by providing ample suitable roosts, while reduced understory clutter will improve travel corridors and foraging opportunities. As discussed in the Status of the Species section, maternity roost trees with solar exposure reduce the amount of time a pup needs to develop and reduces the amount of heat energy needed to keep a colony warm. This thermoregulatory benefit can increase survival of adults and pups due to lower energy demands. All of these beneficial effects help offset, in the long-term, any potential population level adverse effects due to loss of potential roost trees, reduction in traditional foraging areas, and disturbance due to noise/human presence.

The other project elements of timber management--road construction, and construction of skid trails and log landings--may adversely affect Indiana bats. These elements can be implemented any time of year but do require avoidance of hickories year around and snags in the summer (GFW-TES-9, SFW-TES-10) when direct impacts to Indiana bats could occur. Up to 392 acres of permanent roads, 146 acres of temporary roads, and 740 acres of skid trails and log landings are possible on the WNF over the next ten years. The environmental consequences of roads, skids, and landings include loss of an undetected roost tree, alteration of foraging habitat, and disturbance from noise/human presence.

Loss of roost trees can have direct and indirect implications for reproductive females. As explained previously in the Status of Species section, female and young Indiana bats depend on specific roost trees for their reproductive success and survival. If their primary roost tree or several potential roost trees are removed, the exposed individuals will need to search for new roosting sites. This can lead to increased energy expenditure, torpor, and possibly loss of young if the expenditure is sufficiently severe and prolonged. Individual males can also be impacted by loss of an undetected roost tree if cut while occupying the tree. For the proposed action, we do not anticipate direct impacts due to loss of primary maternity roost trees as S&G are in place to avoid taking snags and hickories in the summer. This S&G is anticipated to eliminate the likelihood of taking a unknown primary roost tree. Thus, direct impacts will occur only if an

undetected secondary or a less important roost tree is cut while occupied by individuals. Indirect impacts may occur if a substantial portion of a colony's summer area or a primary maternity roost is cut in the winter. We do not anticipate that either of these scenarios is likely, however. These management actions are typically linear (roads and skids) or small in size (landings) within a landscape which is heavily forested. As such, we do not expect that these activities would ever lead to removal of all or a significant portion of an individual's home range. If a traditional primary roost tree is cut, we fully expect that the individuals will be able to readily locate a new roost within or nearby its traditional roosting area. Thus, although the exposed individuals will need to locate a new primary roost, we do not anticipate the physiological response of these individuals will negatively affect their overall fitness.

Similarly, alteration to a traditional foraging area can cause direct and indirect impacts. If construction of roads, skids or log landings results in a loss of a foraging area, bats will respond by searching for a new foraging area. The implications of finding a new site will depend upon the availability of foraging areas nearby. As with roosting habitat, we anticipate if a foraging area is altered, those individuals exposed will be able to readily locate a new foraging area within their traditional home range or nearby. Although this can lead to increased energy expenditure, we do not anticipate injury or mortality occurring. The reason for this is that these timber management elements are typically linear (roads and skids) or small in size (landings) within a landscape which is heavily forested. As such, these actions are unlikely to take all or a substantial portion of a traditional foraging area for either an individual or a colony.

In addition to roosting and foraging impacts, adverse effects to the Indiana bat may occur during road, landing, and skid construction due to disturbance from noise/human presence. Indiana bats may respond to this exposure by temporarily abandoning roost sites. Although they may flee a specific roost, Indiana bats are expected to remain within their traditional homerange when this short term disturbance occurs.

In summary, we anticipate that adverse effects to exposed individuals could occur as a result of road, skid or log land construction if an undetected secondary or lesser important roost tree is cut during the summer. Although it is difficult to predict given the linear nature of the loss and S&G to avoid hickories and snags in the summer, it is likely that one occupied roost tree could be unknowingly cut during the 10-year period for both road construction and skid and landing construction. As this is likely to be a secondary or less important roost tree, we anticipate only a few individuals would be exposed to this threat.

### *Recreation*

Recreation actions including OHV, hiking, horse, and mountain bike trail construction and maintenance, and lake and pond construction may occur all year around. New trail construction is anticipated to reach 265 acres (see Table 2 for a breakdown of type). Several S&G are in place to avoid impacts to Indiana bat hibernacula and swarming sites by avoiding trail placement near these features (SFW-TEs-1, SFW-TEs-2, and GFW-TEs-3). Environmental consequences of recreation activities include loss of undetected roost trees, alteration of foraging habitat, and disturbance from noise/human presence. The impacts of altering foraging habitat and disturbance from noise/human presence are similar to those that occur during timber management activities discussed above.

As protection of roost trees will occur during construction and maintenance of recreation sites and canopy cover will be maintained over new trails (SFW-TES-7, SFW-TES-8, GFW-TES-9, SFW-TES-10, SFW-TES-12), direct impacts to Indiana bats will only occur if an undetected secondary or less important roost is taken in the summer. Indirect impacts will occur if a primary roost or a substantial portion of an individual's or colony's home-range is removed in the winter. The Forest Service maintains great flexibility in choosing the placements of new trails to minimize exposure of Indiana bats to recreation activities. Further, recreation actions are typically linear (trails) or small in size (parking lot) within a landscape which is heavily forested. For these reasons, these direct and indirect effects are unlikely to result in the loss of a primary maternity roost tree or important secondary roost.

Loss of an unknown secondary or less important roost could occur. Indiana bats are expected to respond much the same way as described above for timber management except on a smaller scale. The frequency and intensity of Indiana bats' exposure to recreational activities is extremely low. While the overall acreage may appear substantial if it was all in one area, each individual project is typically small, linear, and would only remove a small portion of a forested landscape. As with timber management, we only expect adverse effects to occur if an undetected roost tree is cut during summer. If this occurs, we anticipate a few individuals would be exposed and their responses would be temporary and non-injurious and non-lethal.

We also anticipate beneficial effects to the Indiana bat, including increased solar exposure and increased quantity of travel corridors. Indiana bats may respond to increased solar exposure as discussed under timber management. Creation of recreational trails with a canopy cover may increase suitable flight corridors for the Indiana bat which in turn may increase foraging success and future fitness. Thus, recreational activities are not likely to incur any negative population level fitness consequences.

#### *Transportation*

Transportation actions involving construction and maintenance of temporary or permanent roads usually occurs in association with timber, watershed, and oil and gas activities and may occur year around. Effects associated with these actions are discussed within the sections for which they apply (timber or energy). Decommissioning of roads is anticipated to occur on 29 acres over the next 10 years. This action is beneficial for the Indiana bat as it will allow for reforestation and increased roosting opportunities in previously unsuitable habitat.

#### *Fire Management*

Fire management activities involve building fire lines, conducting prescribed burns, lop and scattering hazardous fuels, and suppressing wildfires (see Table 5). Prescribed fire is a valuable management tool for increasing oak regeneration, reducing NNIS, maintaining prairie habitats, and reducing hazardous fuels on the WNF. Several S&G are in place to avoid or minimize impacts to Indiana bats during fire activities and include protection of hibernacula and swarming sites (SFW-TES-2, GFW-TES-3, SFW-TES-4) and protection of roosting and foraging habitat now and into the future (GFW-TES-9, SFW-TES-10, SFW-TES-11). For purposes of this effects analysis, fire management is separated into the actual effects of the burn and construction of fire lines.

Prescribed burning will only occur from August 15 to early spring. No fires will be conducted during the Indiana bat maternity season. Thus, Indiana bats will only be directly exposed to fire while roosting in trees during the late summer. Direct adverse effects due to fire include disturbance from noise, smoke, and heat, loss of a roost tree, and alteration of foraging habitat. Prescribed burns will not occur during the maternity season. As all bats will be volant during a prescribed burn, it is anticipated that they could escape a burning roost tree without injury or mortality.

Responses from direct exposure to noise, smoke, and heat to roosting bats during prescribed burns are expected to be behavioral and include temporary abandonment of roost areas. Loss of roost trees would be similar as to what is described above under timber management. As burning will occur in late summer and beyond, no direct impacts to maternity colonies are anticipated but individual roosting bats could be exposed. Prescribed fires that occur on the WNF are typically low intensity, ground burning fires in which the possibility of burning up a snag is not reasonably certain to occur. Thus, we anticipate direct loss of roost trees and exposure to heat, smoke, and noise are not likely to incur any negative population level fitness consequences.

Direct impacts to foraging habitat may occur if prescribed burns take place while bats are not hibernating. This encompasses a small window during the late summer/early fall burn season. Environmental consequences to alteration of foraging habitat may include short term reduced foraging efficiency due to loss of prey base. We do not anticipate this exposure would cause injury or mortality due to the fact that prescribed fires will be spaced across the landscape and ample foraging areas will likely be maintained within a traditional foraging area for an Indiana bat.

Indirect effects may occur if an unoccupied primary roost tree is burned. In the rare circumstance that a traditional primary or an important secondary roost is lost during a prescribed burn, Indiana bats will have other roosts within their homerange to use the following year, as not all roosts are anticipated to be lost and only a small portion (typically less than 250 acres) of the forest are burned on any given day. Given the forested landscape, Indiana bats are anticipated to know of and locate new roosts easily within their homerange or nearby. Thus, we do not anticipate injurious or lethal responses from indirect exposure to prescribed fires.

Beneficial effects to the Indiana bat from fire include snag creation, reduced understory clutter, and reduced size and intensity of wildfires. Indiana bats may respond to these environmental consequences by having improved foraging success and roosting success (see Table 5).

Fire lines can be constructed and maintained anytime of the year, but loss of potential roost trees will be avoided (GFW-TEs-9, SFW-TEs-10). It is anticipated that up to 74 miles of fire line could occur on the WNF in the next 10 years. The environmental consequences constructing fire lines include loss of an undetected roost tree, alteration of foraging habitat, and disturbance from noise/human presence. We expect exposure and response to these environmental consequences will be as described above for timber management elements.

Briefly, although it is difficult to predict given the linear nature of the loss and S&G to avoid hickories and snags in the summer, it is likely that an occupied roost tree could be unknowingly

cut during the 10-year period due to fire line construction. For the reasons discussed above, this roost tree is not anticipated to be a primary maternity roost tree or important secondary roost, but an unknown lesser used secondary roost or a roost occupied by a single or few individuals.

In summary, we anticipate that adverse effects to exposed individuals could occur as a result of an undetected secondary or lesser important roost tree being cut during fire line construction. Although it is difficult to predict given the linear nature of the loss and S&G to avoid hickories and snags in the summer, it is likely that one occupied roost tree could be unknowingly cut during the 10-year period. As this is likely to be a secondary or less important roost tree, we anticipate only a few individuals would be exposed to this threat.

#### *Watershed*

Watershed activities including wetland restoration, stream/riparian restoration, and acid mine drainage remediation projects may occur any time of the year. Up to 20 miles of stream and riparian restoration and 150 acres of wetland restoration and enhancement could occur over the next ten years. No adverse effects are anticipated from restoration activities. Beneficial effects include increased foraging success due to decreased soil erosion, improved water quality, improved stream flow, and additional water sources as well as increased roost sites due to reforestation in riparian areas in the long term.

Acid mine drainage projects are anticipated to occur on 270 acres over the next 10 years. Actions including construction of dosers, limestone channels, and wetlands to neutralize AMD involve large amounts of soil movement and temporary roads for access to sites. Environmental consequences include loss of unknown roost trees, temporary alteration of foraging habitat, and disturbance from noise/human presence. The impacts of altering foraging habitat and disturbance from noise/human presence are similar to those that occur during timber management activities discussed above.

As protection of roost trees will occur during AMD projects (GFW-TES-9, SFW-TES-10), direct impacts to Indiana bats will only occur if an undetected secondary or less important roost is taken in the summer. Indirect impacts could occur if such roosts are removed in the winter. Much flexibility exists in choosing the placements of temporary roads and channels to minimize exposure of Indiana bats to AMD activities. All AMD projects will have temporary impacts as areas to be disturbed will revegetate over time. Loss of trees during temporary road construction or earthmoving is minor when compared to the heavily forested surrounding landscape. In addition, AMD activities are typically small in size within a landscape which is heavily forested. For these reasons, direct and indirect effects are unlikely to result from a loss of primary or important secondary roost trees. Loss of a lesser important roost tree could be cut, and Indiana bats are expected to respond much the same way as described above for recreational activities. The frequency and intensity of Indiana bats' exposure to AMD projects is extremely low. Although adverse effects may occur due to AMD activities, they are not anticipated to rise to the level of injury or mortality. Further, reduction in AMD will result in improved water quality and may improve Indiana bats' foraging efficiency. Thus, from a population level perspective, we do not anticipate any negative consequences.

AMD projects also involve the closing of subsidences and mine openings. As these features could be used by Indiana bats as hibernacula, several S&G are in place to minimize impacts

(GFW-TES-3, SFW-TES-5, and GFW-TES-6). All potentially suitable mine openings will be evaluated and surveyed before closure. If Indiana bats are detected, the opening will be gated and the surrounding habitat will be protected from alteration. Due to the S&G and commitment of the WNF to protect potential hibernacula, injury or death of an Indiana bat during AMD projects is extremely unlikely to occur. Thus, watershed activities are not likely to incur any negative population level fitness consequences.

#### *Pest Management*

Pest management including mechanical, chemical, and biological control of NNIS as well as grape vines and young maple will occur throughout the forest on 15,377 acres over the next 10 years. Indiana bats may directly be exposed to noise and human presence during management periods if conducted in the summer. Indiana bats may respond to noise and human disturbance by temporarily abandoning roost sites. Although they may flee a specific roost, Indiana bats are expected to remain within their traditional homerange when this short term disturbance occurs. We expect beneficial effects, including increased roost sites due to improved health of the oak/hickory forest community and increased foraging efficiency in the long term due to increased biodiversity (fewer invasive monocultures = more insect prey), to occur. Although pest management activities are anticipated to occur on many acres throughout the forest the adverse effects due to disturbance to the Indiana bat are minor and short term and will not rise to the level of injury or mortality.

#### *Wildlife Management*

Wildlife management activities include reforestation, establishing and maintaining wildlife openings, and installing bat friendly gates. Trees are not typically removed for these activities. Wildlife openings may be established after trees are cut for other management reasons (e.g. log landings) or in already open areas. Although all life stages could be exposed to these activities, it is not anticipated that the Indiana bat will show a response to these minor actions. Wildlife management activities are not likely to adversely affect or reduce roosting or foraging habitat, nor are they likely to disturb individuals.

Further, there will be beneficial effects including increased solar exposure, increased roost trees, and protected hibernacula sites. Indiana bats may respond to increased solar exposure and increased roosting opportunities as described under timber management. Protection of hibernacula through bat-friendly gates may increase survival of Indiana bats in the winter and lead to increased numbers at the population level.

#### *Land Acquisition & Exchange*

Land acquisition and exchange creates larger contiguous areas of public ownership thus reduces the potential exposure to activities on private lands. Although Indiana bats are protected wherever they occur, private landowners do not have a mandate to further the conservation of the species. The WNF will not exchange land if listed species occur on that parcel. For these reasons, no adverse effects are anticipated from these activities.

#### *Energy*

Oil and gas development, utility lines, and temporary roads associated with these activities can occur any time of the year throughout the forest. The WNF anticipates leasing 42 acres of oil and gas over the next ten years and will apply S&G to these projects to protect hibernation,

roosting, and foraging habitat (SFW-TES-2, GFW-TES-3, GFW-TES-9, SFW-TES-10, and Appendix H (Notification 10, Stipulation 10, Stipulation 12). Because all snags and hickories will be avoided, it is extremely unlikely that a primary roost tree would be removed during oil and gas development with Federal leases. The environmental consequences of oil and gas development include loss of an undetected secondary or lesser important roost tree, alteration of foraging habitat and disturbance from noise/human presence as discussed under timber harvesting.

In addition, up to 50 acres of utility lines may be granted by a special use permit to private individuals with inholdings. Although the WNF provides Indiana bat protection recommendations to private individuals needing access across or on the forest, S&G are not always enforceable. The environmental consequences anticipated include loss of roost trees, alteration of foraging habitat, and disturbance from noise/human presence.

Loss of roost trees can have substantial implications for reproductive females. As explained previously in Status of Species section, female and young Indiana bats depend on specific roost trees for their reproductive success and survival. If their primary roost tree or several secondary roost trees are removed, the exposed individuals will need to search for new roosting sites. This can lead to increased energy expenditure, torpor, and possibly loss of young if the expenditure is sufficiently severe and prolonged. Individual males can also be impacted by loss of an undetected roost tree if cut while occupying the tree. For the proposed action, we do not anticipate direct impacts due to loss of primary maternity roost trees as S&G are in place to avoid taking snags and hickories in the summer for utility lines (although they may not always be enforceable). Direct impacts will occur only if an undetected secondary or a less important roost is cut while occupied by individuals. Indirect impacts may occur if a primary maternity roost is cut in the winter. However, these actions are typically linear and small within a landscape which is heavily forested. As such, we do not expect that these activities would ever lead to removal of all or a significant portion of an individual's home range. If a traditional roost tree is cut, we fully expect that the individuals will be able to readily locate a new roost within or nearby its traditional roosting area. Thus, a loss of primary roost or other important roost trees during the winter is unlikely to negatively affect the fitness of the individuals exposed. As previously explained, loss of secondary roosts are likely to affect single or a few individuals.

Similarly, utilities can reduce a traditional foraging area used by a colony or male bat. As with roosting habitat, we anticipate if a foraging area is altered, those individuals exposed will be able to readily locate a new foraging area within their traditional home range or nearby. Although this can lead to increased energy expenditure, we do not anticipate the increased energy needs will cause injury or mortality. As indicated, these actions are typically linear and small and will occur within a landscape which is heavily forested. Because of this, these actions are unlikely to take all of the traditional foraging area available for an individual or a colony.

In addition to roosting and foraging impacts, adverse effects to the Indiana bat may occur during utility line construction due to disturbance from noise/human presence. Indiana bats may respond to this exposure by temporarily abandoning roost sites. Although they may flee a specific roost, due to the linear and small scale disturbance of these elements, Indiana bats are expected to remain within their traditional homerange when this short term disturbance occurs.

In summary, we anticipate that given the linear nature of the loss and the fact that S&G to avoid hickories and snags in the summer may not always be applied, it is likely that an occupied roost tree could be unknowingly cut during the 10-year consultation period due to utility construction. For the reasons discussed above, this roost tree is not anticipated to be a primary maternity roost tree or important secondary roost, but an unknown lesser used secondary roost or a roost occupied by a single male.

Surface coal mining is highly unlikely to occur within the next ten years and thus will not be analyzed under this programmatic consultation.

### *Hazard Tree Removal*

Hazard tree removal can occur any time a live or dead tree poses an imminent safety concern on the WNF. Hazard tree removal typically takes place in developed recreation areas, along trails and roads, along utility corridors, and along fire lines. The WNF anticipates that up to 2,550 hazard trees could be removed over the next 10 years. Over the past 4 years only 20 hazard trees were removed in the summer. Most hazard trees are not suitable roost trees for the Indiana bat (L. Andrews per.com). The WNF estimates that about 2% of the hazard trees to be taken down in the summer could be potentially suitable roost trees. Based on past trends on the WNF it is unlikely that a primary roost or important secondary roost would be removed. Hazard tree removal is usually carried out in the winter when Indiana bats would not be directly exposed. Although it is difficult to predict, based on past trends, the likelihood that a hazard tree occupied with females and non-volant pups would be removed is extremely low. A standard is in place (SFW-TEs-10) that requires emergence surveys on hazard trees that may be potential maternity trees before they are removed in recreation areas (i.e., high public use areas). If an emergence survey detects a maternity tree, every effort will be made to save the tree unless it is an immediate safety issue. As it is extremely unlikely that an occupied roost tree will need to be removed no injury or mortality is anticipated to occur. If a minor secondary roost tree is cut, we fully expect that the individuals will be able to readily locate a new roost within its traditional roosting area upon returning the following summer. Thus, if a roost tree is removed in the winter, we do not anticipate any detectable negative fitness response.

### *Summary*

The overall goals and objectives of the Revised Forest Plan are expected to be beneficial for the Indiana bat. Adverse effects to the Indiana bat through implementation of the Revised Forest Plan may result from disturbance from human presence, reduction in foraging habitat, and loss of unknown roost trees. We anticipate, however, that the S&G will greatly limit the extent to which these adverse effects will occur. We expect that it is reasonably certain that occupied secondary or less important roost trees could be removed during the summer period as a result of construction of roads, skid trails, and log landings; creation of fire lines; and utility development. These actions may result in fitness consequences at the individual level, but are not expected to have negative population-level consequences. Specifically, fitness level consequences to individual females are not anticipated to rise to the level of affecting the fitness of the maternity colony due to the few number of individuals that are expected to be exposed. Likewise, take of single males is not expected to be detected at the hibernaculum or the population level.

Although 9.2% of the suitable Indiana bat habitat in the action area could be altered through Forest Plan implementation, much of this alteration will result in long term habitat improvements

for the Indiana bat. Many S&G are in place to avoid and minimize adverse effects. In addition, activities which may directly or indirectly affect the Indiana bat and its habitat would likely be distributed across the landscape and over time. Tier II project analysis will occur and at that time any additional protective measures needed to avoid or minimize adverse effects will be identified. The amount of suitable Indiana bat habitat found on the WNF will increase by 30,620 acres over the next ten years with the implementation of the Revised Forest Plan. Standards, guidelines, and WNF's Conservation Plan ensure the following: 1) protection of known and potential hibernacula and swarming sites; 2) maintenance, protection, and creation of foraging and roosting habitat; 3) obtaining information on population distribution, status and trends; 4) providing bat educational opportunities for WNF staff; and 5) conducting studies that aid in the survival and recovery of the Indiana bat. Thus, we anticipate that the short-term individual fitness consequences will occur, over the long-term, but the Revised Forest Plan will benefit Indiana bats occurring within the action area overall. Thus, we do not anticipate any detectable negative consequences to the populations in which the individuals occurring within the action area belong to. As such, no detectable reductions in reproduction, numbers or distribution for the species are anticipated.

Table 5. Effects analysis for Indiana bat

Management Elements		Environmental Impact	Ibat Exposure	Ibat Response	Population RND Response	
Agriculture	grazing		shortening vegetation	all life stages	none	
			maintain open habitat	all life stages	none	
	hay		noise disturbance	all life stages	none	
			soil compaction	all life stages	none	
			maintain open habitat	all life stages	none	
Timber Management	Road construction		see transportation	see transportation	see transportation	see transportation
	Skid & Log landings		remove groups of trees	indirect winter exposure and direct & indirect summer exposure	winter: none because of S&G summer: range from no response to mortality--> decrease roosting sites-->slow pre- and post-natal development--> reduced young and female survival; decrease foraging efficiency-->reduce young and adult survival; direct injury or mortality from felling roost tree	short-term reduction in reproductive success
			soil compaction	all life stages	none	
	Even-aged	clear-cut	decrease stem density	winter: no direct exposure	NA	
				winter: indirect exposure - all life stages	none because of S&G	
			summer harvest: all life stages	range from no response -->decrease foraging efficiency--> reduce young and adult survival	no response	
		oak regeneration	all life stages	increase roost opportunities	none to increase reproduction success & numbers	
		increase solar exposure	all life stages	improve roosting opportunities with increase pre- and post-natal development efficiency, which leads into increase adult fitness (less time needed to care for young, better thermoregulatory conditions-->less torpor, lower metabolic expenditure)	none to increase reproduction success & number	
		increase noise/human presence	summer harvest: all life stages	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response	
	thinning	same as clear-cut without oak regeneration	same as clear-cut	same as clear-cut	same as clear-cut	

Management Elements		Environmental Impact	Ibat Exposure	Ibat Response	Population RND Response	
	Uneven-aged	Shelterwood and Two-aged cuts	same as clear-cut	same as clear-cut	same as clear-cut	same as clear-cut
		remove individual trees or group selection	winter: no direct exposure	NA		
			winter: indirect exposure - all life stages	none because of S&G		
			summer harvest: all life stages	range from no response-->decrease foraging efficiency--> reduce young and adult survival	no response	
			reduce vegetation clutter	same as individual trees or group selection	no response to increase foraging success; increased travel corridors	
			increase noise/human presence	summer harvest: all life stages	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response
increase solar exposure	all life stages	improve roosting opportunities with increase pre- and post-natal development efficiency, which leads into increase adult fitness (less time needed to care for young, better thermoregulatory conditions-->less torpor, lower metabolic expenditure)	increase reproduction success & number			
	Crop tree release	same as clear-cut without oak regeneration	all life stages	none because of S&G		
Recreational Management	Pond/lake construction	increase sunlight/edge	all life stages	improve roosting opportunities with increase pre- and post-natal development efficiency, which leads into increase adult fitness (less time needed to care for young, better thermoregulatory conditions-->less torpor, lower metabolic expenditure)	none to increase reproduction success & numbers	
		increase noise/physical disturbance	all bats if in summer; none if winter	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response	
		increase water sources	all life stages	increase foraging efficiency- increase fitness		
	trails (construction, operation, and maintenance)	loss of 265 linear forest acres	indirect winter exposure and direct & indirect summer exposure	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response	
		decrease understory; canopy maintained	indirect winter exposure and direct & indirect summer exposure	no response to increase foraging success; increase travel corridors		

Management Elements			Environmental Impact	Ibat Exposure	Ibat Response	Population RND Response
			increase erosion; runoff	all life stages; no direct winter exposure; indirect winter exposure and both direct & indirect summer exposure	no response due to S&G	
			increase noise/human presence	summer harvest: all life stages	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response
			increase invasive species	all life stages	no response	
			soil disturbance/compaction	all life stages	no response	
	construction of facilities/ parking lots		loss of 60 acres forest - along roadsides/trails	indirect winter exposure and direct & indirect summer exposure	range from no response to avoidance of existing foraging areas--> decrease for efficiency	no response
			increase erosion; runoff	all life stages; no direct winter exposure; indirect winter exposure and both direct & indirect summer exposure	no response due to S&G	
			increase noise/physical disturbance	summer: all life stages	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response
			increase invasive species	all life stages	no response	
			soil disturbance/compaction	all life stages	no response	
	Operation of facilities/ parking lots		increase noise/physical disturbance	summer: all life stages	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response
			increase invasive species	all life stages	no response	
Transportation	Construction	new construction	loss of linear forest	winter: no direct exposure	NA	
				winter: indirect exposure - all life stages	none because of S&G	
				summer harvest: all life stages	range from no response to mortality-->decrease roosting sites-->slow pre- and post-natal development-->reduced young and female survival; direct injury or mortality from felling roost tree	short-term reduction in reproductive success

Management Elements			Environmental Impact	Ibat Exposure	Ibat Response	Population RND Response
			noise/physical disturbance	summer: all life stages	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response
			spread nonnative species	all life stages	no response	
			increase erosion; runoff	all life stages; no direct winter exposure; indirect winter exposure and both direct & indirect summer exposure	no response due to S&G	
		upgrading/ widening	loss of trees	winter: no direct exposure	NA	
				winter: indirect exposure - all life stages	none because of S&G	
			summer harvest: all life stages	range from no response to mortality-->decrease roosting sites-->slow pre- and post-natal development-->reduced young and female survival; direct injury or mortality from felling roost tree	short-term reduction in reproductive success	
	noise/physical disturbance	summer: all life stages	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response		
	increase erosion; runoff	all life stages; no direct winter exposure; indirect winter exposure and both direct & indirect summer exposure	no response due to S&G			
	Decommissioning		close & rehabilitate roads	all life stages	decrease noise & physical disturbance & rehabilitation will improve habitat	none to increase reproduction success & numbers
	Maintenance	resurfacing and roadside maintenance	noise/physical disturbance	summer: all life stages	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response
Fire Management	Hazardous fuels reduction	Mechanical methods	noise/physical disturbance	summer: all life stages	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response
			reduced size and intensity of wildfires	all life stages	decreased fire-related mortality; reduced fire-related impacts on prey abundance	none to increase reproduction success & numbers

Management Elements		Environmental Impact	Ibat Exposure	Ibat Response	Population RND Response	
		lop and scatter	all life stages	no response		
		control/reduce NNIS	all life stages	no response		
	Prescribed Burning (low intensity; for multiple purposes)	fire	reduced size and intensity of wildfires	all life stages	decreased fire-related mortality; reduced fire-related impacts on prey abundance	none to increase reproduction success & numbers
			maintain natural openings/wildfire dependant habitats	all life stages	no response	
			smoke/airborne particulate matter	winter: no direct exposure; summer: limited direct exposure	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs; no direct effects during maternity/non-volant period due to S&G	no response
			control/reduce NNIS	all life stages	no response	
			reduced understory/clutter	all life stages	improve travel/foraging habitat; response range from none to increased foraging success	none to increase reproduction success & numbers
			snag destruction	winter: no direct exposure; winter/summer: indirect effects to all life stages	range from no response to mortality-->decrease roosting sites-->slow pre- and post-natal development-->reduced young and female survival; decrease foraging efficiency--> reduce young and adult survival; no direct injury or mortality due to S&G	no response
			snag creation	winter: no direct exposure; winter/summer: indirect effects to all life stages	increased snags improve roosting habitat -> increased pup development -> increased adult fitness (less time needed to care for young, better thermoregulatory conditions -> less torpor, lower metabolic expenditure)	none to increase reproduction success & numbers
			fire lines	74 miles of fire lines; loss of trees	winter: no direct exposure; winter/summer: indirect effects to all life stages; summer direct	range from no response to mortality-->decrease roosting sites-->slow pre- and post-natal development-->reduced young and female survival; decrease foraging efficiency--> reduce young and adult survival; direct injury or mortality from felling roost tree
	noise/physical disturbance	winter: none, summer: limited direct exposure to all life stages		no response		
	spread NNIS	all life stages		no response		

Management Elements		Environmental Impact	Ibat Exposure	Ibat Response	Population RND Response	
			increased erosion; runoff	winter: none, summer: limited direct exposure to all life stages	no response	
	Fire suppression	Fire line control (hand tools, bulldozers, ATVs, tractors, water, & foam)	increased erosion; runoff	winter: none, summer: limited direct exposure to all life stages	no response due to S&G	
			reduced size and intensity of wildfires	all life stages	decreased fire-related mortality; reduced fire-related impacts on prey abundance	none to increase reproduction success & numbers
			noise/physical disturbance	winter: none, summer: limited direct exposure to all life stages	no response	
			spread NNIS	all life stages	no response	
		Aerial control (water or foam)	increased erosion; runoff	winter: none, summer: limited direct exposure to all life stages	no response	
			noise/physical disturbance	winter: none, summer: limited direct exposure to all life stages	no response	
			reduced size and intensity of wildfires	all life stages	decreased fire-related mortality; reduced fire-related impacts on prey abundance	none to increase reproduction success & numbers
	Rehab (seed, mulch, waterbars)	reduce erosion; runoff	all life stages	no response		
	Watershed	wetland restoration		increase / improve wetland habitat	all life stages	increase foraging efficiency- increase fitness
			soil disturbance compaction	all life stages	none	
			increase insect production	all life stages	increase foraging efficiency- increase fitness	none
			short-term increase noise/physical disturbance/human presence during construction	all bats if in summer; none if winter	no response	
stream/riparian restoration			decrease runoff/sediment	all life stages	increase foraging efficiency- increase fitness	none
			increase forest habitat	all life stages	increase roost and forage opportunities	none to increase reproduction success & numbers

Management Elements			Environmental Impact	Ibat Exposure	Ibat Response	Population RND Response	
			improved flow/sinuosity	all life stages	range from no response to increase foraging efficiency - increase fitness	none	
			short-term increase noise/physical disturbance/human presence during construction	all bats if in summer; none if winter	no response		
	acid mine drainage projects	doser construction	loss of 270 forested acres	indirect winter exposure and direct & indirect summer exposure	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response	
		limestone channel & wetland construction	increase water quality	all life stages	increase foraging efficiency- increase fitness	none to increase reproduction success & numbers	
			increase invasive plants	all life stages	no response		
			temporary roads	short-term increase noise/physical disturbance/human presence during construction	all bats if in summer; none if winter	range from no response to temporary abandonment--> decrease for efficiency; slow pre- and post natal development-->increase energy costs	no response
		closing mine portals	soil disturbance/ compaction	all life stages	none		
			loss of hibernacula	direct winter exposure and direct & indirect summer exposure	no response due to S&G		
	Pest Management	mechanical (mowing, cutting, digging, pulling)		modified air flow/temperature	direct winter exposure and direct & indirect summer exposure	no response due to S&G	
				soil disturbance/ compaction	all life stages	none	
increase sunlight on forest floor				all life stages	none		
improve health of mast trees (grape vine removal)				all life stages	increase roost opportunities in long term	none to increase reproduction success & numbers	
			increase noise/physical disturbance/human presence	all bats if in summer; none if winter	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response	

Management Elements			Environmental Impact	Ibat Exposure	Ibat Response	Population RND Response
	chemical (pesticides & herbicides)		increased biodiversity - long term	all life stages	range from no response to increase foraging efficiency- increase fitness	none
			overspray/non-target death	all life stages	none	
			decreased water quality	all life stages	no response due to S&G to decreased foraging efficiency	none
			increased biodiversity - long term	all life stages	range from no response to increase foraging efficiency- increase fitness	none
	biological		effects on non-target species	NA		
			increase biodiversity - long term	all life stages	range from no response to increase foraging efficiency- increase fitness	none
Wildlife Management	reforestation		increase forest habitat	all life stages	increase roost and forage opportunities	none to increase reproduction success & numbers
	Establish wildlife openings		increase sunlight/edge	all life stages	improve roosting opportunities with increase pre- and post-natal development efficiency, which leads into increase adult fitness (less time needed to care for young, better thermoregulatory conditions-->less torpor, lower metabolic expenditure)	none to increase reproduction success & numbers
			short-term increase noise/physical disturbance/human presence	all bats if in summer; none if winter	range from no response to temporary abandonment--> decrease for efficiency; slow pre- and post natal development-->increase energy costs	no response
	maintain forest openings		noise/physical presence	all bats if in summer; none if winter	range from no response to temporary abandonment--> decrease for efficiency; slow pre- and post natal development-->increase energy costs	no response
			increase invasive species	all life stages	no response	
	install bat-friendly gates		protect potential hibernacula	all bats	range from no response to increase in winter survival and increased fitness	none to increase numbers
Land acquisition & exchange			increased forested land/ contiguous protection	all life stages	increase roost and forage opportunities	none to increase reproduction success & numbers
Mineral development	Oil/gas development (federal leases)	Temporary access roads	see transportation			

Management Elements			Environmental Impact	Ibat Exposure	Ibat Response	Population RND Response	
		Facilities construction and operation	noise/physical disturbance	all bats if in summer; none if winter	range from no response to temporary abandonment--> decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response	
			loss of trees	winter: no direct exposure	NA		
				winter: indirect exposure - all life stages	none because of S&G		
				summer harvest: all life stages	range from no response -->decrease foraging efficiency-->reduce young and adult survival	no response	
			spread nonnative species	all life stages	no response		
	increase erosion; runoff	winter: none, summer: limited direct exposure to all life stages	no response due to S&G				
	utility lines	create and maintain lines and rights-of way	loss of trees	indirect winter exposure and direct & indirect summer exposure	winter: none because of S&G	summer: range from no response to mortality-> decrease roosting sites-->slow pre- and post-natal development--> reduced young and female survival; decrease foraging efficiency-->reduce young and adult survival; direct injury or mortality from felling roost tree	short-term reduction in reproductive success
			increase erosion; runoff	winter: none, summer: limited direct exposure to all life stages	no response due to S&G		
			increase noise/human presence	all bats if in summer; none if winter	range from no response to temporary abandonment->decrease foraging efficiency; slow pre- and post natal development-->increase energy costs	no response	
			increase invasive species	all life stages	no response		
			soil disturbance/compaction	all life stages	no response		
	Hazard tree removal			loss of 2,550 trees	indirect winter exposure and very limited direct & indirect summer exposure	no response due to S&G	
short-term increase noise/physical disturbance/human presence				all bats if in summer; none if winter	range from no response to temporary abandonment--> decrease for efficiency; slow pre- and post natal development-->increase energy costs	no response	

### **Effects of Management Activities on running buffalo clover**

Table 6 describes all management actions, their environmental impacts, and the effects to running buffalo clover. Effects are analyzed based on what life history stage is exposed (plants or seeds) and what the response to that exposure may be. As many actions could have a range of responses based on frequency or intensity of the exposure, additional details are provided in the text below. S&G that minimize exposure or response are described in more detail in Appendix A.

#### *Timber Management*

Removal of trees in and of itself, may affect running buffalo clover, but the intensity and supporting actions are what determine how the species will respond. As running buffalo clover is a disturbance dependant species, some level of timber harvest may be beneficial for the species (Madarish and Schuler 2002). Actions that provide moderate soil disturbance and introduce filtered sunlight to a closed canopy system will illicit a positive response from running buffalo clover including increased germination and flowering. Whereas, clearcutting or road construction would expose the species to habitat conditions that are unsuitable for survival and reproduction.

Guidelines are in place that require surveys for running buffalo clover to occur before any ground disturbing or canopy altering action takes place (GFW-TES-31). This should avoid most impacts to running buffalo clover forestwide. Running buffalo clover may be exposed to adverse actions if populations were not detected during surveys. This is possible with this species due to a seed bank that may germinate after surveys have been conducted.

#### *Recreation and Transportation*

Guidelines require surveys before any ground disturbing or canopy altering action takes place (GFW-TES-31). If populations are found in a proposed trail or road construction site, there is a standard (SFW-TES-30) that requires avoidance of plants and minimization of the habitat surrounding the plants (e.g. changes in canopy cover). Running buffalo clover found along an existing trail may benefit from the increased sunlight a trail footprint provides as well as occasional trampling (e.g. horseback or hiking). If running buffalo clover is exposed to intense disturbance, such as heavy ORV traffic, the species may respond adversely through direct mortality and loss of suitable habitat through soil compaction. Running buffalo clover may also be exposed to invasive species that occur along trails and roads. Invasive plants are a major threat to the recovery of running buffalo clover range-wide (USFWS 2005a). Responses from this type of exposure may range from none to decreased growth, reproduction, and mortality due to competition for resources and overshadowing.

#### *Fire Management*

Guidelines require surveys before any ground disturbing or canopy altering action takes place (GFW-TES-31). If populations are found in a prescribed fire area standards and guideline are in place that require actions to avoid exposure to ground disturbing activities related to fire line construction as well as to the fire itself (SFW-TES-27, SFW-TES-28). If undetected plants are exposed to fire or in a wildfire situation where surveys are not conducted, individual plants may respond adversely through death, but if a seed bank is available fire may benefit the species and

elicit a positive response through increased germination due to reduction in plant competition and increased light levels on the ground.

#### *Watershed Improvements and Wildlife Management*

Running buffalo clover may be exposed to watershed improvements and wildlife management activities that involve forest restoration. If plants were detected through surveys and exposed to riparian improvements they would exhibit positive responses due to improved forested habitat including increased plant growth and reproduction. In addition, creation of new suitable habitat through reforestation may increase the potential for new populations of running buffalo clover through seed dispersal.

#### *Pest Management*

Running buffalo clover is not expected to be exposed to control measures for grape vine or non-native invasive insect species (gypsy moth), but will be exposed to invasive plant control. In known running buffalo clover populations control will consist of mechanical methods, as guideline GFW-TES-29 restricts the use of herbicides near running buffalo clover sites. Running buffalo clover may respond to mechanical methods such as mowing or pulling invasive plants by exhibiting increases in germination, growth, and reproduction.

#### *Land Acquisition & Exchange*

Standards and guideline require that all lands to be exchanged are surveyed for running buffalo clover, thus the species is not expected to be exposed to that activity. Running buffalo clover may be exposed to acquisition of new forested lands and is expected to respond favorably due to management that benefits that species.

#### *Energy*

Although S&G are in place to protect running buffalo clover and its habitat when federally-owned minerals are leased (SFW-TES-30, GFW-TES-31, and Appendix H-Notification 3) this may not be the case for placement of utility lines. In particular, surveys for running buffalo clover may not be able to occur during the spring or summer when the species is detectable. Coal mining on the forest is possible due to outstanding rights, but is highly unlikely to occur within the next ten years and thus will not be analyzed here. Currently, the only population of running buffalo clover on the forest is protected from mineral developments.

Table 6. Effects Analysis for running buffalo clover

Management Elements			Environmental Impact	RBC Exposure	RBC Response	Population RND Response	
Agriculture	grazing		shortening vegetation	NA			
			maintain open habitat				
	hay		increase noise/human presence				
			soil compaction				
		maintain open habitat					
Timber Management	Skid trails		soil disturbance	plants and seeds	ranges from none due to S&G to increased germination of seeds and decreased growth or mortality of plants	none to increase in numbers and reproduction	
	Roads and Log landings		remove groups of trees	plants and seeds	ranges from none due to S&G to decreased growth and mortality	none	
			increased invasive plants	plants and seeds	ranges from none to decreased fitness due to competition	none	
			soil compaction	plants and seeds	ranges from none due to S&G to mortality of plants	none	
	Even-aged	clear-cut		decrease stem density	plants and seeds	ranges from none due to S&G to mortality due to unsuitable habitat	none
				oak regeneration	plants and seeds	none	
				increase solar exposure	plants and seeds	ranges from none due to S&G to increased germination of seeds and decreased growth or mortality of plants	none
				increase noise/human presence	NA		
		thinning		same as clear-cut without oak regeneration	plants and seeds	ranges from none due to S&G to increased germination of seeds and decreased growth or mortality of plants	none to increase in numbers
		shelterwood and two-aged		same as clear-cut	plants and seeds	ranges from none due to S&G to increased germination of seeds and decreased growth or mortality of plants	none to increase in numbers
	Uneven-aged			remove individual trees or group selection	plants and seeds	ranges from none due to S&G to decreased growth or mortality	none to increase in numbers
				increase noise/human presence	NA		

Management Elements			Environmental Impact	RBC Exposure	RBC Response	Population RND Response
			increase solar exposure	plants and seeds	ranges from none due to S&G to increased germination of seeds and decreased growth or mortality of plants	none to increase in numbers
	Crop tree release		same as clear-cut	plants and seeds	ranges from none due to S&G to increased germination of seeds and decreased growth or mortality of plants	none to increase in numbers
Recreational Management	Pond/lake construction		increase sunlight/edge	NA		
			increase noise/physical disturbance			
			increase water sources			
	trails (construction, operation, and maintenance)		loss of 265 linear forest acres; canopy maintained	plants and seeds	ranges from none due to S&G to increased growth, reproduction along edges to mortality within trail footprint	none
			increase erosion; runoff	plants and seeds	none due to S&G	
			increase noise/human presence	NA		
			increase invasive species	plants and seeds	reduced fitness due to competition	none
			soil disturbance/compaction	plants and seeds	ranges from none due to S&G to increased germination of seeds along trail and mortality of plants within trail	none
	construction of facilities/ parking lots		loss of 60 acres forest - along roadsides/trails	plants and seeds	ranges from none due to S&G to increased growth, reproduction along edges to mortality within facility footprint	
			increase erosion; runoff	plants and seeds	none due to S&G	
			increase noise/physical disturbance	NA		
			increase invasive species	plants and seeds	reduced fitness due to competition	none
			soil disturbance/compaction	plants and seeds	ranges from none due to S&G to increased germination of seeds along disturbance and mortality of plants within footprint	none
	Operation of facilities/ parking lots		increase noise/physical disturbance	NA		
			increase invasive species	plants and seeds	reduced fitness due to competition	none
Transportation	Construction	new construction	loss of trees/vegetation	plants	ranges from none due to S&G to mortality	none
			soil compaction	plants and seeds	ranges from none due to S&G to tissue damage to mortality	none
			noise/physical disturbance	NA		
			spread nonnative species	plants and seeds	reduced fitness due to competition	none

Management Elements			Environmental Impact	RBC Exposure	RBC Response	Population RND Response
		upgrading/ widening	increase erosion; runoff	plants and seeds	none due to S&G	
			loss of trees/vegetation	plants	ranges from none due to S&G to mortality	none
			noise/physical disturbance	NA		
			increase erosion; runoff	plants and seeds	none due to S&G	
	Operation		increased human access	NA		
			spread nonnative species	plants and seeds	reduced fitness due to competition	none
			noise/physical disturbance	NA		
		roadside maintenance	noise/physical disturbance	NA		
Fire Management	Hazardous fuels reduction	Mechanical methods	reduced size and intensity of wildfires	plants and seeds	range from none to beneficial for germination, vegetative growth and reproduction	none to increase in numbers and reproduction
			noise/physical disturbance	NA		
			lop and scatter	plants	range from none to tissue damage and reduced reproduction	none
	Prescribed Burning		reduced size and intensity of wildfires	plants and seeds	range from none to beneficial for germination, vegetative growth and reproduction	none to increase in numbers and reproduction
			74 miles of fire lines; loss of trees	plants and seeds	range from none due to S&G to mortality	none
			maintain natural openings/wildfire dependant habitats	NA		
			noise/physical disturbance	NA		
			smoke/airborne particulate matter	NA		
			control/reduce NNIS	plants and seeds	range from none to increase in germination, vegetative growth and reproduction	none
			reduced understory/clutter	plants and seeds	range from none to increase in germination, vegetative growth and reproduction	none to increase in numbers and reproduction
			snag destruction	NA		
	snag creation					
	Fire suppression	Fire line control (hand tools, bulldozers, ATVs, tractors, water, & foam)	increased erosion; runoff	plants and seeds	none due to S&G	

Management Elements			Environmental Impact	RBC Exposure	RBC Response	Population RND Response
			reduced size and intensity of wildfires	plants and seeds	range from none to beneficial for germination, vegetative growth and reproduction	none to increase in numbers and reproduction
			loss of trees	plants	range tissue damage to mortality	none
			spread nonnative species	plants and seeds	reduced fitness due to competition	none
		Aerial control (water or foam)	increased erosion; runoff	plants and seeds	range from none to reduction in vegetative growth and reproduction	none
			reduced size and intensity of wildfires	plants and seeds	range from none to beneficial for germination, vegetative growth and reproduction	none to increase in numbers and reproduction
		Rehab (seeding, mulch, waterbars)	reduced erosion	plants and seeds	none due to S&G	
Watershed	wetland restoration		increase / improve wetland habitat	NA		
			soil disturbance compaction			
			increase insect production			
			short-term increase noise/physical disturbance/human presence during construction			
	stream/riparian restoration		decrease runoff/sediment	plants and seeds	range from none to beneficial for germination and vegetative growth	increase in numbers
			increase forest habitat	plants and seeds	provide suitable habitat for germination, growth, and reproduction	none to increase in numbers and reproduction
			improved flow/sinuosity	NA		
			short-term increase noise/physical disturbance/human presence during construction	NA		
	acid mine drainage projects	doser construction	loss of 270 forested acres	NA		
		wetland construction	increase noise			
		limestone channels	decrease canopy cover			
		temporary roads	increase invasive plants			

Management Elements			Environmental Impact	RBC Exposure	RBC Response	Population RND Response
			increase water quality			
			soil disturbance/ compaction			
Pest Management	mechanical (mowing, digging, pulling)		soil disturbance/ compaction	plants and seeds	range from none due to S&G to increased fitness to mortality	none
			increase sunlight on forest floor	plants and seeds	beneficial for germination and reproduction	none to increase in numbers and reproduction
			improve health of mast trees (vine removal)	NA		
			increase noise/physical disturbance/human presence	NA		
			increased biodiversity - long term	plants and seeds	range from none to beneficial for germination, vegetative growth and reproduction	none to increase in numbers and reproduction
	chemical (pesticides & herbicides)		overspray/non-target death	plants	none due to S&G	none
			decreased water quality	NA		
			increased biodiversity - long term	plants and seeds	range from none to beneficial for germination, vegetative growth and reproduction	none to increase in numbers and reproduction
	biological		effects on non-target species	NA		
			increase biodiversity - long term	plants and seeds	range from none to beneficial for germination, vegetative growth and reproduction	none to increase in numbers and reproduction
Wildlife Management	reforestation		increase forest habitat	plants and seeds	provide suitable habitat for germination, growth, and reproduction	none to increase in numbers and reproduction
	develop forest openings		loss of 500 forested acres	NA		
			increase sunlight/edge			
			short-term increase noise/physical disturbance/human presence during construction			
	maintain forest openings		noise/physical presence	NA		
		increase invasive species				

Management Elements			Environmental Impact	RBC Exposure	RBC Response	Population RND Response
Land acquisition & exchange			increased forested land/ contiguous protection	plants and seeds	provide suitable habitat in federal ownership for germination, growth, and reproduction	none to increase in numbers and reproduction
Energy	Oil/gas development	Temporary access roads	noise/physical disturbance	NA		
			loss of trees; canopy breaks	plants and seeds	beneficial for germination and reproduction	none to increase in numbers and reproduction
			soil compaction	plants and seeds	none due to S&G	none
			spread nonnative species	plants and seeds	reduced fitness due to competition	none
			increase erosion; runoff	plants and seeds	none due to S&G	
		Facilities construction	noise/physical disturbance	NA		
			loss of trees/vegetation	plants and seeds	none due to S&G	none
			spread nonnative species	plants and seeds	reduced fitness due to competition	none
			increase erosion; runoff	plants and seeds	none due to S&G	
		facilities operation	noise/physical disturbance	NA		
	increased human access		NA			
	utility lines		decrease understory; canopy maintained	plants and seeds	beneficial for germination and reproduction	increase in numbers and reproduction
			increase erosion; runoff	plants and seeds	none due to S&G	
			increase noise/human presence			
			increase invasive species	plants and seeds	reduced fitness due to competition	none
soil disturbance/compaction			plants and seeds	range from none to tissue damage to mortality	none	

## V. CUMULATIVE EFFECTS

Cumulative effects include the effects of State, tribal, local, or private actions that are reasonably certain to occur within the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Based on past trends, future non-federal actions within the action area are anticipated in the form of private oil and gas development, coal, clay, and limestone mining, road construction and maintenance, and timber harvest. Development of up to 150 oil and gas wells (about 79 acres) may occur on the WNF due to outstanding mineral rights. This energy development is not considered a federal action, as no permit is required from the WNF. It is estimated that the number of people in the action area could increase by 8.5% by 2020 (USFS 2005), bringing with them increased housing development, industrial and commercial sites.

It is unknown how many acres of suitable habitat for Indiana bat or running buffalo clover could be altered or lost by these future actions. The actions listed above would have varying degrees of effects on listed species from no effect to adverse effects. Permanent conversion of forested habitat to unsuitable habitat would have the greatest potential impacts to Indiana bat and running buffalo clover. Other activities would have the same general effects as WNF actions, providing they are implemented with similar methods and protective measures. We anticipate that suitable habitat for federally listed species within the action area will increase (due to WNF habitat management) or remain at similar levels to what currently exists over the next ten years.

## VI. CONCLUSION

### **Indiana bat**

After reviewing the current status of Indiana bat, the environmental baseline for the action area, the effects of the proposed Forest Plan Revision and the cumulative effects, it is the Service's biological opinion that the WNF Forest Plan Revision, as proposed, is not likely to jeopardize the continued existence of Indiana bat. Critical habitat for this species has been designated at hibernacula in Illinois, Indiana, Kentucky, Missouri, Tennessee, and West Virginia; however, this action does not affect these areas, thus, no destruction or adverse modification of that critical habitat is anticipated.

As explained in our Effects section, we anticipate that there may be individual fitness consequences but do not expect any colony or population level fitness implications. Instead, we anticipate over the long-term the goals of the proposed action, even with the anticipated negative cumulative effects, will benefit Indiana bats occurring within the action area. Thus, we do not anticipate any appreciable reductions in reproduction, numbers or distribution for the species.

### **Running buffalo clover**

After reviewing the current status of running buffalo clover, the environmental baseline for the action area, the effects of the proposed Forest Plan Revision and the cumulative effects, it is the

Service's biological opinion that the WNF Forest Plan Revision, as proposed, is not likely to jeopardize the continued existence of running buffalo clover. No critical habitat has been designated for this species; therefore, none will be affected.

The Revised Forest Plan provides protection and habitat enhancement for running buffalo clover were it occurs now and if it should be found in other areas of the WNF. As shown through their Conservation Plan (Appendix A) the WNF is committed to maintaining viability of running buffalo clover on the Forest. Only one small population currently exists on the WNF, although not anticipated, the loss of this one population would not appreciably hinder the recovery of the species as a whole. Thus, we do not anticipate any detectable reductions in reproduction, numbers or distribution for the species.

## INCIDENTAL TAKE STATEMENT

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of Federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law.

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened animals, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

### AMOUNT OR EXTENT OF TAKE ANTICIPATED

In this incidental take statement, we are evaluating the incidental take of Indiana bats that may result from the implementation of the Revised Forest Plan for the WNF. The Forest Plan is a comprehensive plan level document that allows and guides, but does not authorize site-specific actions to occur. With the implementation of the Revised Forest Plan we anticipate some adverse effects to occur to the Indiana bat. As such, some site-specific projects, conducted under the Forest Plan may result in adverse effects to individual Indiana bats that rise to the level of take. The S&G proposed substantially reduce the potential for adverse effects and incidental take to occur as a result of actions implemented under the 2005 Forest Plan. Therefore, projects completed under the 2005 Forest Plan that comply with all of the S&G and other project commitments detailed in the BA in many cases would not adversely affect the Indiana bat therefore no incidental take would occur in those instances. However, as described within the Effects section, an unknown occupied roost tree could be removed, particularly during 1) construction of permanent and temporary roads, 2) construction of skids and landings, 3) utility construction, and 4) fire line construction.

It is anticipated that occupied secondary roost or less important roost trees may be unknowingly cut. These trees are likely to be occupied by either singly roosting males or a few females. It is reasonable to assume that only a subset of these individuals will be directly taken through injury or death (Bellwood 2002) and that most of the individuals in the occupied roost tree will escape. Although very difficult to predict, we anticipate that an unknown occupied roost tree could be

cut during any of the activities identified above. The occurrence of this, however, we believe is unlikely to be more than once per activity. Thus, we anticipate that no more than 4 occupied roost trees will be incidentally taken over the next ten years.

Incidental take of Indiana bats will be difficult to detect for the following reasons: the species is highly motile; the species occurs in habitat (e.g., trees) that makes detection difficult; and finding dead or moribund bats is unlikely due to a small body size and the likely scavenging of specimens by predators. However, we believe the level of take of this species can be monitored by tracking the level of habitat modification and adherence to S&G. Specifically, if the S&G are not implemented, or if the current anticipated level of habitat loss is exceeded, we fully expect the level of incidental take to increase as well. Thus, incidental take will be monitored using the number of acres/miles provide in Table 7 below.

Table 7. Management activities causing habitat modification rising to the level of take over ten years.

<b>Activity</b>	<b>Measure</b>
Permanent Road Construction & Reconstruction	392 acres
Temporary Road Construction	146 acres
Skid Trails and Log Landings	740 acres
Utility Development	50 acres
Fire Lines	74 miles

## **EFFECT OF THE TAKE**

In the accompanying Biological Opinion, the Service determined that, based on the Revised Forest Plan and the conservation measures described in Appendix A this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat. The amount of suitable Indiana bat on the WNF will increase over the next ten years. Only a small fraction of the suitable Indiana bat habitat on the WNF will be altered over the next ten years through the implementation of the Forest Plan. Furthermore, most of these actions are short term habitat alteration that may improve foraging and roosting habitat for the Indiana bat in the long term. The proposed activities are not anticipated to reduce the status of the Indiana bat on the WNF, and thus the implementation of the Forest Plan will not appreciably reduce the likelihood of survival and recovery of the Indiana bat.

## **REASONABLE AND PRUDENT MEASURES**

The Service believes that the WNF has proposed all possible measures necessary to minimize impacts of incidental take as part of their Forest Plan in the form of goals, objectives, standards, and guidelines and in the Conservation Plan (Appendix A). In order to be exempt from the prohibitions of section 9 of the Act, the WNF must comply with all S&G, and monitoring proposed in the Forest Plan’s Conservation Plan. This includes monitoring the extent of incidental take that occurs on a project-by-project basis for the next ten years.

## **MONITORING**

The implementing regulations for incidental take require that Federal agencies must report the progress of the action and its impact on the species (50 CFR 402.14(i)). To meet this mandate, the WNF will monitor and report the progress of their action as follows:

1. As individual projects are proposed under the PBO, the WNF will provide the Service project-specific information that includes 1) a description of the proposed action and the area to be affected including latitude and longitude information, 2) the species that may be affected and their known proximity to the project area, 3) a description of how the action may affect the species, 4) a determination of effects, 5) a cumulative total of incidental take that has occurred to date under the PBO, and 6) a description of any additional actions or effects, if any, not considered in the tier I consultation.
2. On an annual basis, the WNF will provide the Service a tally of acreages as listed in Table 2 for all management actions. This is to ensure the anticipated level of impacts do not exceed what was analyzed under the PBO. In addition, the WNF will provide the Service with a tally of hickory trees that were removed during the implementation of management activities to enable the project to proceed without causing adverse effects to other resources important to the Indiana bat (GFW-TES-9).

## **REINITIATION NOTICE**

This concludes formal consultation with the WNF on the Revised Land and Resource Management Plan. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if; (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

## LITERATURE CITED

- Abrams, M. D. 1992. Fire and the development of oak forests. *Bioscience* 42:346-353.
- Abrams, M. D. 1998. The red maple paradox. *Bioscience* 48(5): 355-364.
- Bailey, R.G. 1998. Ecoregions map of North America: Explanatory Note. Misc. Publ. 1548. Washington, DC: USDA Forest Service.
- Barclay, R.M. 1991. Population structure of temperate zone insectivorous bats in relation to foraging behaviour and energy demand. *Journal of Animal Ecology* 60(1):165-178.
- (BCI) Bat Conservation International. 2001. Bats in eastern woodlands. Austin, Texas. 311 pp.
- Becus, M.S. and J.B. Klein. 2003. Mowing schedule improves reproduction and growth of endangered running buffalo clover (Ohio). *Ecological Restoration* 20(4): 295.
- Belwood, J.J. 1979. Feeding ecology of an Indiana bat community with emphasis on the endangered Indiana bat, *Myotis sodalis*. M.S. thesis, Univ. Florida, Gainesville, FL. 103 pp.
- Belwood, J.J. 2002. Endangered bats in suburbia: observations and concerns for the future. Pages 193-198. In Kurta, A., and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Bookhout, T., and M. J. Lacki. 1981. A survey of bats in Wayne National Forest. Final Report, The Ohio State University Research Foundation, Columbus. 70 p.
- Brack, V.M., Jr. 1983. The nonhibernating ecology of bats in Indiana, with emphasis on the endangered Indiana bat, *Myotis sodalis*. Ph.D. Dissertation. Purdue University, W. LaFayette, IN. 280 pp.
- Brack, V., and R.K. LaVal. 1985. Food habits of the Indiana bat in Missouri. *Journal of Mammalogy* 66:308-315.
- Brack, V., and D. Little. 2001. An Autumn Survey for the Endangered Indiana Bat (*Myotis sodalis*) at Mine Portals along Alternate Corridors for U.S. Route 33 Nelsonville Bypass (HOC/ATH – 33-17.00/0.00), Hocking and Athens Counties, Ohio. Prepared for the Ohio Dept. of Transportation.
- Brack, V. Jr., J.O. Whitaker, Jr., and S.E. Pruitt. 2004. Bats of Hoosier National Forest. *Proceedings of the Indiana Academy of Science* 113(1):76-86.
- Britzke, E.R., M.J. Harvey, and S.C. Loeb. 2003. Indiana bat, *Myotis sodalis*, maternity roosts in the southern United States. *Southeastern Naturalist* 2(2):235-242.

- Brooks, R.E. 1983. *Trifolium stoloniferum*, running buffalo clover: Description, distribution, and current status. *Rhodora* 85(842): 343-354.
- Butchkoski, C.M. and J.D. Hassinger. 2002. Ecology of a maternity colony roosting in a building. Pages 130-142 *In* Kurta, A., and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Callahan, E.V., R.D. Drobney, and R.L. Clawson. 1997. Selection of summer roosting sites by Indiana bats (*Myotis sodalis*) in Missouri. *Journal of Mammalogy* 78:818-825.
- Clawson, R.L. 2002. Trends in population size and current status. Pages 2-8 *In* Kurta, A., and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Cope, J.B., A.R. Richter, and R.S. Mills. 1974. A summer concentration of the Indiana bat, *Myotis sodalis*, in Wayne County, Indiana. *Indiana Academy of Science* 83:482-484.
- Crawford, D.J., E.J. Esselman, J.L. Windus, and C.S. Pabin. 1998. Genetic variation in running buffalo clover (*Trifolium stoloniferum*: Fabaceae) using random amplified polymorphic DNA markers. *Annals of the Missouri Botanical Garden* 85:81-89.
- Cusick, A.W. 1989. *Trifolium stoloniferum* (Fabaceae) in Ohio: History, habitats, decline and rediscovery. *SIDA* 13(4): 467-480.
- De Hoop, C.F. and N.J. Lalonde. 2003. Some measured levels of noise produced by logging equipment in 1998. Louisiana Forest Products Development Center, Working Paper #58.
- Fenton, M.B. 1990. The foraging behaviour and ecology of animal-eating bats. *Can. J. Zool.* 68:411-22.
- Ford, W.M., M.A. Menzel, J.L. Rodrigue, J.M. Menzel and J.B. Johnson. 2005. Relating bat species presence to simple habitat measure in a central Appalachian forest. *Biological Conservation* 126:528-539.
- Fralish, J. S. 2004. The keystone role of oak and hickory in the central hardwood forest. Pages 78-87 in Upland oak ecology symposium: history, current conditions, and sustainability. USDA Forest Service General Technical Report SRS-73.
- Franklin, C.J. 1998. Self-compatibility and variation in seed production among Ohio populations of federally endangered *Trifolium stoloniferum* (Fabaceae). M.S. Thesis. The Ohio State University, Columbus, OH.
- Gardner, J.E., J.D. Garner, and J.E. Hofmann. 1991. Summer roost selection and roosting behavior of *Myotis sodalis*, Indiana bat, in Illinois. Final report submitted to the Illinois Natural History Survey, Champaign, Illinois. 56 pp.

- Garner, J.D., and J.E Gardner. 1992. Determination of summer distribution and habitat utilization of the Indiana bat (*Myotis sodalis*) in Illinois. Unpublished report prepared for Illinois Department of Conservation, Division of Natural Heritage, and Illinois Natural History Survey, Center for Biogeographic Information. 23p.
- Gardner, J.E., J.E. Hofmann, and J.D. Garner. 1996. Summer distribution of the federally endangered Indiana bat (*Myotis sodalis*) in Illinois. *Transactions of the Illinois State Academy of Science* 89: 187-196.
- Gleason, H.A. and A. Cronquist. 1991. *Manual of vascular plants of northeastern United States and adjacent Canada*. 2<sup>nd</sup> Edition. New York Botanical Garden, Bronx.
- Gumbert, M.W. 2001. Seasonal roost tree use by Indiana bats in the Somerset Ranger District of the Daniel Boone National Forest, Kentucky. M.S. Thesis, Eastern Kentucky University, Richmond, Kentucky.
- Gumbert, M.W., J.M. O'Keefe, and J.R. MacGregor. 2002. Roost fidelity in Kentucky. Pages 143-152 *In* Kurta, A., and J. Kennedy, editors. *The Indiana bat: biology and management of an endangered species*. Bat Conservation International, Austin, Texas.
- Hall, J.S. 1962. A life history and taxonomic study of the Indiana bat, *Myotis sodalis*. Reading Publ. Mus. Art., Gallery Publ. 12:1-68.
- Hobson, C. S., and J. N. Holland. 1995. Post-hibernation movement and foraging habitat of a male Indiana bat, *Myotis sodalis* (Chiroptera: Vespertilionidae), in western Virginia. *Brimleyana* 23:95-101.
- Homoya, M.A., J.R. Aldrich, E.M. Jacquart. 1989. The rediscovery of the globally endangered clover, *Trifolium stoloniferum*, in Indiana. *Rhodora* 91(866): 207-212.
- Humphrey, S.R. 1978. Status, winter habitat, and management of the endangered Indiana bat *Myotis sodalis*. *Florida Scientist* 41:65-76.
- Humphrey, S.R., and J.B. Cope. 1977. Survival rates of the endangered Indiana bat, *Myotis sodalis*. *Journal of Mammalogy* 58:32-36.
- Humphrey, S.R., A.R. Richter, and J.B. Cope. 1977. Summer habitat and ecology of the endangered Indiana Bat, *Myotis sodalis*. *Journal of Mammalogy* 58: 334-346.
- Jacobs, J. and R. Bartgis. 1987. The running buffalo clover. Pp. 439-445 *In* R.D. Silvestro (ed.) *Audubon Wildlife Report*. Academic Press, Orlando, FL.
- Kiser, J. D., H. D. Bryan, and G. W. Libby. 1998. A survey for the federally endangered Indiana bat (*Myotis sodalis*) in the Bluegrass Ridge and Markin Fork areas of the Ironton Ranger District, Wayne National Forest. Final Report for the USDA Forest Service, Wayne National Forest. 7 p. + appendices.

- Kiser, J.D., and H.D. Bryan. 1997. A survey for the federally endangered Indiana bat (*Myotis sodalis*) on the Athens and Ironton Ranger Districts, Wayne National Forest. Final report submitted to the USDA-Forest Service, Wayne National Forest, Athens, Ohio. 7 pp.
- Kiser, J.D., and C.L. Elliot. 1996. Foraging habitat, food habits, and roost tree characteristics of the Indiana bat, *Myotis sodalis*, during autumn in Jackson County, Kentucky. Final Report for the Kentucky Department of Fish and Wildlife Resources. 65 pp.
- Kiser, J.D., R.R. Kiser, B.W. Summer, and K.L. Schultes. 1999. A mist net survey and radiotelemetry study for the federally endangered Indiana bat (*Myotis sodalis*) on the Athens and Ironton Ranger District, Wayne National Forest. Final report submitted to the USDA-Forest Service, Wayne National Forest, Athens, Ohio 7 pp.
- Kiser, J.D., R.R. Kiser, K.E. Brock, and J. Beverly. 2000. A mist net survey for the federally endangered Indiana bat (*Myotis sodalis*) on the Athens and Ironton Ranger Districts, Wayne National Forest. Final report submitted to the USDA-Forest Service, Wayne National Forest, Athens, Ohio. 14 pp.
- Kurta, A., and S.W. Murray. 2002. Philopatry and migration of banded Indiana bats (*Myotis sodalis*) and effects of radio transmitters. *Journal of Mammalogy* 83(2):585-589.
- Kurta, A., and K.J. Williams. 1992. Roosting habitat, microclimate, and behavior of the endangered Indiana bat (*Myotis sodalis*) in southern Michigan. Final report to the Michigan Department of Natural Resources. 17 pp.
- LaVal, R.K., and M.L. LaVal. 1980. Ecological studies and management of Missouri bats, with emphasis on cave-dwelling species. Terrestrial Series No. 8. Missouri Dept. of Conservation, Jefferson City. 52 pp.
- LaVal, R.K., R.L. Clawson, M.L. LaVal, and W. Caire. 1976. Foraging behavior and nocturnal activity patterns of Missouri bats, with emphasis on the endangered species *Myotis grisescens* and *Myotis sodalis*. *Journal of Mammalogy* 58: 592-599.
- Lee, Y.F., and G.F. McCracken. 2004. Flight activity and food habits of three species of *Myotis* bats (Chiroptera: Vespertilionidae) in sympatry. *Zoological Studies* 43(3): 589-597.
- MacGregor, J. R., J. D. Kiser, M. W. Gumbert, and T. O. Reed. 1999. Autumn roosting habitat of male Indiana bats (*Myotis sodalis*) in a managed forest setting in Kentucky. Pages 169-170 in J. W. Stringer and D. L. Loftis, eds. Proceedings of the 12<sup>th</sup> central hardwood forest conference, Lexington, Kentucky. USDA Forest Service General Technical Report SRS-24.
- Madarish, D. and T.M. Schuler. 2002. Effects of forest management practices on the federally endangered running buffalo clover (*Trifolium stoloniferum* Muhl. ex. A. Eaton). *Natural Areas Journal* 22(2): 120-128.

- Menzel, M.A., J.M. Menzel, T.C. Carter, W.M. Ford, J.W. Edwards. 2001. Review of the forest habitat relationships of the Indiana bat (*Myotis sodalis*). USDA Forest Service, Pennsylvania.
- Miller, N.E., R.D. Drobney, R.L. Clawson, and E.V. Callahan. 2002. Summer habitat in northern Missouri. Pages 165-171 *In* Kurta, A., and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Murray, S.W. 1999. Diet and nocturnal activity patterns of the endangered Indiana bat, *Myotis sodalis*. M.S. thesis. Eastern Michigan University, Ypsilanti, MI. 77 pp.
- Murray, S. W., and A. Kurta. 2002. Spatial and temporal variation in diet. Pages 182-192 *in* A. Kurta and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Murray, S.W., and A. Kurta. 2004. Nocturnal activity of the endangered Indiana bat (*Myotis sodalis*). *Journal of Zoology* 262:197-206.
- Myers, R.F. 1964. Ecology of three species of Myotine bats in the Ozark Plateau. Unpubl. Ph.D. Dissertation, Univ. of Missouri-Columbia, Columbia, MO. 210 pp.
- NatureServe Explorer: an online encyclopedia of life [web application]. 2004. Version November 2003. Arlington, Virginia, USA: NatureServe. Available at: <http://www.natureserve.org/explorer>.
- Ohio Division of Forestry. 2004. History of Ohio's Forests. Available at: <http://www.dnr.state.oh.us/forestry/forest/ohiogreen.htm> .
- (ODNR) Ohio Department of Natural Resources. 2003. Revised Indiana Bat Management Strategy. Ohio Division of Wildlife publication. 22 p.
- Ohio EPA. 2004. Watershed assessment unit summaries. 2004 Integrated Report, Appendix D2.
- O'Shea, T.J., and D.R. Clark, Jr. 2002. An overview of contaminants and bats, with special reference to insecticides and the Indiana bat. Pages 237-253 *In* Kurta, A., and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Racey, P. A. 1982. Ecology of bat reproduction. Pages 57-104 in T. H. Kunz, editor. Ecology of Bats. Plenum Press, New York, New York.
- Richter, A.R., S.R. Humphrey, J.B. Cope, and V. Brack, Jr. 1993. Modified cave entrances: thermal effect on body mass and resulting decline of endangered Indiana bats (*Myotis sodalis*). *Conservation Biology* 7(2):407-415.

- Ritter, D. F., R. C. Kochel, and J. R. Miller. 1995. Process Geomorphology, Third Edition. Wm. C. Brown Publishers, Dubuque.
- Rommé, R.C., K. Tyrell, and V. Brack, Jr. 1995. Literature summary and habitat suitability index model – components of summer habitat for the Indiana bat, *Myotis sodalis*. Final Report for the Indiana Department of Natural Resources; Federal Aid Project E-1-7, Study No. 8. 39 p.
- Runkle, J. R. 1982. Patterns of disturbance in some old-growth mesic forests of eastern North America. *Ecology* 63(5):1533-1546.
- Schultes, K.L. 2002. Characteristics of roost trees used by Indiana bats (*Myotis sodalis*) and northern bats (*Myotis septentrionalis*) on the Wayne National Forest, Ohio. M.S. thesis. Eastern Kentucky University.
- Schultes, K. L. 2003. Monitoring results for an Indiana bat hibernaculum. Monitoring Notes. 2 pp.
- Schultes, K. L. 2005. Indiana bat priority III hibernaculum census. Monitoring Notes. 2 p.
- Schmidt, A.C., K. Tyrell, and T. Glueck. 2002. Environmental contaminants in bats collected from Missouri. Pages 228-236 *In* Kurta, A., and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Sutherland, E. K., T. F. Hutchinson, and D. A Yaussy. 2003. Introduction, study area description, and experimental design. Pages 1-16 in Characteristics of mixed-oak forest ecosystems in southern Ohio prior to the reintroduction of fire. USDA Forest Service General Technical Report NE-299.
- Taylor, N.L., J.M. Gillett, J.J.N. Campbell, and S. Berger. 1994. Crossing and morphological relationships among native clovers of eastern North America. *Crop Science* 34(4): 1097-1100.
- Thomson, C.E. 1982. *Myotis sodalis*. The American Society of Mammalogists. Mammalian Species No. 162. pp. 1-5.
- Timpone, J.C. 2004. Roost site selection of bats in northwest Missouri with emphasis on the endangered Indiana bat (*Myotis sodalis*). Masters Thesis. Southwest Missouri State University, Springfield, Missouri.
- Toomey, R.S., Colburn, M.L., and R.A. Olson. 2002. Paleontological evaluation of use Of caves: a tool for restoration of roosts. *In* Kurta, A. and J. Kennedy, eds. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.

- Tuttle, M. D., and J. Kennedy. 2002. Thermal requirements during hibernation. Pages 68-78 *In* Kurta, A., and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Tuttle, M.D., M.B. Fenton, and E. Bernard. 2004. Ecological role of bats in forest ecosystems. 2nd Bats and Forests Symposium and Workshop, March 9-12, 2004. Hot Springs, Arkansas.
- (USFS) USDA Forest Service. 2001. Pine Creek ecosystem analysis. Wayne National Forest, Ohio.
- (USFS) USDA Forest Service. 2005. Biological Assessment for the Wayne National Forest Revised Land and Resource Management Plan.
- (USFWS) U.S. Fish and Wildlife Service. 1983. Recovery plan for the Indiana bat. Fort Snelling, Minnesota.
- (USFWS) U.S. Fish and Wildlife Service. 1999. Agency draft Indiana bat (*Myotis sodalis*) revised recovery plan. U.S. Fish and Wildlife Service, Fort Snelling, Minnesota.
- (USFWS) U.S. Fish and Wildlife Service. 2001. Biological opinion on the land and resource management plan for the Wayne National Forest, Ohio.
- (USFWS) U.S. Fish and Wildlife Service. 2002. Biological opinion of the application for an incidental take permit for the federally endangered Indiana bat (*Myotis sodalis*) for the Six Points Road interchange and associated development. Bloomington Field Office. Bloomington, Indiana. 35p.
- (USFWS) U.S. Fish and Wildlife Service. 2005a. Running buffalo clover (*Trifolium stoloniferum*) draft recovery plan: first revision. U.S. Fish and Wildlife Service, Fort Snelling, MN 65pp.
- (USFWS) U.S. Fish and Wildlife Service. 2005b. Biological opinion on the construction, operation, and maintenance of the U. S. 33 Nelsonville Bypass for the federally endangered Indiana bat. 60 p. + appendices.
- Whitaker, J.O., Jr., and V. Brack, Jr. 2002. Distribution and summer ecology in Indiana. Pages 48-54 *In* Kurta, A., and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.
- Yaussy, D. A., T. F. Hutchinson, and E. K. Sutherland. 2003. Structure, composition, and condition of overstory trees. Pages 99-111 in E. K. Sutherland and T. F. Hutchinson, eds. Characteristics of mixed-oak forest ecosystems in southern Ohio prior to the reintroduction of fire. USDA Forest Service GTR NE-299.

## Appendix A. Revised Forest Plan Conservation Plan for Federally Listed Species

(taken from WNF Revised Forest Plan)

### Conservation Direction and Guidance for all Federally Listed Species

#### Administrative & Technical Information

Consult with the Fish and Wildlife Service to ensure activities planned and implemented on the WNF are in accordance with the Endangered Species Act.

To ensure that the exemption of incidental take is appropriately documented, the Fish and Wildlife Service will implement a tiered programmatic consultation approach. As individual projects are proposed under the Forest Plan, the Forest Service shall provide project-specific information to the Fish and Wildlife Service that:

- a. describes the proposed action and the specific area to be affected;
- b. identifies the species that may be affected;
- c. describes the manner in which the proposed action may affect Federally listed species, and the anticipated effects;
- d. specifies that the anticipated effects from the proposed action are similar to those anticipated in the programmatic Biological Opinion for the revised Forest Plan;
- e. a cumulative total of incidental take that has occurred to date under the Tier I Biological Opinion; and
- f. describes any additional effects, if any, not considered in the Tier I consultation.

The Fish and Wildlife Service will review the information for each proposed project and this project-specific review is appropriately documented. If it is determined that an individual proposed project is not likely to adversely affect federally listed species, the Fish and Wildlife service will complete its documentation with a standard concurrence letter that refers to the Biological Opinion for the revised Forest Plan, the Tier I programmatic document (i.e., it “tiers” to it), and specifies that the Fish and Wildlife Service concurs that the proposed project is not likely to adversely affect listed species or critical habitat. If it is determined that the proposed project is likely to adversely affect listed species or designated critical habitat, then the Fish and Wildlife Service will complete a Tier II Biological Opinion with a project-specific incidental take statement.

#### Protection of Individuals

For all federal oil and gas lease projects, the Forest Service is responsible for assuring that the area to be disturbed is examined prior to allowing any surface disturbing activities on lands covered by this lease type. The examination is to determine effects upon any plant or animal species listed, or proposed for listing, as Federally endangered or threatened and their habitats. If the findings of this examination determine that the operation(s) may have a detrimental effect on a species covered by the Endangered Species Act, the operator’s plans may be denied or restrictions added.

The Forest Service has the responsibility to conduct the required examination. In cases where the Forest Service time frames cannot meet the needs of the lessee/operator, the lessee/operator may, at his discretion and cost, conduct the examination on the lands to be disturbed. This examination must be done by or under the supervision of a qualified resource specialist approved by the Forest Service. An acceptable report must be provided to the Forest Service identifying the anticipated effects of the proposed action on Federally endangered and threatened species, or their habitats. [Appendix H - Oil & Gas Leasing Notification 3]

#### Inventory, Analysis and Monitoring

Coordinate and cooperate with the U.S. Fish and Wildlife Service and experts from other agencies, universities, and organizations to conserve, protect, recover, and monitor populations and habitats of Federally listed species.

#### Education and Awareness

Provide training opportunities for employees on the identification, biology, and habitat requirements of Federally listed species along with monitoring techniques.

### Species-specific Conservation Direction and Guidance

#### A. **Indiana Bat**

Additional resource management direction and guidance found in the Forest Plan and should be considered during project planning and implementation, as needed, to promote recovery of this species.

#### Administrative & Technical Information

Preferred Indiana bat roost trees include the following species: shagbark hickory, shellbark hickory; bitternut hickory; silver maple; green ash; white ash; eastern cottonwood; northern red oak; post oak; white oak; slippery elm; American elm; black locust; pignut hickory; red maple; sugar maple; and black oak. This list of trees is based on review of literature and data on Indiana bat roosting requirements. Other species may be added, as identified.

When identifying existing Indiana bat roosting habitat (SFW-**TES-10(a)**), the trees that are hollow, have major splits, or have broken tops need to have characteristics that provide maternity habitat for one or more Indiana bats. In other words, these trees must possess crevices into the hollow area or where the split or broken top occurred for it to provide habitat for this species. Furthermore, trees with broken tops should be 6 inches dbh or greater where the broken top occurs.

Discovery of dead bats of undetermined species on the WNF should be reported immediately to the U.S. Fish and Wildlife Service, Reynoldsburg Field Office, and the remains transported on ice to that office. The USFWS will make the final species determination of any dead or moribund bats found on the WNF. If an Indiana bat is identified, the USFWS will contact the appropriate USFWS law enforcement office.

No attempt should be made to handle any live bat, regardless of its condition. This does not apply to individuals who are permitted, as agents of the State, to conduct work on Federally listed bat species.

Report bats that appear to be sick or injured to USFWS Reynoldsburg Field.

#### Protection of Individuals

Goal 5.1.1 – Retain or develop Indiana bat roosting and foraging habitat; protect all known Indiana bat hibernacula.

Objective 5.1.1a – If additional Indiana bat hibernacula are discovered on NFS land, install bat-friendly gates to prevent unauthorized entry.

**SFW-**TES-1**** – Deter human access to areas surrounding known hibernacula by closing or relocating trails that lead to, or pass within easy viewing distance of hibernacula.

**SFW-**TES-2**** – Establish a one-quarter mile buffer around all known hibernacula. Within this one-quarter mile buffer:

- a. Prohibit new trail and road construction;
- b. Do not conduct prescribed burning during the fall swarming period (generally mid-August to mid-October) or during the hibernation period (September 15th through April 15th);

- c. Do not permit surface occupancy for exploration or development of Federally owned minerals;
- d. Implement vegetation management only to maintain or improve Indiana bat roosting, swarming, or foraging habitat.

**GFW-*TES-3*** – Establish a one-quarter mile buffer around all mine openings that are known Indiana bat fall swarming sites, but where actual Indiana bat hibernation has not been established. Reduce or eliminate human disturbances within the buffer. Implement vegetation management only to maintain or improve Indiana bat roosting, swarming, or foraging habitats.

**SFW-*TES-4*** – Develop prescribed burning plans that specify weather conditions that would prevent smoke dispersal into known hibernacula.

**SFW-*TES-5*** – Before backfilling any mine openings, such as portal entrances or subsidence depressions with developed openings, conduct surveys for potential bat presence during the fall swarming period (generally mid-August to mid-October).

**GFW-*TES-6*** – Conduct pre-gating and post-gating mist net surveys at mines where bat-friendly gates are installed.

**SFW-*TES-13*** – Prohibit the cutting of standing dead trees for firewood.

**SFW-MIN-10** (Appendix H, Stipulation 10) – Within management areas where surface occupancy is generally permitted, apply the No Surface Occupancy stipulation for Federal leases where the following conditions occur:

- Areas within ¼ mile of Indiana bat hibernacula

Appendix H, Stipulation 12 (Controlled Surface Use on USA oil and gas leases – Known locations of Federally listed species) – No cutting of snags (trees with less than 10% live canopy), shagbark or shellbark hickories, or trees that are hollow and/or have major splits or broken tops, except during the bat hibernation season (September 15<sup>th</sup> – April 15<sup>th</sup>). If such trees are a safety hazard, they may be cut anytime they pose an imminent threat to human safety, but if cut in the non-hibernation season, the Forest Service biologist must be notified in advance. This stipulation applies only to trees over six inches in diameter.

#### Habitat Protection & Improvement

Goal 5.1.1 – Retain or develop Indiana bat roosting and foraging habitat; protect all known Indiana bat hibernacula.

Objective 5.1.1a – If additional Indiana bat hibernacula are discovered on NFS land, install bat-friendly gates to prevent unauthorized entry.

**SFW-*TES-7*** – When even-aged regeneration methods are used, retain forested flight corridors within and between early successional habitat patches. These flight corridors may include forested corridors along ephemeral, intermittent, and perennial streams; and where present, clumps of snags and trees of varying size classes in the early successional habitat. When present, leave larger-sized trees on the edges of early successional patches for future maternity roosts.

**SFW-*TES-8*** – Within hardwood cutting units with uneven-aged vegetation management prescriptions, maintain an average of at least 60 percent canopy cover.

**GFW-*TES-9*** – Retain all shagbark and shellbark hickory trees greater than or equal to 6 inches dbh, unless removal is necessary to protect human safety or to avoid adverse impacts to steep

slopes, erodible soils, floodplains or wetlands (e.g., cut a hickory rather than relocating a skid trail onto a steep slope).

**SFW-TEs-10** – During the non-hibernation season (April 15<sup>th</sup> – September 15<sup>th</sup>), do not cut, unless they are a safety hazard:

- a. Trees of any species 6 inches dbh or greater that are hollow, have major splits, or have broken tops that provide maternity habitat.
- b. Snags 6 inches dbh or greater that have Indiana bat roost tree characteristics. Consider any tree with less than 10 percent live canopy to be a snag.

When removal of hazard trees is necessary in a recreation area during the non-hibernation season (e.g., developed recreation sites, access roads, trails), conduct emergence surveys at the identified hazard trees that possess the characteristics identified above, and at any hazard trees that possess large areas of loose bark providing maternity habitat.

**SFW-TEs-11** – Schedule any summer prescribed burning after August 15<sup>th</sup> to reduce potential effects on Indiana bat reproduction.

**SFW-TEs-12** – With all hardwood timber harvests, retain a minimum of 12 live trees per acre (averaged over the cutting unit) of any species that are 6 inches dbh or greater with large areas of loose bark, unless they pose a safety hazard.

In addition to these, retain live preferred roost trees, when present to provide a supply of future roost trees (i.e., large, overmature trees) as shown in the following table. Refer to the Administrative & Technical Information section above for a list of tree species preferred as roost trees by Indiana bats. Consult with the U. S Fish and Wildlife Service regarding exceptions that may be needed to minimize adverse effects to other resources or human health and safety.

Indiana Bat Preferred Roost Tree Size Class	Number of live trees to retain (average per acre over the cutting unit)
>20 inches (dbh)	3*
>11 in (dbh and < 20 in (dbh)	6

\*If there are few or no live Indiana bat roost trees > 20 inches dbh in the stand, retain three live trees > 16 inches dbh and < 20 inches dbh per acre (averaged across the cutting unit). If there are no live trees > 16 inches dbh, retain nine additional live trees > 11 inches dbh and < 16 inches dbh per acre (averaged across the cutting unit).

**SFW-TEs-13** – Prohibit the cutting of standing dead trees for firewood.

**GFW-TEs-14** – Provide water sources that promote aquatic insect production and provide drinking sources for Indiana bats along suitable flight paths, especially in upland areas, and off/away from recreation sites, and designated trails and roads.

Appendix H, Stipulation 12 – No cutting of snags (trees with less than 10% live canopy), shagbark or shellbark hickories, or trees that are hollow and/or have major splits or broken tops, except during the bat hibernation season (September 15<sup>th</sup> – April 15<sup>th</sup>). If such trees are a safety hazard, they may be cut anytime they pose an imminent threat to human safety, but if cut in the non-hibernation season, the Forest Service biologist must be notified in advance. This stipulation applies only to trees over six inches in diameter.

#### Education & Awareness

Provide refresher training to employees, as needed, to ensure proper identification of Indiana bat roosting habitat. Such training should include how to recognize potentially suitable maternity roosts from non-maternity roost trees.

Provide training to employees on the proper methods for conducting emergence surveys.

#### Inventory, Analysis & Monitoring

Emphasis will be placed on collecting information that supports Indiana bat recovery objectives. This may include, but is not limited to, monitoring population trends of known hibernacula; monitoring of microclimate conditions in known hibernacula, and assessing our understanding of Indiana bat winter and summer distributions on the WNF, including any maternity colonies.

Monitor annually and report every five years the answers to the following monitoring questions, as required in Chapter 4 of the Forest Plan:

- a. How many acres of potentially suitable Indiana bat habitat were protected or improved?
- b. How many bat-friendly gates were installed on known Indiana bat hibernacula?

#### B. Bald Eagle

Additional resource management direction and guidance found in the Forest Plan and should be considered during project planning and implementation, as needed, to promote recovery of this species.

#### Administrative & Technical Information

By June 1 of each year, provide an annual report to the U.S. Fish and Wildlife Service and the Ohio Division of Wildlife, which includes the following:

- a. Results of any winter searches for communal bald eagle night roosts and concentrations, including mid-winter bald eagle surveys conducted in cooperation with the USFWS and the Ohio Division of Wildlife;
- b. Discovery of any bald eagle nesting territories on the WNF. If no surveys have been conducted and no territories discovered on the WNF during an annual reporting period, an annual report should be submitted with a statement to this effect;
- c. Documented cases of a prescribed fire that behaved contrary to predicted movement patterns and which resulted in a confirmed adverse impact to bald eagles.

For any prescribed fire that could potentially impact bald eagles, provide the USFWS with the opportunity to review burn plans with the WNF Fire Management Officer prior to the burn plan's approval.

#### Protection of Individuals

Goal 5.1.2 – Protect bald eagle communal night roosts, daytime concentration sites, and occupied breeding territories.

**SFW-~~TES~~-16** – Protect any bald eagle communal night roosts and concentrations (including nests) discovered during winter surveys or during any additional field surveys or proposed project areas, following guidelines outlined in the Northern States Bald Eagle Recovery Plan.

**SFW-~~TES~~-17** – Report discovery of bald eagle nests immediately to the U. S. Fish and Wildlife Service and the Ohio Department of Natural Resources, Division of Wildlife.

**SFW-~~TES~~-19** – Allow no prescribed fire within one-half mile of occupied bald eagle sites. Consider all bald eagle communal night roosts, daytime concentration sites, or occupied breeding territories as occupied sites. To prevent smoke inversion from occurring at occupied bald eagle sites, and to minimize smoke drifting toward them from prescribed fires outside the one-half mile radius of occupied sites, require burn plans to take into account of wind direction, speed, and mixing height as well as transport winds.

Appendix H, Stipulation 12 – Protect known nests and roosts as described in the Bald Eagle Recovery Plan, or as directed by the U. S. Fish and Wildlife Service.

## Habitat Protection & Improvement

**SFW-**TES-18**** – Protect supercanopy trees, or other identified congregation roost trees, along major river corridors and lakes in addition to following Forest-wide riparian area standards and guidelines.

Appendix H, Stipulation 12 – Protect all supercanopy trees or other identified congregation roost trees for bald eagles along major river corridors and lakes.

## Education & Awareness

Provide field training for new employees so they will be able to recognize bald eagle signs at night roosts, even when eagles are absent.

## Inventory, Analysis & Monitoring

Objective 5.1.2a – Conduct a minimum of three annual winter searches to locate any previously unknown communal night roosts or bald eagle concentrations.

**SFW-**TES-15**** – Focus winter bald eagle searches in areas that eagles are known to frequent or where concentrated food sources occur near NFS land. Conduct searches during early-, mid-, and late-winter. Follow search criteria outlined in the Northern States Bald Eagle Recovery Plan.

**SFW-**TES-20**** – If the bald eagle is found nesting on the Wayne National Forest, monitor populations according to the recovery plan. At such time as the bald eagle is de-listed, use the de-listing monitoring plan.

In addition to these Forest-wide objectives and standards, monitor annually and report every five years the answers to the following monitoring questions, as required in Chapter 4 of the Forest Plan:

- a. How many winter bald eagle searches were conducted?
- b. How many bald eagles were observed?

## C. American Burying Beetle

Additional resource management direction and guidance found in the Forest Plan and should be considered during project planning and implementation, as needed, to promote recovery of this species.

## Protection of Individuals

Goal 5.1.3 – Cooperate in efforts to reintroduce the American burying beetle.

**GFW-**TES-21**** – Discourage the use of bug zappers by campers in dispersed or developed recreation sites within 10 air miles of known occupied American burying beetle habitat.

**GFW-**TES-23**** – During the American burying beetle activity period, use bait-away methods prior to and during the implementation of major earth disturbing activities that occur in known occupied American burying beetle habitat.

**GFW-**TES-26**** – Restrict the use of insecticides within known occupied American burying beetle habitat.

## Habitat Protection & Improvement

**GFW-**TES-22**** – Limit ground compaction to the minimum area possible during major earth disturbing activities (including, but not limited to new road and trail construction, mineral resource exploration and development, or new facilities) that occur in suitable American burying beetle habitat within 10 air miles of known occupied American burying beetle habitat.

**GFW-~~TES-24~~**– In occupied American burying beetle habitat, design new roads with the minimum safe width necessary for planned use of the road.

**GFW-~~TES-25~~** – Within 10 air miles of known occupied American burying beetle habitat, keep ground disturbance to a minimum during the reconstruction and maintenance of existing roads. Limit width of road, ditches, and surface materials to the minimum necessary for the planned use.

#### Inventory, Analysis & Monitoring

Cooperate in efforts to determine the extent of occupied habitat on the WNF as reintroduction efforts continue on NFS lands and non-Federal lands.

Monitor annually and report every five years the answers to the following monitoring question, as required in Chapter 4 of the Forest Plan:

- a. What cooperative efforts were accomplished to achieve the reintroduction of the American burying beetle?

#### **D. Running Buffalo Clover**

Additional resource management direction and guidance found in the Forest Plan and should be considered during project planning and implementation, as needed, to promote recovery of this species.

#### Protection of Individuals

Goal 5.1.4 – Actively manage known populations of running buffalo clover to maintain appropriate habitat conditions.

**SFW-~~TES-27~~** – Implement measures to protect known running buffalo clover populations during prescribed fire activities. These may include, but are not limited to wetting down the occupied area, raking off fuels from the occupied area, or constructing firelines around the occupied area.

**SFW-~~TES-28~~** – Avoid mechanical construction of firelines in known occupied RBC habitat. Mechanical fireline construction adjacent to known RBC populations must maintain appropriate light conditions in known occupied habitats.

**GFW-~~TES-29~~** – Restrict the application of herbicides within 25 feet of known running buffalo clover populations.

#### Habitat Protection & Improvement

Objective 5.1.4a – Maintain partial to filtered sunlight over and adjacent to occupied habitat.

**SFW-~~TES-30~~** – Protect and maintain known RBC populations during road and trail construction, reconstruction, and maintenance by locating ground disturbance outside the occupied habitat. Appropriate light conditions must be maintained in the occupied habitat during such activities.

**GFW-~~TES-31~~**: Conduct surveys for running buffalo clover in suitable habitat prior to implementing ground or canopy disturbing activities.

#### Education & Awareness

Ensure employees are familiar with locations of known running buffalo clover populations on the WNF.  
Conduct annual refresher training on running buffalo clover identification for all field-going employees.

#### Inventory, Analysis and Monitoring

Objective 5.1.4b – Conduct annual monitoring of known running buffalo clover populations and adjacent areas to identify potential risks or management needs.

Monitor annually and report every five years the answers to the following monitoring question, as required in Chapter 4 of the Forest Plan:

- a. What running buffalo clover population and habitat monitoring efforts were accomplished?

## Appendix B. Documentation of Indiana bat on the WNF.

- 1979** Mine surveys and mist netting conducted in 1979 and 1980 did not record the Indiana bat on the WNF (Bookhout and Lacki, 1981).
- 1997** Mist net surveys were conducted in July on the Athens Unit (20 sites) and on the Ironton Ranger District (20 sites) (Kiser and Bryan, 1997). Four lactating female Indiana bats were captured along the Hocking River in the Haydenville area on the Athens Unit. This was the first evidence that maternity roost(s) occurred in or near the WNF on the Athens Unit. One male Indiana bat was captured in the Shawnee area of the Athens Unit. One male was captured in the Five Forks area on the Ironton Ranger District.
- 1998** Mist net surveys were conducted during the summer at 11 sites in the Bluegrass Ridge area of the Ironton Ranger District, but failed to capture Indiana bats (Kiser et al., 1998).
- A passive survey was conducted at a mine opening on the Ironton Ranger District in September, and a harp trap survey was conducted at the same location in October (L. Andrews, pers. comm.). One male Indiana bat was captured, indicating that Indiana bats may have been using the mine for hibernation.
- 1999** Wintering Indiana bats were confirmed when an abandoned limestone mine was entered and approximately 150 Indiana bats were found. This mine has since been designated as a Priority III hibernaculum.
- Mist net surveys were conducted in June and July on the Athens Unit (19 sites) and the Ironton Ranger District (18 sites) (Kiser et al., 1999). One adult male Indiana bat was captured in the Dorr Run area on the Athens Unit. Biologists captured what they thought was a pregnant Indiana bat in the Dorr Run area, however genetic study determined it to be a little brown bat. Five Indiana bats (three adult males, one young-of-year male, and one post-lactating female) were captured in the Bear Run area on the Ironton Ranger District. This survey provided the first indication of reproduction occurring on the Ironton Ranger District. Six of the Indiana bats captured during the mist net surveys (four adult males, one juvenile male, and one post-lactating female) were fitted with radio-transmitters, and three were successfully tracked to collect more information about their summer roost tree use (Schultes, 2002).
- 2000** Abandoned limestone mines near the Priority III hibernaculum were entered in February, but no Indiana bats were found.
- Mist net surveys were conducted in June and July on the Athens Unit (25 sites) and the Ironton Ranger District (26 sites) (Kiser et al., 2000; Schultes, 2002). Two adult male Indiana bats were captured, one on the Athens Unit (Dorr Run area) and one on the Ironton Ranger District (Bear Run area). One additional adult male was captured on privately-owned land adjacent to the Dorr Run area of the Athens Unit.
- Three of the adult male Indiana bats captured during the mist net surveys were fitted with radio-transmitters and tracked to collect more information about their summer roost tree use (Schultes, 2002).
- In September during a fall-swarming survey, a female Indiana bat was captured at the entrance to an abandoned underground coal mine in the Dorr Run area (Athens Unit) (Brack and Little, 2001).
- 2001** The Priority III hibernaculum was closed to the public with the installation of a bat-friendly gate.
- 2002** Fall swarming surveys in September resulted in the capture of a male Indiana bat in the Snake Hollow area of the Athens Unit (L. Andrews, pers. comm.). The individual was

captured in a mist net that was set at the entrance to an abandoned underground coal mine.

- 2003** A February survey of the Priority III hibernaculum found approximately 200 Indiana bats inside the mine (Schultes, 2003).

Two abandoned limestone mines in the Bear Run area on the Ironton Ranger District were closed to the public with bat-friendly gates.

- 2004** The “Brushy Mine”, an abandoned limestone mine, was surveyed in February. Illegal off-highway vehicles had been driving into the mine, posing a threat to human safety, as well as to any bats inhabiting the mine. No Indiana bats were observed in the mine, however other species were documented. A mist net survey was conducted at the Brushy Mine in June. Bats were captured, but no Indiana bats were netted. A bat-friendly gate was installed at the mine in June, after the mist net survey, to protect the bats from human disturbance.

Mist net surveys were conducted in June and July on the Marietta Unit (37 sites) and the Ironton Ranger District (13 sites). No Indiana bats were captured (Meade, 2004)).

Relative humidity and temperature data loggers were installed in the Priority III hibernaculum in September to monitor microclimate trends over time.

In late-September, an adult female Indiana bat was captured at an entrance to an abandoned underground coal mine in Monkey Hollow (Athens Unit) during a fall-swarming survey (L. Andrews, pers. comm.).

- 2005** A February survey of the Priority III hibernacula detected 333 Indiana bats (Schultes 2005).

The temperature and relative humidity data loggers in the Priority III hibernaculum were downloaded and reset in August 2005. Data have not been analyzed to date.

Fall swarming surveys occurred in September 2005 at several open mine portals on the Athens Unit. No Indiana bats were detected.

# Appendix F3

to the  
Final Environmental Impact Statement  
for the  
Wayne National Forest 2006 Land and Resource  
Management Plan

Final Biological Evaluation  
on the  
Wayne National Forest Land and Resource  
Management Plan

Prepared by

USDA, Forest Service  
Wayne National Forest  
August 31, 2005



# Biological Evaluation

## Organization of the Biological Evaluation

The Biological Evaluation includes introductory information as well as the effects analyses for Regional Forester sensitive species (RFSS) and species proposed for RFSS designation. For a summary of this Biological Evaluation, please refer to Chapter 3 of the Final EIS, *Habitat Indicator 7*.

**Table 1. Contents of the Biological Evaluation.**

	<b>Page</b>
Introduction	F3-1
Description of the Selected Alternative	F3-5
Species Evaluated	F3-11
Overview of the Effects Analysis	F3-13
Effects Analysis	F3-14
Regional Forester Sensitive Species	F3-14
Species Proposed for Regional Forester Sensitive Species Designation	F3-79
List of Preparers and Reviewers	F3-109
Literature Cited	F3-109

## Introduction

The Land and Resource Management Plan (Forest Plan) is a strategic document that establishes land allocations as well as goals, desired conditions, objectives, standards and guidelines for the Wayne National Forest (WNF). The Forest Service initiated the Forest Plan revision process in April 2002 with the publication of the Notice of Intent to revise the Forest Plan in the Federal Register.

As part of the Forest Plan revision process, alternatives were developed to address issues raised during public involvement and comment periods. A Biological Evaluation was prepared and published in the Draft Environmental Impact Statement (EIS) (DEIS-Appendix F). It identified and addressed the potential effects of the alternatives on federally listed species, Regional Forester sensitive species, and species proposed for Regional Forester sensitive species designation.

Upon consideration of public comments received during the 90-day formal comment period of the Draft EIS (April 1- July 1, 2005), the Regional Forester made the decision to modify the Preferred Alternative (E), resulting in what will now be designated as the Selected Alternative, or Alternative E<sub>mod</sub>.

Under Forest Service Manual (FSM) 2672.41, objectives for completing biological evaluations for proposed Forest Service programs and activities are: 1) to ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native plant or animal species, 2) to ensure that Forest Service activities do not cause any species to move toward federal listing, and 3) to incorporate concerns for sensitive species throughout the planning process, reducing negative impacts to species and enhancing opportunities for mitigation.

The Biological Evaluation will document the direct, indirect, and cumulative effects on RFSS and species proposed for RFSS designation for each of the alternatives developed as part of the Forest Plan revision process. In addition, it will demonstrate how each alternative meets requirements of FSM 2672.3 (i.e., the objectives of the Forest Plan must include overall goals of effecting recovery and achieving eventual delisting of any federally listed species known to occur within the National Forest).

## Location and Ecological Setting of the Proposed Action

### Wayne National Forest

The WNF proclamation boundary encompasses 853,531 acres in 12 southeastern Ohio counties: Athens, Gallia, Hocking, Jackson, Lawrence, Monroe, Morgan, Noble, Perry, Scioto, Vinton, and Washington. There are 238,053 acres of NFS lands within the WNF proclamation boundary; the remaining lands are state-owned, privately-owned, or lands owned by local governments. The WNF is broken into three administrative units (Athens, Ironton, and Marietta).

The WNF is located in the Southern Unglaciaded Allegheny Plateau (Ecological Section 221E). The topography is characterized by numerous narrow ridges and deep valleys. Topographic relief ranges from a minimum of 500 feet to a maximum of over 1,000 feet. Slopes are typically benched or segmented with alternating steep and moderate slope gradients. Most gradients average 25 to 55 percent.

The bedrock geology is characterized by inter-bedded sedimentary strata of Permian age on the Marietta Unit, while bedrock underlying the Athens Unit and the Ironton Ranger District is of Pennsylvanian age. Most of the surface soils are silt loam, loam or sandy loam. However, the subsurface soils range from sandy loam to clay. Soil type and topography contribute to some areas of the WNF having high potential for soil erosion.

The WNF is located in the heart of Ohio's oil, gas and coal deposits. Industrial minerals such as sand, gravel, limestone, clay, shale, sandstone, and salt are also found within the National Forest. About 40% of the WNF

is currently underlain by federally owned minerals, including oil and gas. Reserved and/or outstanding minerals wholly or partially encumber the remaining 60% of the National Forest.

Extraction of coal, clay, limestone and iron ore have occurred in southeastern Ohio during the last 150 years. Today, remnants of this industrial era are present on the WNF in the form of abandoned surface and underground mines. Features associated with these abandoned mine lands affect riparian and water quality.

The WNF is part of the mixed mesophytic forest region. Approximately 80% of all lands within the WNF proclamation boundary are forested (Ohio Land Use Cover, based on Landsat TM 1994). Just over 94% of NFS lands are forested with the remaining 6% covered by non-forest lands such as roads, water, grasslands and other openland. National Forest System lands are dominated by hardwood forest types, however some pine is present (Table 2).

**Table 2. Acres of forest types by age class on National Forest System lands\*.**

Age (years)	Pine	Pine - Hardwood	Oak - Hickory	Yellow Poplar	Lowland Hardwood	Maple-Beech	Upland Hardwood	Total
No Age	52	23	138		74		34	321
0-9	55	279	110	13	275		312	1,044
10-19	953	640	4,632	93	349	74	4,974	11,715
20-29	1,217	532	4,343	614	747	196	4,725	12,374
30-39	4,470	1,811	4,417	1,088	2,297	274	6,962	21,319
40-49	3,539	3,157	3,024	2,129	1,844	189	7,427	21,309
50-59	2,233	3,093	5,724	3,019	1,281	596	9,239	25,185
60-69	1,405	1,986	10,493	2,792	720	443	8,221	26,060
70-79	364	650	13,120	1,691	505	675	6,254	23,259
80-89	85	297	13,722	899	257	755	3,179	19,194
90-99		352	13,628	347	69	347	2,021	16,764
100-109		34	14,131	125	63	360	1,073	15,786
110-119			10,524	93	17	148	574	11,356
120-129			6,625	12		117	172	6,926
130-139		22	1,859		34	70	51	2,036
140-149			988			20	78	1,086
150+			197			15	28	240
<b>Total</b>	<b>14,373</b>	<b>12,876</b>	<b>107,675</b>	<b>12,915</b>	<b>8,532</b>	<b>4,279</b>	<b>55,324</b>	<b>215,974</b>

\*Data in this table do not include the approximately 9,300 acres of NFS lands where a silvicultural examination has yet to be conducted.

Of the forested NFS lands, oak-hickory is the major forest type, comprising 47% of all forested stands. The majority of the WNF has been harvested one or more times since the late 1700s. Cultivation or grazing followed the harvest of many forest stands. Today, many forest

communities were established after timber harvesting that occurred about 80-140 years ago.

All streams in the WNF proclamation boundary flow towards the Ohio River. There are 31 fifth-level watersheds that contain part of the WNF proclamation boundary; however only 15 of these watersheds contain more than 1% NFS lands (Table 3).

**Table 3. Fifth level watersheds encompassing the WNF proclamation boundary.**

Watershed Name	Hydrologic Unit Code	Watershed Size (acres)	NFS land (%)
Monday Creek	0503020406	74,209	44.7
Pine Creek	0509010302	117,859	36.5
Symmes Creek (Black Fork to Buffalo Creek)	0509010109	64,168	35.1
Little Muskingum River (Clear Fork to Ohio R.)	0503020110	106,032	26.5
Ohio River (Sunfish Cr. to Muskingum River)	0503020102	87,344	22.3
Sunday Creek	0503020407	88,773	21.9
Symmes Creek (Buffalo Creek to Ohio River)	0509010110	96,987	17.9
Little Muskingum River (above Clear Creek)	0503020109	95,313	15.5
Ohio River (below Big Sandy R. to Pine Cr.)	0509010301	83,471	13.1
Hocking River (Enterprise to Monday Cr.)	0503020405	80,819	10.4
Symmes Creek (headwaters to Black Fork)	0509010108	76,244	10.1
Raccoon Creek (headwaters to Hewett Fork)	0509010102	86,715	6.7
Hocking River (Monday Creek to Athens)	0503020408	65,523	5.2
East Fork of Duck Creek	0503020111	87,190	1.7
Raccoon Creek (Hewett Fork to Elk Fork)	0509010103	99,234	1.4
Little Scioto River (Rocky Fork to Ohio River)	0509010304	97,405	0.37
Federal Creek	0503020409	92,547	0.34
Middle Fork of Salt Creek	0506000208	69,738	0.17
Raccoon Creek (Little Raccoon Cr. to Ohio R.)	0509010106	90,082	0.17
Duck Creek (except East Fork)	0503020112	95,765	0.16
Salt Creek (Queer Cr to Scioto River)	0506000210	85,157	0.07
Hocking River (Athens to Ohio River)	0503020410	70,213	0.01
Wolf Creek	0504000409	98,776	0
Seneca Fork Wills Creek	0504000501	96,296	0
Ohio River (Muskingum R. to Hocking R.)	0503020201	90,407	0
Rush Creek (Little Rush Cr. to Hocking River)	0503020403	87,046	0
Ohio River (Fish Creek to Sunfish Creek)	0503020101	79,210	0
Moxahala Creek	0504000405	69,353	0
Rush Creek (headwaters to Little Rush Creek)	0503020402	63,267	0
Ohio River (Kanawha River to Raccoon Cr.)	0509010101	29,064	0
Ohio River (Raccoon Cr. to Symmes Cr.)	0509010107	88,976	0
<b>Total</b>		<b>2,523,191</b>	<b>9.43</b>

Riparian areas, wetlands and floodplains have been affected by extensive disturbance and modifications. Nearly all floodplains and riparian areas, and most of the wetlands on NFS lands were cleared, drained, and farmed in the past. Transportation corridors, including roads and railroads, were developed through these areas by early settlers. Riparian and aquatic resources have also been affected by stream channel alteration (typically by straightening stream channels and the filling in of oxbows), streamside forest clearing, livestock access to streams, cultivation of fields up to the edge of the channel, and more recently from increased development of residential sites in the floodplain on private lands. Such activities have resulted in altered hydrologic regimes, increased erosion and sedimentation within stream channels, degraded water quality and aquatic habitat.

The landscape of the WNF, including NFS lands and other ownerships, is fragmented by residences, farms, mines and quarries, industrial developments, and towns. The scattered pattern of NFS lands, including subsurface ownership of minerals, has resulted in the construction of roads and utility corridors across NFS lands to access these private inholdings.

---

## Description of the Alternatives

The National Forest Management Act requires the development and analysis of a broad range of reasonable alternatives that respond to the issues and concerns identified during the planning process. For purposes of this Forest Plan revision, each alternative had a different approach to managing the resources on the WNF. While all alternatives provided a wide range of multiple uses, goods and services, they addressed the issues in different ways.

Preliminary themes for revised Forest Plan alternatives were developed during public and employee collaborative workshops in 2003. These themes were designed to address the issues and concerns identified early on in the planning process. The themes were used to develop five alternatives, in addition to the No Action Alternative (Alternative A) that carried forward the emphasis of the current Forest Plan.

Alternative E was identified as the Preferred Alternative with the release of the Draft EIS and Proposed Revised Forest Plan (announced in the Federal Register on April 1, 2005). After review of public comments received during the subsequent 90-day comment period, the Regional Forester chose to modify the Preferred Alternative, and identified E<sub>mod</sub> as the Selected Alternative.

**The Selected Alternative (Alternative E<sub>mod</sub>) provides the management strategy that will guide all resource management activities and will establish management direction for the WNF for the next 10-15 years.**

Management Areas (MA) are the foundation of a Forest Plan (see Chapter 3 of the revised Forest Plan). Each MA emphasizes different management prescriptions and uses (Table 4). The alternatives, including Alternative E<sub>mod</sub>, consist of a specific arrangement of MAs on the ground, otherwise known as the MA allocation. Allocation includes the type, amount and distribution of the MAs referenced in Table 4.

For comparison purposes, Table 5 is provided to show how Alternative E<sub>mod</sub> falls within the range of MA allocations analyzed for Alternatives A-F in the Biological Evaluation for the Draft EIS (DEIS-Appendix F). Table 5 shows that the acreages associated with the MA allocation for Alternative E<sub>mod</sub> are within the range of those acreages analyzed for Alternatives A-F.

To achieve the desired future condition for each MA, various management activities are projected to occur in each of the alternatives, including Alternative E<sub>mod</sub>. For analysis purposes, the intensity of management activities is projected out for 10 years. Table 6 is provided to show how the projected management activities associated with Alternative E<sub>mod</sub> fall within the range of management activities previously analyzed for Alternatives A-F (see the Biological Evaluation - DEIS, Appendix F).

**Table 4. Brief description of the management areas.**

Management Area Name	Description
Candidate Areas (CA)	Emphasis is on the preservation of potentially unique natural areas. These areas possess potentially significant natural or historic characteristics. Management is directed at protecting the potentially unique characteristics of these areas until they can be studied for designation as research natural areas, special areas, or other management areas.
Developed Recreation (DR)	Emphasis is on the management of existing recreation facilities and the future needs for the highly developed sites that serve large numbers of people. It covers the most developed range of recreation opportunities provided on the Forest. By offering a variety of recreation opportunities, services, and facilities in a natural setting, the Forest intends to provide visitors with a quality outdoor recreation experience.
Diverse Continuous Forest (DCF)	Provides mature forest habitat for conservation of forest interior species.
Diverse Continuous Forest with OHVs (DCFO)	Emphasizes trails for motorized recreation and mature forest habitat for conservation of forest interior species.
Forest and Shrubland Mosaic (FSM)	Sustains a distribution of early successional habitat conditions interspersed throughout a forested landscape. Dispersed, non-motorized recreation opportunities are offered in this management area.
Forest and Shrubland Mosaic with OHVs (FSMO)	Emphasizes trails for motorized recreation as well as early successional habitat conditions interspersed throughout a forested landscape.
Future Old Forest (FOF)	Characterized mostly by old forest that change only as a result of natural disturbances and natural succession. These areas offer Forest visitors opportunities to experience solitude and closeness to nature. Such opportunities may be limited in the vicinity of private oil and gas rights until the oil and gas reservoirs are depleted.
Future Old Forest with Mineral Activity (FOFM)	This management area is located on the Marietta Unit of the Athens Ranger District. It continues a primarily custodial regime of vegetation management. Its two objectives are (a) promotion of mostly old forest that changes only as a result of natural disturbance and succession; and (b) opportunities for relatively primitive recreation experiences. Unlike the FOF Management Area, surface occupancy of federal oil and gas leases is permitted in this management area. Many oil and gas wells are already present within this management area, both on lands in private surface ownership and on NFS land where the subsurface minerals are privately owned (outstanding and reserved rights).
Grassland and Forest Mosaic (GFM)	Emphasizes habitat for grassland-dependent wildlife species on expanses of reclaimed coal mine lands. Dispersed, non-motorized recreation opportunities are offered in this management area.
Historic Forest (HF)	The emphasis of this management area is moving conditions toward the “historic range of variability.” This includes maintaining and increasing the predominance of oaks and hickories on most sites, featuring larger and older trees with more open stands than currently cover most of this area. These conditions would be promoted through a combination of mostly uneven-aged timber harvest, frequent prescribed fire, and herbicide use, where necessary, to promote oak and hickory regeneration.
Historic Forest with OHVs (HFO)	Emphasizes trails for motorized recreation as well as moving forest conditions back toward their “historic range of variability”. This includes maintaining and increasing the predominance of oaks and hickories on most sites, with larger, older trees and stands more open than those currently found in this area. These conditions are to be attained by a combination of mostly uneven-aged timber harvest, frequent prescribed fire, and herbicide use, where necessary, to promote oak and hickory regeneration.
Research Natural Areas (RNA)	Includes designated Research Natural Areas which emphasize preservation of unique ecosystems for scientific purposes; and research to better understand natural processes.
River Corridors (RC)	Emphasizes retaining, restoring, and enhancing the inherent ecological processes and functions associated with riverine systems. Management will protect or enhance the scenic quality of these areas. As a result, high-quality riverine recreation opportunities should be available in these river corridors. Areas allocated to this management area are linear-shaped and occur along the mainstem of Symmes Creek, the Hocking River, the Little Muskingum River, and along the Ohio River.

**Table 4. Brief description of the management areas.**

Management Area Name	Description
Special Areas (SA)	Emphasizes the preservation, management, and study of unique natural areas. These areas are regionally or locally significant and have been formally designated after recommendation by a review committee and approved by the Regional Forester. These areas meet one or more of the following criteria: (a) be representative of unique geological, ecological, cultural or other scientific values; (b) be an appropriate area for scientific research; and (c) have potential to be a regional or national landmark based on its natural or cultural values.
Timbre Ridge Lake (TRL)	Focus of this management area is the scenery and recreation afforded by the 100-acre Timbre Ridge Lake and the rugged, wooded hills that surround it.

**Table 5. Management area allocation by acres of NFS lands across the alternatives.**

	A <i>No Action</i>	B	C	D	E	E <sub>mod</sub> <i>Selected</i>	F
Candidate Areas	981	981	981	981	981	981	981
Developed Recreation	1,839	1,839	4,078	4,078	4,078	4,078	4,078
Diverse Continuous Forest	155,408	12,079	98,292	83,405	55,089	55,267	45,971
Diverse Continuous Forest with OHVs	45,010	27,851	43,901	29,846	22,278	22,953	22,278
Forest and Shrubland Mosaic	0	143,329	22,946	45,536	57,562	54,580	35,779
Forest and Shrubland Mosaic with OHVs	0	17,159	0	0	0	0	0
Future Old Forest	18,470	9,603	23,649	8,793	13,496	16,478	26,326
Future Old Forest with Mineral Activity	0	8,867	0	10,154	10,154	10,154	28,225
Grassland and Forest Mosaic	0	0	5,334	5,334	5,334	5,334	5,334
Historic Forest	0	0	17,869	17,869	26,456	26,278	26,456
Historic Forest with OHVs	0	0	0	14,054	21,622	20,947	21,622
Research Natural Areas	117	117	117	117	117	117	117
River Corridors	8,682	8,682	12,544	12,544	12,544	12,544	12,544
Special Areas	7,546	7,546	7,546	7,546	7,546	7,546	7,546
Timbre Ridge Lake	0	0	796	796	796	796	796
<b>Total</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>	<b>238,053</b>

**Table 6. Upper limits of projected outputs for management activities for the first decade.**

Units of measure – acres (unless otherwise noted)	A <i>No Action</i>	B	C	D	E	$E_{Mod}$ Selected	F
<b>Vegetation Management</b>							
Even-aged Hardwood Timber Harvest	0	5,960	1,630	1,780	1,820	1,725	1,370
Even-aged Pine Timber Harvest	0	200	200	200	200	200	200
Uneven-aged Timber Harvest	5,000	5,000	16,120	15,470	14,590	14,556	13,500
Thinning	0	0	940	1,230	1,540	1,460	970
Crop Tree Release	1,150	3,250	3,239	2,786	2,142	2,113	1,719
Grape Vine Control	1,500	3,720	4,148	3,544	2,711	2,683	2,212
Site Prep for Native Pine	200	200	200	200	200	200	200
Reforestation	500	500	500	500	500	500	500
Prescribed Fire							
Oak Regeneration	6,764	12,214	35,725	40,599	46,611	46,215	44,537
NNIS	200	200	200	200	200	200	200
Herbaceous Habitat	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Hazardous Fuels	61,355	55,905	32,394	27,520	21,508	21,904	23,582
Herbicide Application							
Oak Regeneration	800	4,376	7,236	9,005	11,155	10,994	10,846
NNIS	600	600	600	600	600	600	600
Development of Permanent Forest Openings	500	500	500	500	500	500	500
Maintenance of Permanent Forest Openings and other Herbaceous Habitats (Mechanical)	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Control of Non-Native Invasive Species							
Mechanical	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Biological	100	100	100	100	100	100	100
Wetland Restoration & Enhancement	150	150	150	150	150	150	150
Waterhole Construction	15	15	15	15	15	15	15
Fishing Pond/Lake Construction	15	15	15	15	15	15	15
Restoration & Improvement of Aquatic/Riparian Habitat							
Lentic	150	150	150	150	150	150	150
Lotic	20 miles	20 miles	20 miles	20 miles	20 miles	20 miles	20 miles
Installation of Bat-Friendly Gates on Mines	20-30 gates	20-30 gates	20-30 gates	20-30 gates	20-30 gates	20-30 gates	20-30 gates

**Table 6. Upper limits of projected outputs for management activities for the first decade.**

Units of measure – acres (unless otherwise noted)	A <i>No Action</i>	B	C	D	E	<i>E<sub>Mod</sub></i> <i>Selected</i>	F
<b>Recreation Management</b>							
OHV Trail Construction	223	223	150	187	150	150	110
Hiking Trail Construction	8.5	8.5	18	18	18	18	18
Horse Trail Construction	36	36	61	61	61	61	61
Mountain Bike Trail Construction	36	36	36	36	36	36	36
Recreation Facility Construction & Parking Lots	60	60	60	60	60	60	60
<b>Transportation Management</b>							
Temporary Road Construction	118	130	146	146	145	146	140
Permanent Road Construction	52	68	74	74	74	74	71
Permanent Road Reconstruction	145	223	320	317	311	318	284
Road Decommissioning	29	29	29	29	29	29	29
Skid Trails and Landings	198	441	747	739	718	740	634
<b>Energy Minerals Management</b>							
Surface Coal Mining Activities	1,250	1,250	1,250	1,250	1,250	1,250	1,250
Reclamation of Depleted or Orphan Wells	128 wells (70 acres)	128 wells (70 acres)	128 wells (70 acres)	128 wells (70 acres)	128 wells (70 acres)	128 wells (70 acres)	128 wells (70 acres)
Oil & Gas Well Development	234 wells (121 acres)	234 wells (121 acres)	234 wells (121 acres)	234 wells (121 acres)	234 wells (121 acres)	234 wells (121 acres)	234 wells (121 acres)
<b>Special Uses Management</b>							
Utility Corridor Development & Maintenance	50	50	50	50	50	50	50
Agricultural Crop Production & Grazing	50	50	50	50	50	50	50
<b>Watershed Management</b>							
Treatment of AMD	270	270	270	270	270	270	270
Surface Mine Reclamation	20	20	20	20	20	20	20
Closure of Open Mine Portal/Subsidence	232	232	232	232	232	232	232
Stabilization of Disturbed Areas	100	100	100	100	100	100	100
<b>Fire Management</b>							
Reduction of Hazardous Fuels - Mechanical	10,181	10,181	10,181	10,181	10,181	10,181	10,181
<b>Lands Acquisition Management</b>							
Land Acquisition	Up to 40,000 acres	Up to 40,000 acres	Up to 40,000 acres	Up to 40,000 acres	Up to 40,000 acres	Up to 40,000 acres	Up to 40,000 acres
Land Exchange	400	400	400	400	400	400	400

## Species Evaluated

### Regional Forester Sensitive Species

There are 23 plant and animal species on the WNF RFSS list (Table 7) Regional Forester Sensitive Species include U. S. Fish and Wildlife Service candidate species, species delisted by the U. S. Fish and Wildlife Service in the last five years, and species with The Nature Conservancy's Global, Trinomial, or National Ranks of G1-G3, T1-T3 or N1-N3 documented within the WNF proclamation boundary. All RFSS are considered in this Biological Evaluation.

**Table 7. Regional Forester Sensitive Species occurring within the WNF.**

<b>Mammals</b>	Bobcat	<i>Lynx rufus</i>
	Black Bear	<i>Ursus americanus</i>
<b>Birds</b>	Henslow's Sparrow	<i>Ammodramus henslowii</i>
	Cerulean Warbler	<i>Dendroica cerulean</i>
<b>Reptiles</b>	Timber Rattlesnake	<i>Crotalus horridus</i>
<b>Amphibians</b>	Eastern Hellbender	<i>Cryptobranchus alleganiensis</i>
<b>Fish</b>	Western Lake Chubsucker	<i>Erimyzon sucetta</i>
	Eastern Sand Darter	<i>Etheostoma pellucidum</i>
	Ohio Lamprey	<i>Ichthyomyzon bdellium</i>
<b>Mollusks</b>	Round Hickorynut	<i>Obovaria subrotunda</i>
	Lilliput	<i>Toxolasma parvus</i>
	Little Spectaclecase	<i>Villosa lienosa</i>
	Salamander Mussel	<i>Simpsonaias ambigua</i>
<b>Insects</b>	Grizzled Skipper	<i>Pyrgus wyandot</i>
<b>Plants</b>	Juniper Sedge	<i>Carex juniperorum</i>
	Yellowish Gentian	<i>Gentiana alba</i>
	Striped Gentian	<i>Gentiana villosa</i>
	Butternut	<i>Juglans cinerea</i>
	Umbrella Magnolia	<i>Magnolia tripetala</i>
	Blue Scorpionweed	<i>Phacelia ranunculacea</i>
	Yellow-fringed Orchid	<i>Platanthera ciliaris</i>
	Rock Skullcap	<i>Scutellaria saxatilis</i>
	Pigeon Grape	<i>Vitis cinerea</i>

## Species Proposed for Regional Forester Sensitive Species Designation

There are 20 plant and animal species proposed for RFSS designation which are not currently listed as RFSS, but were recommended for listing as RFSS after risk evaluations were conducted, in accordance with (FSM 2670, Supplement 2600-2001-1) (Table 8). The formal RFSS update process is scheduled to occur in 2005. Until this process is completed, these species will be identified as species proposed for RFSS designation for the WNF. However, they will be treated as though they have the formal status of a RFSS. All species proposed for RFSS designation will be addressed in this Biological Evaluation.

**Table 8. Species Proposed for RFSS Designation occurring within the WNF.**

<b>Amphibians</b>	Blanchard's cricket frog	<i>Acris crepitans blanchardi</i>
	Four-toed salamander	<i>Hemidactylium scutatum</i>
	Green salamander	<i>Aneides aeneus</i>
	Mud salamander	<i>Pseudotriton montanus</i>
<b>Insects</b>	Rapids clubtail	<i>Gomphus viridifrons</i>
	Green-faced clubtail	<i>Gomphus quadricolor</i>
<b>Mollusk</b>	Sheepnose	<i>Plethobasus cyphus</i>
<b>Plants</b>	Butterfly pea	<i>Clitoria mariana</i>
	Carolina thistle	<i>Cirsium carolinianum</i>
	Dwarf iris	<i>Iris verna</i>
	Featherbells	<i>Stenanthium gramineum</i>
	Lined sedge	<i>Carex striatula</i>
	Little headed nutrush	<i>Scleria oligantha</i>
	Marshes St. John's wort	<i>Triadenum tubulosum</i>
	Pale straw sedge	<i>Carex albolutescens</i>
	Pinxter flower	<i>Rhododendron nudiflorum</i>
	Smooth beardtongue	<i>Penstemon laevigatus</i>
	Sparse-lobed grape fern	<i>Botrychium biternatum</i>
	Tall nut rush	<i>Scleria triglomerata</i>
	Yellow crownbeard	<i>Verbesina occidentalis</i>

---

## Overview of the Effects Analysis

This analysis of effects is programmatic in that it addresses only the effects of the alternatives, including the Selected Alternative, which includes revised Forest Plan direction (Forest-wide goals, objectives, standards and guidelines and Management Area desired future conditions, objectives, standards and guidelines) on the RFSS and species proposed for RFSS designation. In addition, the programmatic effects analysis addresses the projected management activities which could occur in the first decade of implementation of any of the alternatives; these management activities are displayed in Table 6.

All management actions proposed under the alternatives, including the Selected Alternative, would be subject to second level, site-specific analysis once they were authorized with a Record of Decision.

The projected land allocations and management activities that would occur as a result of implementing the alternatives are displayed in Table 5 and Table 6 of this Biological Evaluation. It is important to note that one aspect of an activity may have a beneficial effect on one or more species, while other aspects of the same activity could have a potentially adverse effect on one or more species. These effects will be displayed individually, and then summarized in a table at the end of each species analysis.

Because the Selected Alternative falls within the range of the previously analyzed Alternatives A-F, the effects disclosed for Alternatives A-F will be similar for Alternative E<sub>mod</sub>. For all species, direct and indirect effects could occur on NFS lands or could occur off-site onto other ownerships.

Cumulative effects, as defined for the National Environmental Policy Act, are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. For terrestrial species, the cumulative effects area will coincide with the WNF proclamation boundary. For aquatic species, the cumulative effects analysis area will include the 31, 5<sup>th</sup> level watersheds that contain the WNF proclamation boundary. This spatial area was chosen because the direct and indirect effects associated with the alternatives are expected to be contained within this cumulative effects analysis area.

---

## Effects on Regional Forester Sensitive Species

### Analysis Process

In association with the Forest Plan revision process, the Forest Service undertook a review of its RFSS list. Based on risk evaluations that were completed, as required in FSM 2670, Supplement 2600-2001-1, six species will be dropped from the RFSS list. Viability of these species would not be affected by the alternatives either because (1) the species population levels are increasing to the point where taxonomic experts do not consider them to be at-risk of losing viability within the planning area; or (2) the species is not present within the planning area. These six species will not be addressed further in this analysis.

- **River Otter** – This species is a conservation success story. It was reintroduced into certain watersheds in Ohio, including the Little Muskingum River, in the 1980s-1990s. Population levels have increased to the point where the Ohio Division of Wildlife has removed it from state threatened and endangered status and has given it furbearer status. Trapping is allowed in certain areas of Ohio with a special beaver/otter permit.
- **Evening Bat** – This species has not been found in the WNF for almost 25 years, despite much effort to locate it (i.e., surveys conducted in 1997, 1998, 1999, 2000, 2003, and 2004). The WNF is located on the northern edge of its range. Efforts to document its occurrence within the planning area will continue, and if it is located, a risk evaluation will be conducted to see whether it should have RFSS status.
- **Olympia Marble** – The Olympia marble has been extirpated from the State of Ohio (D. Parshall, pers. comm.). It is doing well in Michigan and eastern West Virginia, but the taxonomic experts consider the WNF a fringe zone for this species. Efforts to document its occurrence within the planning area will continue, and if it is located, a risk evaluation will be conducted to see whether it should have RFSS status.
- **Wabash River Cruiser** – This dragonfly does not occur within the planning area. There is some debate whether it may be a hybrid of the royal river cruiser (*M. taeniolata*) and the gilded river cruiser (*M. pacifica*) (Garrison 1995 in Glotzhober and McShaffrey 2002). Efforts to document its occurrence within the planning area will continue, and if it is located, a risk evaluation will be conducted to see whether it should have RFSS status.
- **Philadelphia Panic Grass** – The one record from the WNF was stored at the state herbarium and was reviewed by taxonomic

experts (Jim McCormac, Ohio Division of Wildlife and Rick Gardner, Ohio Division of Natural Areas and Preserves). The WNF record is a misidentification and is likely gattinger panic grass (*Panicum gattingeri*). According to these experts, Philadelphia panic grass is not likely to occur in the planning area.

- **Bicknell’s Panic Grass** – The taxonomy of this species has been controversial, resulting in a variety of synonymous names (i.e., *Dicanthelium boreale*, *Panicum boreale* and *Panicum bicknelli*). The most recent publications have grouped *D. bicknelli* with *D. boreale* (Freckman and Lelong, 2003) causing the listing of Bicknell’s panic grass as a RFSS to undergo review on the Forest. Ohio Department of Natural Resources botanists (J. McCormac and R. Gardner) both advised dropping this species from the WNF RFSS list since it is no longer recognized as a species by other states. Bicknell’s panic grass will be removed from the Ohio state rare plant list during the next update (R. Gardner pers. comm.).

Twenty-three plant and animal species remain on the RFSS list. The effects of the alternatives on the species were evaluated using information collected from currently accepted and applicable scientific literature, other scientific sources, from taxonomic experts, and with professional judgment of Forest Service biologists. The Biological Evaluation provides two assessments of impacts to the species, (a) habitat outcomes and (b) determination of effects.

### Habitat Outcomes

The habitat outcome (also known as viability outcome in the species viability evaluations) was determined for historic, current and likely future environmental conditions for RFSS on NFS lands and on all lands in the cumulative effects analysis area for each alternative (Table 10 and Table 11). The habitat outcome is a judgment, based on scientific information found in the literature and from discussion with taxonomic experts. It should be thought of as an index of the capability of the environment to support population abundance and distribution of RFSS, but not as an actual prediction of population occurrence, size, density or other demographic characteristics (T. Schenck. pers. comm.).

The current and likely future habitat outcomes for RFSS were determined for each alternative. “Future” is defined as decades 2, 5, and 10 of the revised Forest Plan implementation. Analysis focused on the risk factors pertinent to the species within the planning area and within the control of the Forest Service. The assessment of future habitat conditions, distribution and quality were based on the knowledge of the species distributional range and life history. For example, some of these species occur naturally in a localized or patchy distribution, and would not occur in the conditions described in habitat outcomes A-C because their natural

condition may be D or E. A judgment of historical environmental conditions provides a reference or context within which to evaluate the impacts to evaluate the impacts of the alternatives.

The majority of RFSS were included in the species viability evaluation process. This process is summarized in Appendix E of the Final EIS. The process included exhaustive literature searches to compile information about these species life histories, occurrences, population and habitat trends, and threats to viability. Taxonomic experts provided additional information about the species, including general information about the effects of management activities on individual or groups of species. The historical, current and future habitat outcomes were determined by the Forest Service after review of data and discussions with taxonomic experts. Some habitat outcomes were changed from that which was displayed in the Species Data Collection Forms (i.e., a product of the species viability evaluations process) because additional information had been acquired after the evaluations were completed. For RFSS not included in the species viability evaluation process, habitat outcomes were determined by the Forest Service after review of conservation assessments and discussions with taxonomic experts.

Judgments of habitat outcomes within the cumulative effects analysis area is displayed for each species by alternative. There has likely been a reduction in the species historical range in the cumulative effects analysis area, except for some species which occur in localized or patchy distributions.

For many species, in general, cumulative and direct/indirect effects are similar. Since historical times, similar types of disturbances and management practices have occurred in the cumulative effects analysis area as have occurred on NFS lands.

**Table 10. Definition of habitat outcomes used to estimate current and likely future conditions for RFSS on NFS lands.**

Habitat Outcome	Definition
A	Suitable ecological conditions are broadly distributed and of high abundance across the historical range of the species within the planning area. The combination of distribution and abundance of ecological conditions provides opportunity for continuous or nearly continuous intraspecific interactions for the species.
B	Suitable ecological conditions are either broadly distributed or of high abundance across the historical range of the species within the planning area, but there are gaps where suitable ecological conditions are absent or only present in low abundance. However, the disjunct areas of suitable ecological conditions are typically large enough and close enough to permit dispersal among subpopulations and potentially to allow the species to interact as a metapopulation across its historical range within the planning area.
C	Suitable ecological conditions are distributed frequently as patches and/or exist at low abundance. Gaps where suitable ecological conditions are either absent, or present in low abundance, are large enough that some subpopulations are isolated, limiting opportunity for species interactions. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations. For species for which this is not the historical condition, reduction in overall species range from historical within the planning area may have resulted from this isolation.
D	Suitable ecological conditions are frequently isolated and/or exist at very low abundance. While some of the subpopulations associated with these ecological conditions may be self-sustaining, there is limited opportunity for population interactions among many of the suitable environmental patches. For species for which this is not the historical condition within the planning area, reduction in overall species range from historical condition within the planning area may have resulted from this isolation.
E	Suitable ecological conditions are highly isolated and exist at very low abundance, with little or no possibility of population interactions among suitable environmental patches, resulting in strong potential for extirpations within many of the patches, and little likelihood of re-colonization of such patches. There has likely been a reduction in overall species range from historical within the planning area, except for some rare, local endemics that may have persisted in this condition since the historical period.

**Table 11. Definition of habitat outcomes used to estimate current and likely future conditions for RFSS in the cumulative effects analysis area.**

Habitat Outcome	Definition
A	The combination of environmental and population conditions provides opportunity for the species to be broadly distributed and of high abundance across its historical range within the cumulative effects analysis area. There is potential for continuous or nearly continuous intraspecific interactions at high population size.
B	The combination of environmental and population conditions provide opportunity for the species to be broadly distributed and/or of high abundance across its historical range within the cumulative effects analysis area, but there are gaps where populations are potentially absent or present only in low density as a result of environmental or population conditions. However, the disjunct areas of higher potential population density are typically large enough and close enough to other subpopulations to permit dispersal among subpopulations and potentially to allow the species to interact as a metapopulation across its historical range within the cumulative effects analysis area.
C	The combination of environmental and population conditions restrict the potential distribution of the species, which is characterized by patchiness and/or areas of low abundance. Gaps where the likelihood of population occurrence is low or zero are large enough that some subpopulations are isolated, limiting opportunity for species interactions. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations. For species for which this is not the historical condition within the planning area, reduction in overall species range from historical condition may have resulted from this isolation.
D	The combination of environmental and population conditions restrict the potential distribution of the species, which is characterized by areas with high potential for population isolation and/or very low potential abundance. While some of these subpopulations may be self-sustaining, gaps where the likelihood of population occurrence is low or zero are large enough that there is limited opportunity for interactions among them. For species for which there is not the historical condition within the planning area, reduction in overall species range from historical has likely resulted from this isolation.
E	The combination of environmental and population conditions restricts the potential distribution of the species, which is characterized by high levels of isolation and very low potential abundance. Gaps where the likelihood of population occurrence is low or zero are large enough there is little or no possibility of interactions, strong potential for extirpations, and little likelihood of recolonization. There has likely been a reduction in overall species range from historical within the planning area, except for some rare, local endemics that may have persisted in this condition since the historical period.

### Determination of Effect

This analysis of effects is programmatic in that it addresses only the effects of Forest-wide goals, objectives, standards and guidelines and Management Area desired future conditions, objectives, standards and guidelines, and variations in land allocations and management activities among the alternatives, on the RFSS. All management actions proposed under the alternatives would be subject to second level, site-specific analysis once they were authorized with a Record of Decision.

The projected land allocations and management activities that would occur as a result of implementing any of the alternatives are displayed in Table 5 and Table 6 of this Biological Evaluation (near the beginning of this document). It is important to note that one aspect of an activity may have a beneficial impact, while other aspects of the same activity may have a potentially negative impact. These effects will be summarized in a table at the end of the analysis.

Judgments of the determination of effects of the alternatives on RFSS are expressed as “likelihoods” or “risk” because of uncertainty inherent in evaluating future scenarios and because the environmental conditions of many RFSS are not often well understood.

### Conservation Measures Common to all Alternatives

All alternatives include a Forest-wide Goal (5.2) that states, “Promote conservation activities that protect, restore, or enhance habitat for RFSS.” In addition, all alternatives incorporate Forest-wide standards and guidelines to ensure the protection and sustained viability of any RFSS on NFS lands. These include:

- **(TES-32)** – Protect and improve occupied Regional Forester sensitive species habitat.
- **(TES-33)** – Do not conduct vegetation management within a 50-foot radius of rock shelters and within 50 feet of the base and 50 feet of the top (measured horizontally) of naturally occurring, large rock faces or outcrops, unless designed to enhance the site characteristics for a Federally listed species or a known population of RFSS. Large rock faces or outcrops are defined as rock outcrop areas 15 feet or more in height and 100 feet or more in length. These rock outcrop habitats are not limited to solid “cliffs” and may include discontinuous rock faces, if the outcrop area is predominantly rock faces.
- **(TES-34)** – Avoid vegetation management within 50 feet of the base and 50 feet of the top of smaller rock faces (approximately 15 feet or more in height and less than 100 feet in length).

- **(TES-35)** – Do not permit collection of Regional Forester sensitive plant or animal species, except for scientific or educational purposes. Require a permit for such collecting.
- **(TES-36)** – Localized removal of vegetation to reduce woody encroachment (e.g., mowing, brush removal in the understory, selective thinning of the overstory, grazing) may be used to maintain or improve habitat for RFSS.
- **(Revised Forest Plan, Appendix D)** – Maintain a RFSS list, per Regional policy direction. Coordinate and cooperate with experts from other agencies, universities and organizations to conserve, protect, and monitor populations and habitats of Regional Forester sensitive species

### Affected Environment

Habitat and behavior information, occurrences in the planning area, and threats to the viability of the RFSS are identified in Table 12. A detailed description of the threats to viability for most species is contained in the Species Data Collection Forms prepared as part of the species viability evaluation process. These are found in the Forest Plan revision planning record. Threats to viability addressed in the effects analysis section are those in which the Forest Service can assert control during implementation of any of the alternatives.

**Table 12. Affected environment for RFSS.**

Species	Habitat	Occurrence	Threats to Viability
Black bear	Black bears can be found in a wide variety of the more heavily wooded habitats, ranging from swamps and wetlands to dry upland hardwood and coniferous forests. Although they will utilize open areas, bears prefer wooded cover with a dense understory. Winter den sites include dense thickets, hollow logs, tree or rock cavities, and caves.	Forest-wide (bear sightings have been steadily increasing since the mid-1980s, and evidence suggests Ohio may support a small breeding population)	Locally threatened by habitat loss and interference by humans (NatureServe, 2004).
Blue Scorpionweed	Blue scorpionweed can be found in sunny or semi-shaded areas in a variety of moist or well-drained woods and thickets (Spooner, 1985). The species occurs on the WNF in several habitats: sandy soil in a riparian area adjacent to a stream in partial shade (ODNR, 2003a), south-facing, semi-shaded upland slopes (McCartney and Goodwin, 2003a), and open, sunny floodplains. The species occurs in areas with, and appears to favorably respond to, disturbance from flooding and prescribed fire (J. Dumke, pers. comm.).	Handley Branch Special Area, Ironton Ranger District. A second population has been found in Lawrence County, outside the Handley Branch Special Area.	Direct loss of occupied habitat; decline in habitat suitability resulting from introduction of non-native invasive species (McCartney and Goodwin, 2003a).

**Table 12. Affected environment for RFSS.**

Species	Habitat	Occurrence	Threats to Viability
Bobcat	Bobcats may be found in a wide variety of habitats ranging from lowland swamps to partially forested mountainous areas; understory density can vary from open areas such as a stand of pines to more dense areas of growth like a regenerating clearcut area. Den sites include caves/mines, rocky outcrops, hollow trees and logs.	Forest-wide (48 unverified sightings state-wide in 2002). Verified sightings in Lawrence County in 2004 and 2005.	Conversion of habitat to commercial, residential, or agricultural uses (NatureServe, 2004).
Butternut	Typical habitat for butternut is mesic ravine slopes of mixed hardwood stands, creek bottoms, and riverbanks.	All counties within WNF proclamation boundaries.	Butternut canker, loss of canker-resistant reproductive individuals.
Cerulean warbler	Cerulean warblers are described as using riparian forests, lowland forests, bottomland forests, floodplain forests, and forested wetlands (Burhans et al., 2002). Other habitat descriptions include mature deciduous forest, mesic forest, or floodplain with a closed or semi-open canopy (Rosenburg et al., 2000) and predominantly forested landscapes, mature forest, large and tall trees of broad-leaved, deciduous species with an open understory; in wet bottoms, or upland situations including mesic slopes, and mountains from <100 to >3,280 feet elevation (Hamel, 2000). Cerulean warblers have been associated with dry oak-hickory woodlands, mesophytic forests, and wet beech-maple woodlands in Ohio (Peterjohn and Rice, 1991). The species also will use second-growth forest previously cleared for agriculture (Oliarnyk, 1996 in Hamel, 2000). Research of mature forests in southeastern Ohio showed that cerulean warblers were associated with dry, steep areas such as hillsides and ridges (Dettmers and Bart, 1999).	Forest-wide	Loss of mature interior forest habitat (Ewing, 2003a)
Eastern hellbender	Hellbenders are habitat specialists, restricted to clean, cool, relatively-shallow streams with many large rocks scattered on the bottom with substrates of sand and gravel (Bishop, 1943, Hillis and Bellis, 1971, Nickerson and Mays, 1973, Taber et al., 1975, Williams et al., 1981). They are usually found in smaller rivers and large streams, in water about 0.5 to 2 m deep (Petranka, 1998). Lotic systems that have areas of moderate to fast-flowing rapids are ideal for these salamanders (Hulse et al., 2001). Hellbenders depend on highly vascularized skin folds for gas exchange (Ultsch et al., 1990), which limits them to well-oxygenated aquatic systems with cool to cold water and high flow.	Little Muskingum River	Degradation of water quality and aquatic habitat (Johnson, 2003a; Mayasich and Phillips, 2003).

**Table 12. Affected environment for RFSS.**

Species	Habitat	Occurrence	Threats to Viability
Eastern sand darter	The eastern sand darter is often associated with clean sandy bottoms of streams and rivers and sandy shoals in lakes (Smith, 1985, Holm and Mandrak, 1996).	Little Muskingum River, Symmes Creek	Degradation of water quality and aquatic habitat (Wu, 2003a).
Grizzled Skipper	Openings in the forest with populations of the host plant, Canada cinquefoil, such as pipelines, power cuts, clear-cuts, open barrens/glades of all types, and even areas adjacent to woods and roadsides (Parshall, 2002). South facing slopes and ridges are more likely to be dry, and are suitable sites for the skipper.	Athens Unit (Dorr Run area) – only known site in Ohio	Habitat destruction; decline in habitat quality due to over-shading; prescribed fire; insecticides used to treat gypsy moth infected areas (Parshall, 2002).
Henslow's sparrow	In addition to prairie, Henslow's sparrows use secondary grasslands such as hayfields and pastures (Smith and Smith, 1992). It requires grasslands with tall, dense grass; a good layer of litter and dead components; and fairly long intervals between burning and grazing. Reclaimed coalmines, such as those in Ohio and Indiana, provide additional habitat (Bajema et al., 2001; USFWS, 1998).	Reclaimed surface mine areas and some hayfields on the Athens Unit and the Ironton Ranger District	Encroachment of woody vegetation through natural succession in occupied areas; improper maintenance of grassland habitat (Ewing, 2003b).
Juniper sedge	The Lawrence County population was found growing on a ridge top with a closed canopy dominated by oak (ODNR, 2003b) and with underlying clay soils in 1995 (McCartney and Goodwin 2003b). The Athens County population was found growing in an oak-hickory forest surrounding a prairie opening with an underlying clay lens in 2002 (ODNR, 2003b). The WNF populations are limited by shade and presence of alkaline, clay soils (SVE Sedges Panel, 2003). Habitat structure with full sunlight conditions is preferred by <i>C. juniperorum</i> . However, it can tolerate fair amounts of shade as large plants have been observed growing in dense cedar stands (Gardner, pers. comm.), although these represent relic populations (McCartney and Goodwin, 2003b). Unpublished monitoring data suggests this species responds favorably to burns (R. Gardner, pers. comm.).	Isolated locations on Athens Unit and Ironton Ranger District	Direct loss of occupied habitat; decline in habitat suitability resulting from encroachment of woody vegetation through natural succession in occupied areas, fire suppression, or introduction of non-native invasive species (McCartney and Goodwin 2003b).
Lilliput	This species is most commonly found in shallow water in lentic environments in mud, sand or fine gravel. This species is probably a long-term brooder (bradytic). Gravid females have been observed May-July (Roe, 2002a). Potential host fishes include <i>Lepomis cyanellus</i> and <i>L. gulosus</i> ; other centrarchids have been also implicated as hosts (Roe, 2002a).	Symmes Creek (upper area of watershed), Hocking River	Degradation of water quality and aquatic habitat (Roe, 2002a).
Little spectaclecase	The little spectaclecase is typically found in slower currents of shallow sand/mud bottom of small creeks to medium-size rivers.	Symmes Creek, Pine Creek	Degradation of water quality and aquatic habitat (Wu, 2003b).

**Table 12. Affected environment for RFSS.**

Species	Habitat	Occurrence	Threats to Viability
Ohio lamprey	Ohio lampreys spawn in the spring, usually in the first or second week of May, in Ohio. They move upstream into moderate sized tributaries, where they build nests in sand and gravel areas near riffles. After spawning, the adults die (Rice and Michael, 2001).	Little Muskingum River	Degradation of water quality and aquatic habitat (Wu, 2003c).
Pigeon grape	The pigeon grape typically grows in moist alluvial soil (Gleason and Cronquist, 1991); floodplains forests (Oklahoma University, 2003), and in rich, low thickets, bottoms, and banks of streams in semi-shade or no shade (Plants For a Future, 1997-2000). It occurs in moist situations, often in alluvial soils (Burns, 1982).	Pine Creek on the Ironton Ranger District	Direct loss of occupied habitat (felling of host trees); direct loss of individuals through cattle grazing in riparian areas; decline in habitat suitability resulting from introduction of NNIS and fire-related activities (McCartney and Swiezynski, 2003a).
Rock Skullcap	Rock skullcap tends to grow in oak-hickory forests in lowland areas, ridge tops and slopes, and along streams and trails and it has also been found growing in hemlock stands interspersed with hardwoods (McCartney and Goodwin, 2003c). Partially open canopy forests with sparse understory are the preferred habitat for this species. It is known to occur in dry woods, but occasionally is found in moist areas along streams (Spooner, 1983).	One isolated population on Marietta Unit and various woodland locations in Gallia and Lawrence counties on the Ironton Ranger District	Direct loss of occupied habitat; decline in habitat suitability resulting from removal of canopy, prescribed fire, or introduction of non-native invasive species (McCartney and Goodwin, 2003c).
Round hickorynut	This species is typically found in medium to large sized rivers in gravel substrates of moderate current at depths of up to two meters (Gordon and Layzer, 1989). This species is bradyctictic. Females are gravid from September to June. No host fishes have been determined for this species (Roe, 2002b).	Little Muskingum River, Little Scioto River, Pine Creek, Symmes Creek, Hocking River	Degradation of water quality and aquatic habitat (Roe, 2002b).
Salamander mussel	The salamander mussel prefers sand and silt substrates under flat rocks, which is also a preferred habitat for its host, the mudpuppy (Roe, 2002c). It may also be found under other similar objects in streams, or on mud or gravel bars (Cummings and Mayer, 1992; Watters, 1995). It generally inhabits medium to large rivers (Cummings and Mayer, 1992).	Little Muskingum River, Symmes Creek	Degradation of water quality and aquatic habitat (Ewing, 2003c).
Striped Gentian	Striped gentian tends to grow in mesic woodlands, pinelands, dry ravines and roadsides (Andreas, 1984). This gentian has also been associated with dry upland woods (Radford et al., 1968). One population was found in an oak barren/wildlife opening on the WNF.	Ironton Ranger District	Direct loss of occupied habitat; decline in habitat suitability resulting from encroachment of woody vegetation through natural succession in occupied areas, fire suppression, or introduction of non-native invasive species (McCartney and Goodwin, 2003d).

**Table 12. Affected environment for RFSS.**

Species	Habitat	Occurrence	Threats to Viability
Timber rattlesnake	Dens are underground crevices usually found in rocky areas (Brown, 1993). Gravid females bask on rocks in close proximity to the den (Reinert, 1984). Summer habitat is described as "lightly wooded clearings and oak-hickory knolls usually containing boulders, rock slabs, and outcrop fissures."	Limited numbers occur in Adams, Athens, Hocking, Jackson, Pike, Ross, Scioto, and Vinton counties (ODNR, 2003c), Lawrence County (Ewing, 2003d)	Disturbance of den sites; decline of habitat quality around dens and basking areas and within foraging areas; human disturbance (Ewing, 2003d).
Umbrella Magnolia	Umbrella magnolia tends to grow in wet woods and margins of swamps (Gleason and Cronquist, 1991). It prefers rich, moist, well-drained soils, often along creeks, in partial to full-shade (Floridata, 2000). It grows well in acidic soils (Floridata, 2000) and requires an overstory canopy that protects it from full sun (Schneider, 1994).	Mesic shaded ravines and coves on the Athens Unit and Ironton Ranger District	Direct loss of occupied habitat; decline in habitat suitability resulting from removal of canopy, or introduction of non-native invasive species (McCartney and Swiezynski, 2003b).
Western lake chubsucker	This species tends to inhabit lakes and large, low gradient, vegetated streams. This species requires high quality habitat including clean sand, marl and organic debris substrate, submerged aquatic vegetation, and clear waters usually in natural lakes and slow-water sections of large streams.	Symmes Creek (upper area of watershed)	Degradation of water quality and aquatic habitat (Wu, 2003d).
Yellow Fringed Orchid	Yellow fringed orchid prefers sunny, wet situations in acidic, often sandy substrates (Cusick and Burns, 1983). This orchid occurs in pastures, wet fields, seepage areas, roadbanks and ditches. It also inhabits bogs, swamps, marshes, wet sandy barrens, thickets bordering streams or ponds. Southern Ohio populations are known from a mixed hardwood-pine association (Cusick and Burns, 1983)	Two populations on Marietta Unit	Direct loss of occupied habitat; decline in habitat quality resulting from encroachment of woody vegetation through natural succession in occupied areas or introduction of non-native invasive species (McCartney and Swiezynski, 2003c).
Yellow gentian	The historic distribution of yellow gentian possibly followed the distribution of little and big bluestem prairies throughout the Prairie Peninsula, which extended into various locations within the Unglaciaded Plateau of southeastern Ohio. The gentian seems to prefer open, prairie-like habitat patches with calcareous soils. Both populations within Athens County are adjacent to oak-hickory woods, which likely indicate that the prairie patches are remnant ecosystems that are being threatened by reforestation.	Two isolated occurrences on the Athens Unit	Direct loss of occupied habitat; decline in habitat suitability resulting from encroachment of woody vegetation through natural succession in occupied areas, fire suppression, or introduction of non-native invasive species (Larson, 2003).

## Direct, Indirect, and Cumulative Effects

### Aquatic Species

- Eastern hellbender
- Eastern sand darter
- Lilliput
- Little spectaclecase
- Ohio lamprey
- Round hickorynut
- Salamander mussel
- Western lake chubsucker

### Activities with No Impact

Some activities projected to occur during the first decade would have no effect on these species or their suitable habitat. These activities are not ground disturbing and would not pose a threat to increased sedimentation or changes in water quality.

- Crop tree release and grape vine control involving the manual treatment of individual vines and girdling or felling of individual trees
- Development and maintenance of permanent forest openings using mechanical methods (e.g., mowing, chainsaw work)
- Control or eradication on non-native invasive species using mechanical methods (e.g., brushing, mowing) or biological methods
- Restoration and improvement of ponds and lakes (e.g., placing underwater habitat structures)
- Herbicide application (i.e., spot treatment)
- Installation of bat-friendly gates

### Activities with Beneficial Effects

National Forest activities which protect and improve stream habitat and water quality would benefit these species.

The RC Management Area was established to emphasize the retention, restoration, and enhancement of the inherent ecological processes and functions associated with riverine systems. All alternatives allocate NFS lands to the RC Management Area along Symmes Creek, the Hocking

River, and the Little Muskingum River; however, Alternatives C, D, E, E<sub>mod</sub>, and F also allocate lands along the Ohio River for the RC Management Area.

Each alternative incorporates Forest-wide goals (2.1 and 3.1) and objectives (2.1a-c, 3.1a-d) which promote the restoration and improvement of riparian and watershed health. Each alternative also includes numerous Forest-wide standards and guidelines that protect aquatic resources from potential sources of non-point source pollution. Beneficial management activities that are projected to occur during the first decade of implementation of the alternatives include:

- 500 acres of reforestation
- 150 acres of wetland restoration
- 20 miles of stream restoration and improvement
- 10 miles of road decommissioning
- reclamation of 128 orphan or depleted oil and gas wells (70 acres)
- treatment of 180 abandoned mine land features that contribute to acid mine drainage conditions (270 acres)
- closure of 155 open mine features that contribute to acid mine drainage conditions (232 acres)
- 20 acres of surface mine reclamation
- stabilization of 100 acres of disturbed areas
- land acquisition of up to 40,000 acres

### Activities that May Impact Individuals but are Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

Established Forest-wide standards and guidelines minimize the scale of the potential impact to a point where changes to water quality would not likely be detected.

- **Timber harvesting** (i.e., all methods) involves the felling of trees, removal of trees to a landing, and transport off-site. Mechanical reduction of hazardous fuels may involve the dragging of trees and limbs across the ground. The act of dragging trees to the landing could result in some soil disturbance, but filterstrips minimize the potential for sediment introduction into streams (ARR-5 and 6). If any soil was to enter a stream during the removal of trees, it would likely be minimal and undetectable in mainstem habitats, even in those alternatives with higher harvest rates.
- **Site prep for native pine** - when regenerating native pine, the forest floor must be opened to full sunlight and soil must be

exposed so that native pine seeds can germinate and survive. In most cases, soil disturbances from logging or removal of leaf litter during prescribed fire will be enough to allow seeds to contact soil. However, in certain sites, it may be necessary to scarify the soil (site prep) to facilitate the appropriate environment for seed germination. The objective is to create small, scattered patches of exposed soil, but ground cover would remain on 75 percent or more of the treatment area. Filterstrips would minimize the potential for sediment introduction into streams from such activities (ARR-5 and 6).

- The **construction of firelines** using bulldozers for prescribed fire activities could result in soil disturbance, whereas firelines constructed by hand only affect the litter layer. The Forest Service attempts to use existing roads and fire breaks to avoid constructing fire line (FIRE-7). Furthermore, action would be taken to minimize the potential for sediment movement into streams (FIRE-12 and 13). If any soil were to enter the stream as a result of fireline construction, the amount would likely be minimal and undetectable in mainstem habitats.
- Surface erosion in relation to forest **roads/trails** is dependant on soils, road surfacing, road grade, and age of the road, traffic volumes, and the effectiveness and spacing of drainage structures. Proper design and placement of drainage structures are critical to minimizing the amount of surface flow and surface erosion.

Road surfacing, maintenance and grade play a role in surface erosion. Some roads are surfaced with limestone aggregate or native material. When roads are not located, designed, or maintained properly to divert water from streams, aggregate or native material can move into streams during rainfall events. Movement of material into ditch lines and streams can be increased on roads with steeper grades. Grades of over 12% average slope are avoided unless there are stringent erosion control practices installed.

Sediment delivery to streams may be higher during and just after construction, but raw ditch lines and road surfaces with little binder can also remain chronic sources of sediment. High volumes of traffic on roads with aggregate and native material have a greater affect on the integrity of the road and surfacing than it does on asphalt-surfaced roads.

Road-stream or trail-stream crossings can accelerate inputs of sediment. Use of native materials or aggregate that contain sand or materials smaller than ½ inch in size for road surfaces can degrade channels by filling in pools downstream of crossings. This generally occurs where the road slope approaching the channel is

steep. Surface erosion can occur on roads/trails that are located in the floodplain of streams, specifically with roads/trails surfaced with native materials or aggregate. Floodwaters can wash over the road/trail surface and carry material into the stream.

The amount of area that could potentially be disturbed by permanent and temporary roads and from trails varies among the alternatives. The least amount of area would be disturbed in Alternative A (816 acres), whereas Alternative D would have the highest road and trail disturbance (1,578 acres). These roads and trails would be spread out across the landscape, rather than concentrated in one watershed. Forest-wide standards and guidelines are incorporated in all alternatives to reduce the effects of roads on aquatic systems (i.e., filterstrips, stream crossings). The WNF, in all new construction and re-construction, is meeting or exceeding best management practices and professional engineering practices to reduce any effect the road system may have on soil transport (USDA Forest Service, 2003). Based on this, it is likely some sediment will enter the stream systems from roads and trails (i.e., more in Alternative D, less in Alternative A); however the amount is not expected to alter existing water quality or the composition of stream substrates.

- **Oil and gas activities** have the potential to affect water quality as a result of soil disturbance and subsequent sedimentation. Effects are generally short-lived; revegetation of areas disturbed during the construction of the access road and well pad reduces the potential for soil erosion. Established Forest-wide standards and guidelines can mitigate the effects of oil and gas exploration and development (i.e., filterstrips, stream crossings, stabilizing disturbed areas, NSO on steep slopes). Controlled surface use is allowed in riparian areas and floodplains. In these cases, roads, well pads, tank batteries may be allowed in riparian areas or floodplains when placement of such facilities in adjacent upland areas would cause long-term effects to other resources (e.g., TES species, cultural site).

For reserved and outstanding rights oil and gas wells, operators must follow state regulations which include best management practices for protecting aquatic resources.

Brine or oil spills could occur during oil and gas well operations, although they are rare. The operator is required to construct berms around the wells to contain any oil leaks. The brine is required to be removed by tank truck. Forest-wide standards and guidelines require the installation of control valves on all pipelines crossing streams so that supply and flow of oil and gas can be shut down immediately upon detection of a leak.

All alternatives project up to 121 acres could be disturbed from oil and gas well development. Some sediment could enter the stream systems; however the amount is not expected to alter existing water quality or the composition of stream substrates.

- **Surface coal mines** could alter surface and subsurface hydrology, and subsequently degrade existing stream habitat. Approximately 1,250 acres of NFS land could be affected by surface mining in the future. The Forest Service has no control over this projected activity since private mineral rights are involved in these possible activities. However at a minimum, the operator would need to follow state regulations associated with protection of aquatic resources.
- Nutrient enrichment of localized stream reaches could occur as a result of **grazing allotments**. However, surface runoff from such operations would need to flow through filterstrips, which are designed to decrease nutrient loading of streams.
- Construction of **utility corridors**, specifically those which contain buried transmission lines, causes ground disturbance. Forest-wide standards and guidelines for stream crossings for pipelines (ARR-13 to ARR-17), and filterstrips (ARR-5 and 6) would minimize the potential for sediment introduction into streams.
- Up to 400 acres of **land exchange** could occur in the first decade of the plan. Land exchange can be beneficial (e.g., acquiring frontage along occupied habitat). The exchange could be negative if degradation of aquatic or riparian habitat occurred after the tract was in private ownership. But, there is no certainty in how the landowner would manage the land after it is exchanged out of federal ownership.

### Summary of Direct and Indirect Effects

Potential direct and indirect effects on aquatic RFSS from the alternatives would likely be short-lived and small in scale, and could be mitigated with the use of established Forest-wide standards and guidelines. In some cases (i.e., reserved or outstanding oil and gas wells, or surface mining), other state and federal regulations provide added mitigation measures for potential impacts to aquatic systems.

In all cases, the likelihood is very low that the alternatives and the associated management activities projected to occur in the first decade could affect habitat suitability on NFS lands to the point where habitat outcomes would be decreased (Table 13– found at the end of the RFSS section). Forest-wide standards and guidelines are incorporated into all alternatives to minimize the potential for such activities to degrade water quality or aquatic habitat.

The historic and current habitat outcomes for all aquatic species demonstrate that these species were not and are not naturally widespread in distribution across the cumulative effects analysis area (Table 14).

- The Ohio lamprey, hellbender, and western lake chubsucker are limited in distribution to one watershed, or even certain parts of one watershed. Their microhabitat requirements have not been identified in any other watersheds in the planning area, so therefore it is unlikely they could expand their distributions with or without implementing any of the alternatives.
- The little spectaclecase mussel is a species associated with the pre-glacial Teays River drainage, and therefore its historic and current distributions are restricted to the Pine Creek and Symmes Creek watersheds on the Ironton Ranger District.
- Based on their habitat requirements and likely conditions historically, the eastern sand darter, round hickorynut, salamander mussel and lilliput likely had the widest distribution in the planning area historically, compared to other Regional Forester aquatic sensitive species. Today they are located in specific sections of at least two watersheds, but their potential distribution could be limited from other watersheds by water quality and aquatic habitat degradation that has resulted from past mining activities.

It is possible that efforts to restore mining-degraded aquatic systems on the Athens Unit and the Ironton Ranger District could result in the recolonization of currently uninhabitable sections of watersheds on these units by the eastern sand darter, round hickorynut, lilliput, or salamander mussel. Recovery of streams affected by acid mine drainage takes a very long time, therefore any potential for improved habitat outcomes for these species were not expected to occur until the tenth decade of the implementation of the alternatives.

### Cumulative Effects

Water quality and aquatic habitat have improved in certain watersheds in recent years, as evidenced by the mileage of streams that are attaining Ohio EPA's use designations. However, some streams remain impacted by past mining activities (i.e., primarily watersheds on the Athens Unit, but some streams in the Pine Creek watershed on the Ironton Ranger District), and from non-point source pollution (USDA Forest Service, 2001; 2002).

A minimal amount of timber harvesting occurs on private lands, but these activities are generally small in size and are scattered across the watershed rather than being concentrated in one area. This trend is likely to continue in the future. An evaluation of logging best management practices on private lands indicated that best management practices were employed in

at least 80% of all timber harvests and 95% of these best management practices were rated effective at minimizing sedimentation of streams (McClenahan et al., 1999).

Oil and gas well development on private lands may increase from present levels, based on a reasonably foreseeable future development scenario for federal lands. Operators are required to follow state regulations, which include best management practices for controlling erosion and minimizing impacts from potential spills.

Township and county governments are likely to continue maintaining existing roads, depending on funding. Maintenance primarily targets human safety, with environmental conditions secondary in concern. Some of the roads and road-stream crossings under these jurisdictions may continue to contribute to sedimentation or aquatic habitat modifications in the future.

Efforts by the Forest Service, other state and federal agencies, conservation organizations, and private landowners continue to result in improved water quality conditions within the planning area. The added impact of Forest Service activities on NFS lands could have a minimal adverse effect on water quality and sedimentation of habitats, but mitigation measures incorporated into each alternative would reduce the cumulative impact to the point where it is unlikely habitat outcomes would change in the cumulative effects analysis area with implementation of any alternative, in the short-term or in the long-term (Table 14).

### **Determination of Effect**

Though the probability is low, each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability of any aquatic RFSS (Table 15).

## **Black Bear and Bobcat**

### **Activities with No Impact**

Of the management activities projected to occur during the first decade, the following are not likely to impact the black bear and bobcat. Some of these activities remain the same across the alternatives, while others may vary. None pose any threat to loss or conversion of forest habitat used by these species.

- Herbicide application
- Grazing or hayfield allotments (these occur on existing agricultural land)
- Stabilization of disturbed areas

- Control of non-native invasive species with herbicides, biological, or mechanical means
- Restoration of aquatic habitat (lentic)

### Activities with Beneficial Effects

Each alternative incorporates a variety of management prescriptions that can create a diversity of habitats favorable to these species. In addition, some NFS lands are incorporated into the FOF and FOFM MAs and would provide habitat that is relatively secluded from human disturbance. Alternative F has the greatest amount of NFS lands allocated to these MAs, followed by Alternatives E<sub>mod</sub> → C and E → D → A and B.

The following management activities are projected to occur in the first decade and would result in beneficial improvements to forest habitat for the black bear and bobcat. These activities improve habitat quality of feeding and drinking sources, both in the short-term and for the long-term. Some of these activities may vary in amount among the alternatives, while others would not.

- Crop tree release
- Grape vine control
- Site prep for native pine
- Reforestation
- Development and maintenance of permanent forest openings
- Wetland restoration and enhancement
- Waterhole construction
- Fishing pond/lake construction
- Restoration of lotic aquatic habitat
- Road decommissioning
- Reclamation of depleted or orphan wells
- Treatment of AMD
- Surface mine reclamation
- Land acquisition

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability on NFS Lands

There are management activities which may have the potential to disturb individuals for a short period of time and may alter the forest vegetation

structure temporarily, but the activities result in long-term improvements to bobcat and black bear habitat.

- **Timber harvesting** (all kinds) would alter the vegetation structure, providing small (uneven-aged management) to larger areas (even-aged management) of herbaceous-brushy growth that directly provides food (soft/hard mast) for black bears. It may indirectly provide food for bobcat prey (soft/hard mast attracts small mammals).
- Smoke from **prescribed fire** may disturb individuals in the area, but the increased vegetation growth after fire could have the same benefits as timber harvesting.
- **Mechanical treatment of hazardous fuels** reduces the risk of wildfire, but may involve noisy machines for a period of time.
- **Road construction** removes forest habitat, but the edge that is created offers opportunities for enhanced foraging for both species. There would be a low risk of mortality for these species from road-vehicle encounters since the majority of roads projected for construction would be administrative in nature and lightly used for short periods of time.
- Forest habitat is permanently lost as a result of **oil and gas well development**, but the impact Forest-wide would only be 121 acres. The opening could result in increased local diversity and could provide some limited foraging opportunities for the bobcat.
- Forest canopy is lost as a result of **utility corridor construction**. The resulting herbaceous or shrubby habitat could provide enhanced foraging opportunities for both species.
- In most cases **land exchange** is beneficial for these species; however there is always a chance that an unknown den site could be exchanged.

Two management activities could adversely affect these two species are:

- **Trail construction** would not cause a significant loss of habitat in any of the alternatives, but the subsequent use of the trails by Forest visitors could lead to the increased potential for disturbance of individual bobcats and black bears. Hiking, mountain bike and horse trails are likely to occur in different parts of the planning area, but OHV trails would be concentrated in designated areas on the Athens Unit and Ironton Ranger District. The risk for disturbance is highest in these OHV areas because of the concentration of trails.
- Both species may use abandoned mines found in this region, as well as rocky outcrops and hollow trees and logs for den sites. The

likelihood is low, but **closure of open mine portals** for treatment of AMD or to protect human safety could affect individuals using them for den sites. There are hundreds of open mine sites on the WNF to provide other suitable denning areas, as well as natural occurring rock features and downed wood.

### Summary of Direct and Indirect Effects

The black bear and bobcat are wide-ranging species and use a variety of forest habitats (NatureServe, 2004). A few individuals have been observed within the planning area within recent years. Both species could be affected by human disturbance, but they are tolerant to some degree of human interaction because the planning area is comprised of a mixture of inhabited and uninhabited lands. Disturbance generated from projected management activities in each alternative is expected to be minimal, with the exception of recreational trails that could lead to increased use by forest visitors. The use of non-motorized trails is typically low and the level of disturbance of these species would not be expected to differ from current conditions. Motorized trails would be concentrated in certain areas of the WNF. Black bear and bobcat abundance may be lower in these concentration areas, or they could avoid the areas altogether.

About 1% of NFS lands are likely to be converted from forest to non-forest during the first decade (e.g., construction of roads, oil/gas wells, recreation facilities). Forest habitat would be altered as a result of timber harvesting and prescribed fire, but these effects would be short-lived and considered beneficial to these species over time.

The historical habitat outcome was likely greater for the black bear and bobcat than it is currently, but increases in forest cover on NFS lands provides well-distributed and widespread suitable habitat currently. In all cases, the likelihood is very low that the alternatives and the associated management activities projected to occur in the first decade could affect habitat suitability on NFS lands to the point where habitat outcomes would be decreased (Table 13 – found at the end of the RFSS section).

### Cumulative Effects

The Ohio Division of Wildlife considers eastern Ohio to have a large amount of suitable, but unoccupied habitat for these two species, and expects populations of black bear and bobcat to increase (ODNR, 2004).

Loss of forest habitat could occur on private lands within the WNF proclamation boundary in the future, primarily from development of new homes, oil and gas wells, and roads. With the exception of the possible Nelsonville Bypass project, these activities would not be expected to increase significantly from current levels. The Nelsonville Bypass project could result in the loss of up to 768 acres of forested habitat on the Athens

Unit. Activities that could occur on NFS lands in the future, in any alternative, are generally beneficial in nature. The added impact of Forest Service activities on NFS lands in any of the alternatives is not expected to have any cumulative adverse effects on black bear or bobcat habitat, and it is unlikely habitat outcomes in the cumulative effects analysis area would change with implementation of any alternative, in the short-term or in the long-term (Table 14 – found at the end of this RFSS section).

### Determination of Effect

Though the probability is low, each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 15 – found at the end of this RFSS section).

### Cerulean Warbler

The cerulean warbler is identified as a management indicator species for this Forest Plan revision process. An analysis of how the alternatives address the habitat needs of this species is detailed in the Final EIS, *Habitat Indicator 4*.

### Activities with No Impact

There are management activities that may occur in the alternatives which would not result in the loss of mature interior forest habitat, or decline in suitable cerulean warbler habitat. These include:

- Crop tree release
- Grape vine control
- Site prep for native pine
- Control of non-native invasive species (all methods)
- Wetland restoration and enhancement
- Waterhole construction
- Restoration and improvement of aquatic habitats (lentic and lotic)
- Installation of bat-friendly gates
- Treatment of AMD
- Closure of open mine portals and subsidences

### Activities with Beneficial Effects

The amount of mature forest habitat would increase in all alternatives as a result of varying habitat management regimes. This trend in mature forest habitat is explained in detail in the Final EIS - *Habitat Indicator 4*.

- Timber harvesting that creates gaps in the canopy and promotes the growth of large trees (especially oaks) is beneficial to this species in the long-term. Uneven-aged management, Historic Forest prescriptions, and thinning are more likely to result in immediate improvements to habitat suitability than would even-aged management. Timber harvesting using even-aged methods creates early successional forest habitat that is used by cerulean warblers during post-breeding for feeding, and possible predator avoidance (Vitz, 2003).
- Reforestation, reclamation of depleted or orphan wells, surface mine reclamation, stabilization of disturbed areas, and road decommissioning are activities that long-term effects on the restoration of forest cover and potentially suitable cerulean warbler habitat.
- Taxonomic experts involved in the species viability evaluation process consider the cerulean warbler a species associated with oak and hickory species. Prescribed fire can contribute to the regeneration of oaks.
- Reduction of hazardous fuels minimizes risk of wildfire. The smoke and heat of an uncontrolled wildfire during the breeding season could affect individuals.
- Land acquisition and land exchange aids in consolidation of NFS lands, which provides more opportunity for landscape level forest management.

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability on NFS Lands

In each of the alternatives, there are activities that have the potential to negatively impact these RFSS or their habitat. Some of these management activities vary across alternatives, while others do not. Refer to Table 6 for projected outputs for the following activities across alternatives.

- **Even-aged timber harvesting** may cause habitat fragmentation of mature interior forest. Fragmentation could lead to increased nest predation and parasitism. Even-aged management varies by alternative from none in Alternative A to 5,960 acres per decade in Alternative B.
- Rich et al. (1994) inferred that most of interior forest bird species do not perceive narrow forest dividing corridors (e.g., **roads and trails**) as sources of forest fragmentation, but predators could gain better access to interior forest areas. However, edge effects on nesting success appear to be influenced by the degree of habitat fragmentation at the landscape scale rather than the local scale (Chalfoun et al., 2001; Stephens et al., 2003), as evidenced in

studies conducted in the Midwest (Robinson et al., 1995), Northeast (Gale et al., 1997), Pennsylvania (Rodewald, 2002), and within the WNF (Dettmers, 1997). The WNF lies within a heavily forested landscape where 80% of all the lands within the proclamation boundary are covered by forest (Landsat TM, 1994). Potential disturbance from roads and trails vary by alternative, from 816 acres in alternative A to 1,552 acres in Alternative C to 816.5.

- Development of permanent openings, construction of fishing ponds and lakes, construction of **recreational facilities and parking lots**, development of **oil and gas wells**, and **surface mining** would reduce the amount of potentially suitable cerulean warbler habitat currently available and could have the same fragmentation effects as roads and trails. These activities do not vary between alternatives. Development of permanent openings, construction of fishing ponds and lakes, development of oil and gas wells and parking lots would result in small openings in the canopy, which may be favorable to this species.
- **Land exchange** is typically beneficial because it can aid in the consolidation of NFS lands and improve landscape-level management. It is adverse when suitable mature interior forest habitat is proposed for exchange. Such an exchange could not only result in the inability to provide appropriate habitat management for this species, it could result in the fragmentation of the larger interior forest landscape for this area-sensitive species.

### Summary of Direct and Indirect Effects

Over time, each alternative would incorporate habitat management activities that would result in the majority of the WNF being covered by mature forest habitat. The structure and/or composition of the mature forest would vary from having a high likelihood of providing optimal cerulean warbler habitat (e.g., uneven-aged management and Historic Forest prescriptions). The cerulean is generally associated with oak-hickory forests in the planning areas. All alternatives would likely result in a decline of oak-hickory dominated stands, but alternatives that incorporate both even-aged management and Historic Forest prescriptions would maintain more oak-hickory dominated stands on NFS lands.

There are management activities incorporated into the alternatives which could promote habitat fragmentation and the subsequent possibility for increased rates of nest predation or parasitism. However, most of these effects may be moderated by the fact that the WNF is located within a heavily forested landscape. One exception is the possible 1,200 acre surface mine that could occur on the Ironton Ranger District. Habitat on this large tract of forested land could be unsuitable for decades.

The likelihood is very low that Alternatives A, C, D, E, E<sub>mod</sub>, and F and the associated management activities projected to occur in the short-term or long-term could affect habitat suitability on NFS lands to the point where habitat outcomes would be decreased (Table 13). In the short-term, Alternative B would not likely impact habitat suitability on NFS lands to the point where habitat outcomes would be decreased. In the long-term (e.g., decade 10), almost 79% of the Wayne National Forest may be covered by mature forest habitat in Alternative B, but more of the Wayne National Forest is allocated to even-aged management in this alternative. Approximately 6,500 acres would be harvested by even-aged methods each decade. Even-aged management can temporarily fragment mature, contiguous forest until the stand once again reaches a successional stage that is no longer an ecological barrier to forest-interior species (Rosenberg et al., 2003). Even-aged management can create edge habitat that increases local diversity while reducing habitat quality and quantity for certain species, including Neotropical migratory forest-interior songbirds. It is possible habitat outcomes could decrease over time with implementation of Alternative B.

### Cumulative Effects

The WNF is within the core breeding range of the cerulean warbler. Mature interior forest habitat has increased over the last few decades as lands within the WNF proclamation boundary increased in forest cover. Some timber harvesting, oil and gas well development, and road development could occur on other lands in the future. The trend for most of these activities would likely be similar to levels occurring at present. The exception could be the possible Nelsonville Bypass project in the vicinity of the Athens Unit. Up to 768 acres of forested habitat on public and private lands, which currently do not exhibit a high degree of fragmentation, could be converted to non-forest.

Some Forest Service management activities may occur in proximity to the Nelsonville Bypass project area, such as OHV trail relocation, timber harvesting and prescribed fire. The Forest Service can use the project level planning process to consider how timber harvesting, specifically even-aged management, projects might influence short-term and long-term mature interior forest habitat in this part of the Athens Unit.

Potential adverse cumulative effects may occur if the potential 1,200 acre surface mine comes to fruition. The Forest Service has no authority over private mineral rights; however it can use the project level planning process to consider how Forest Service management activities might influence short-term and long-term available habitat in this part of the Ironton Ranger District.

The habitat outcomes for the cumulative effects analysis area (Table 14 - found at the end of this RFSS section) are not likely to differ from those identified for NFS lands (Table 13).

### Determination of Effect

Though the probability is low, each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 15 - found at the end of this RFSS section).

### Henslow's Sparrow

The Henslow's sparrow is identified as a management indicator species for this Forest Plan revision process. An analysis of how the alternatives address the habitat needs of this species is detailed in Final EIS – *Habitat Indicator 6*. This species may occur in larger, isolated hayfields, but this analysis focuses on the GFM management area which was developed to provide quality habitat for this area-sensitive grassland obligate species.

### Activities with No Impact

There are management activities that may occur in the alternatives which are not associated with grassland habitat quality or its maintenance. These include:

- Timber harvesting (all kinds)
- Crop tree release
- Site prep for native pine
- Grape vine control
- Restoration or improvement of aquatic habitats (lentic and lotic)
- Installation of bat-friendly gates
- OHV trail construction (not permitted in the GFM MA)
- Treatment of AMD
- Closure of open mine portals or subsidences.

### Activities with Beneficial Effects

The GFM management area was developed to accommodate the needs of obligate grassland species using reclaimed mine lands on the WNF. Alternatives C, D, E, E<sub>mod</sub>, and F each allocate 5,334 acres of NFS lands to the GFM management area, while Alternatives A and B do not allocate any NFS lands to this management area.

Other management activities which could occur in the alternatives include:

- Mowing, prescribed fire and light grazing may be used to stop encroachment of woody vegetation and to maintain appropriate vegetation structure (e.g., amounts of thatch) and composition (e.g., native legumes and grasses vs. non-native plant species). These activities can affect the structure of the herbaceous vegetation and make it unsuitable for a season, but they improve vegetation structure over the long-term. Each alternative incorporates management area guidance to conduct these activities on a rotational basis to ensure the majority of the grasslands are in a suitable condition for species that use such habitat.
- Control of non-native invasive plant species may benefit the Henslow's sparrow, especially if native species can provide the grassland structure preferred by this species. Occupied reclaimed mine lands are primarily composed of 3-4 non-native plant species. The taxonomic experts involved in the species viability evaluation process noted that the Henslow's sparrow uses these areas, but once legumes are introduced to the mix of non-natives, numbers of Henslow's sparrows increase (Ewing, 2003b).
- Surface mining can cause adverse effects to many species, but the reclamation process can result in Henslow's sparrow habitat. The habitat created is not as desirable as that found in native prairies and grasslands. Surface mining and reclamation can result in compacted and acidic soils which could affect the grassland vegetation diversity.
- Reclamation of depleted or orphan wells, stabilization of disturbed areas, and road decommissioning could result in revegetation of lands, and reduced habitat fragmentation.
- Reduction of hazardous fuels in nearby forested areas could reduce the risk of uncontrolled wildfire spreading to grassland habitat. Wildfire could adversely affect this species if it occurred during the breeding season or if large acreages of habitat were burned.
- Land acquisition and land exchange aids in consolidation of NFS lands, which provides more opportunity for landscape level forest management.

### **Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability on NFS Lands**

In each of the alternatives, there are activities that have the potential to negatively impact these RFSS or their habitat. Some of these management activities vary across alternatives, while others do not. Refer to Table 6 for projected outputs for the following activities across alternatives.

- Habitat suitability of existing suitable habitat would be lost with the reforestation of existing reclaimed mine lands.

- In some parts of its range the Henslow's sparrow will be found in damp, low lying areas. However, waterhole and fishing pond/lake construction or wetland restoration could increase habitat edge and indirectly increase predator abundance. The probability of constructing or restoring such features in these grassland areas is low, but could occur.
- Construction of roads and non-motorized trails would reduce grassland habitat and could provide easy travel ways for predators. These reclaimed areas have a network of roads and trails from the mining and reclamation process, therefore the construction of new roads and trails would likely be minimal.
- Construction of oil and gas wells would reduce grassland habitat, but by a minor amount. For example, each well site usually encompasses an area up to two acres in size.
- Maintenance regimes of utility corridors in suitable habitat in the GFM MA could result in adverse effects if mowing is conducted before late-summer (i.e., when the Henslow's sparrow completes the nesting season). Infrequent mowing of utility corridors could result in encroachment of woody vegetation and the subsequent decline in habitat quality.
- Land exchange is typically beneficial because it can aid in the consolidation of NFS lands and improve landscape management. It is adverse when suitable grassland habitat is proposed for exchange. Such an exchange could not only result in the inability to provide appropriate habitat management for this species, it could result in the fragmentation of the larger grassland landscape for this area-sensitive species.

### **Activities with a High Risk of Loss of Viability on NFS Lands, but Not Likely to Cause a Trend toward Federal Listing**

The GFM management area was developed to accommodate the needs of obligate grassland species using reclaimed mine lands on the WNF. Alternatives A and B do not allocate any NFS lands to this management area.

In Alternative A, the 973 acres of open grassy habitat currently existing in the Brady Run, Shawnee and Peabody areas would be located within the DCF and DCFO management areas. In Alternative B, these 973 acres would occur in the FSM and DCFO management areas. These open, grassy acres may or may not be maintained in Alternatives A or B because habitat composition objectives for these management areas call for only so much herbaceous or herbaceous-shrub habitat to be maintained (3-6 percent in FSM; 2-4% in DCF and DCFO). In other words, the amount of existing open, grassy habitat could decline or become non-existent in

Alternatives A and B, depending on how much herbaceous or herbaceous-shrubland habitat is needed elsewhere in these management areas for other species. If management is not emphasized on these grasslands, it is possible that these extensive grasslands would decline in habitat quality and become unsuitable for the Henslow's sparrow.

### Summary of Direct and Indirect Effects

As indicated by the historical outcome for the Henslow's sparrow in Table 13 (found at the end of this RFSS section), grassland habitat did not exist in southeastern Ohio in historic times. Surface mining and reclamation laws enacted after 1977 resulted in the creation of large tracts of grassland habitat. The current habitat outcome reflects the limited distribution of grassland habitat on the WNF. There are three larger complexes of reclaimed mine lands on the Wayne, plus some additional smaller, isolated reclaimed areas or fields under special use permit for hay production.

Alternatives C, D, E, E<sub>mod</sub>, and F allocate NFS lands to the GFM MA, which would be spatially located around the three larger complexes of reclaimed mine land on the WNF (Brady Run, Peabody, and Shawnee areas). As pointed out above, there are activities which could directly or indirectly affect suitable habitat or individuals, but the effects are likely to be minimal. Management area direction and guidance incorporated into Alternatives C, D, E, E<sub>mod</sub>, and F could result in improved habitat quality for the species. The likelihood is very low that Alternatives C, D, E, E<sub>mod</sub>, and F and the associated management activities projected to occur in short-term or long-term could affect habitat suitability on NFS lands to the point where habitat outcomes would be decreased (Table 13).

Table 13 highlights the fact that the GFM MA is not incorporated into Alternatives A and B, therefore potential exists for existing grassland habitat to disappear over time. In this scenario, Henslow's sparrow numbers on NFS lands would decline, and individuals would be relegated to smaller hayfields. Because it is an area-sensitive species, these hayfields would provide marginal habitat at best. Individuals may occur on these marginal NFS lands, but nesting success may be compromised by increased predators or hayfield mowing done earlier than late-August.

### Cumulative Effects

The Henslow's sparrow moved out of western and northwestern Ohio as the prairie and grassland habitats disappeared and reclaimed coal mine lands increased in southeastern Ohio, generally in proximity to the Athens Unit and Ironton Ranger District. Within the WNF proclamation boundary, the Crown City Wildlife Management Area offers suitable habitat for this species. The Nature Conservancy owns a large tract of reclaimed coal mine land on the Ironton Ranger District, adjacent to the Brady Run area. The Nature Conservancy has shown interest in selling

this property to the Forest Service. In the event this was to happen, the majority of this tract of land would fall within the GFM management area in Alternatives C, D, E, E<sub>mod</sub>, and F. Other smaller patches or groups of reclaimed coal mine lands exist on the Athens Unit. Management of these areas is under the discretion of the landowner; in some cases landowners reforest these reclaimed lands or sometimes leave them in a grassy or shrubby condition.

The cumulative effects of NFS activities in the alternatives may vary. In Alternatives A and B, there would be no designated GFM MA and existing grassland habitat could decline or disappear over time on NFS lands. This could result in cumulative effects on the abundance and distribution of this species in the planning area since the Crown City Wildlife Management Area is the only property with extensive grassland habitat managed for the Henslow's sparrow. Management of other lands with existing grassland habitat may or may not be managed for this species out into the future. The habitat outcomes in the cumulative effects analysis area may decline with implementation of Alternatives A and B in the long-term (Table 14, found at the end of this RFSS section). The added impact of Forest Service activities on NFS lands in Alternatives C, D, E, E<sub>mod</sub>, and F is not expected to have any cumulative adverse effects on the Henslow's sparrow, and it is unlikely habitat outcomes in the cumulative effects analysis area would change with implementation of these alternatives, in the short-term or in the long-term (Table 14).

### Determination of Effect

Alternatives C through F may impact individuals, but would not likely cause a trend toward federal listing or loss of viability. Alternatives A and B may cause the loss of viability of the Henslow's sparrow on NFS lands, but Alternatives A and B are not likely to cause a trend toward federal listing (Table 15, found at the end of this RFSS section).

## Timber Rattlesnake

### Activities with No Impact

There are management activities projected to occur during the first decade which would not be expected to affect potentially suitable den, basking or foraging habitat. These include the following:

- Maintenance of existing permanent openings with mechanical methods
- Grape vine control
- Crop tree release
- Site prep for native pine

- Control of non-native invasive species with herbicide, mechanical or biological means
- Wetland restoration and enhancement
- Waterhole construction
- Fishing pond/lake construction
- Restoration of aquatic habitat (lotic or lentic)
- Installation of bat-friendly gates
- Grazing or hayfield allotments
- Treatment of AMD
- Closure of open mine portals or subsidences
- Land acquisition

### Activities with Beneficial Effects

Based on information from various studies (Ewing, 2003d), this species is likely to occur on drier sites (ridges and southwest facing slopes) where the understory vegetation is not as dense as mesic sites. It has been found in areas where canopy cover varied from 25%-60%. Uneven-aged management, Historic Forest prescriptions, thinning, shelterwood, clearcut with reserves and two-age harvesting may improve foraging and basking habitat by reducing dense canopy cover. Reforestation would restore habitat, but the benefits would be more evident in the long-term.

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

Certain management activities are projected to occur that could adversely impact individuals.

- Studies have shown that the timber rattlesnake will use forest areas with partial canopy cover, especially where basking sites occur. The **clearcut method** would likely reduce the canopy cover to less than preferable levels. However, this is a short-term effect because the forest stand would mature over time and become suitable once again. The clearcut method may be indirectly beneficial in that prey sources could increase for a period of time. The ODNR (2004) reports that this species uses regenerating clearcuts within mature forest areas for feeding. The amount of clearcutting would likely be minimal since two-age, shelterwood and clearcut with reserves methods are more likely to be favored when implementing even-aged management methods. Each alternative incorporates established Forest-wide standards that address vegetation management around rock outcrops, which are considered potential

habitat for this species (TES-33 and 34). Several closed-canopy plant and animal species occur in association with rock features, therefore vegetation management is not allowed within 50 feet of these areas so as to maintain microclimate conditions. However, vegetation management may be allowed around rock habitats that are found to be occupied by the timber rattlesnake (TES-33 and TES-34). Management of the canopy could enhance habitat conditions.

- No information was found in the literature about the effects of **prescribed fire** on timber rattlesnakes; however, ground fires have the potential to harm individuals that do not move away from the area. The majority of prescribed fires would occur prior to leaf-on (mid-April) or after leaf-off (late-October). The rattlesnake generally emerges from the den in mid-April and re-enters the den in September. A prescribed fire that occurs after April 15th could adversely affect the species if conducted in suitable habitat. Prescribed fire may result in enhanced growth of the understory, which could be beneficial for prey species. The amount of prescribed fire does not vary across the alternatives.
- The risk for human-snake interaction and harm to individual snakes is increased where **roads or trails** occur in suitable habitat. Road and trail construction varies across alternatives.
- In most cases **land exchange** is beneficial; however, there is always a chance that an unknown den site could be exchanged.
- **Oil and gas well development, utility corridor construction, and construction of recreation facilities** would result in the permanent loss of forest habitat. These activities are not likely to differ across the alternatives. Loss of potentially suitable habitat would be minimal (less than 225 acres across the entire WNF).

### Summary of Direct and Indirect Effects

The historical habitat outcome reflects that the distribution of habitat for this species was not widespread. Iron ore and coal mining that occurred since the early 1800s likely eliminated habitat for this species over time. Therefore the current habitat outcome is reduced from historical levels. The Ohio Division of Wildlife reports there may be only three remaining viable reproducing populations left in Ohio, all outside the boundaries of the WNF in Scioto and Vinton counties (ODNR, 2003c). The timber rattlesnake is considered rare in the WNF proclamation boundary. Reliable observations of the species are limited in number, possibly because the animal is secretive. Within the past 5 years, Ohio Division of Wildlife officers or snake experts have confirmed four timber rattlesnake sightings. Two were individual snakes that had been killed on roads by vehicles. These occurred in the Dorr Run area of the Athens Unit and the Hoadley

area of the Ironton Ranger District. The third confirmed sighting was of a snake killed in a logging incident, west of Nelsonville (ODOT, 2002). The fourth was a rattlesnake that was run over on an OHV trail in 2005. Other sightings have been noted in the Dorr Run area and on the Ironton Ranger District (ODOT, 2002; Martin and Fox, unpublished). No den sites have been located on NFS lands.

Human disturbance of denning sites or of individuals is one of the primary threats to this species. The Forest Service cooperates with the Ohio Division of Wildlife in providing education about the timber rattlesnake to local residents and Forest visitors.

The permanent loss of forest habitat occurring from projected management activities in the alternatives would be minimal (i.e., about 1% of the WNF), and alteration of forest habitat that could occur would be short-term in nature. In all cases, the likelihood is very low that the alternatives and the associated management activities projected to occur in the first decade could affect habitat suitability on NFS lands to the point where habitat outcomes would be decreased (Table 13, found at the end of this RFSS section). Forest-wide standards and guidelines are incorporated into all alternatives to minimize the potential for such activities to adversely affect potentially suitable denning sites, basking areas, and foraging areas.

### Cumulative Effects

The historical habitat outcome reflects that the distribution of habitat for this species was not likely widespread in the cumulative effects analysis area, but may have been higher than the current habitat outcome. Iron ore and coal mining that occurred since the early 1800s, as well as road construction along the Ohio River bluffs, likely eliminated habitat for this species over time.

This species has close ties to its natal den, and taxonomic experts believe a viable population includes about 40 individuals of both sexes and various ages (Ewing, 2003d). Sightings of this species in the cumulative effects analysis area have included only individuals, although searches for den sites have been conducted. This species is secretive in nature, and could be affected by ground disturbing activities on other lands. Some timber harvesting, oil and gas well development, and road development could occur on these other lands in the future. The trend for most of these activities would likely be similar to levels occurring at present. The exception could be the possible Nelsonville Bypass project in the vicinity of the Athens Unit. This project could occur in an area where timber rattlesnake sightings have been concentrated. Surveys of the area, to date, have not identified den sites. However, capture and radio-tracking studies have not been performed in this area to rule out the lack of denning sites.

Mitigation measures have been designed into the Nelsonville Bypass project to minimize potential impacts to this species.

Some Forest Service management activities may occur in proximity to the Nelsonville Bypass project area, such as OHV trail relocation, timber harvesting and prescribed fire. However, protective measures integrated into each alternative, in addition to site-specific analysis at the project level, would reduce any cumulative impacts. The added impact of Forest Service activities on NFS lands in Alternatives A-F is not expected to have any cumulative adverse effects on the timber rattlesnake, and it is unlikely habitat outcomes in the cumulative effects analysis area would change with implementation of these alternatives, in the short-term or in the long-term (Table 14, found at the end of this RFSS section).

### Determination of Effect

Though the probability is low, each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 15, found at the end of this RFSS section).

## Grizzled Skipper

### Activities with No Impact

There are activities projected to occur in each of the alternatives that would not result in habitat destruction or the decline of suitable habitat quality, therefore these activities would not impact the grizzled skipper.

- Crop tree release
- Site prep for native pine
- Grape vine control
- Reforestation of disturbed areas and riparian areas
- Herbicide application to treat stump sprouting or non-native invasive species
- Wetland restoration and enhancement
- Restoration or improvement of aquatic habitat (lentic and lotic)
- Installation of bat-friendly gates
- Reclamation or orphan or depleted wells
- Road decommissioning
- Grazing or hayfield allotments
- Reclamation of abandoned mine lands

### Activities with Beneficial Effects

Each alternative incorporates management activities that could result in more favorable habitat for the grizzled skipper or its host plant (Canada cinquefoil). Some of these activities may vary across alternatives.

- Timber harvesting (all kinds) can open up the forest to provide more favorable light conditions.
- Development and maintenance of forest openings
- Control of non-native plant species with mechanical or biological methods
- Utility corridor development and maintenance (if maintenance was appropriate for cinquefoil management)
- Stabilization of disturbed areas
- Reduction of hazardous fuels using mechanical methods can open up the forest floor to more favorable growing conditions for the cinquefoil host species.
- Land acquisition.

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

The one known grizzled skipper site in Ohio occurs on privately-owned land adjacent to NFS lands. Measures incorporated within each of the alternatives would protect this known occupied site from management activities on adjacent NFS lands (TES-32).

The following management activities could impact unknown populations on NFS lands.

- **Prescribed fire** could impact an unknown grizzled skipper population, but may aid in the restoration of areas that are potential reintroduction sites. Each alternative incorporates the same amount of prescribed fire.
- Potentially suitable habitat could be permanently lost or altered by construction of **waterholes, fishing ponds/lakes, trails, roads, recreation facilities and parking lots, surface mines, and oil and gas well development**. Site-specific review of projects would occur at the project level analysis, and at that time biologists would identify potentially suitable habitat and recommend option to avoid impacting it.
- In most cases **land exchange** is beneficial; however, there is always a chance that an unknown den site could be exchanged.

Insecticides used to treat gypsy moth invasions are implicated as one of the possible causes for the decline of this species. No gypsy moth insecticide treatments are projected to occur in any alternative. However, if the need to treat an infestation arose, a site-specific analysis would be conducted and mitigation measures identified to protect known occupied grizzled skipper sites.

### Summary of Direct and Indirect Effects

Although the oak forests of southeastern Ohio were considered to be more open in historic times, a characteristic possibly beneficial for the species, the historical and current habitat outcomes are probably similar. The Canada cinquefoil (its host plant) is widely distributed, but taxonomic experts speculate that certain soil types may also play a role in habitat suitability for the grizzled skipper (L. Andrews, pers. comm.). Therefore, historical distributions of suitable habitat may have been more limited.

The alternatives would not impact the species at its known occupied site. But, there are activities incorporated into each alternative that may impact unknown populations on NFS lands. However, these impacts could be reduced in intensity at the project level as site-specific analysis occurs. In all cases, the likelihood is very low that the alternatives and the associated management activities projected to occur in the first decade could affect habitat suitability on NFS lands to the point where habitat outcomes would be decreased (Table 13, found at the end of this RFSS section).

### Cumulative Effects

The historical habitat outcome in the cumulative effects analysis area was not likely different than that on NFS lands, nor is it likely to be different from the current habitat outcome. The increase in forest cover has been implicated as one possible cause for this species decline.

Loss of habitat on other lands within the proclamation boundary could result from the construction of homesites within forested areas, development of oil and gas wells, and roads (i.e., mostly access roads to homes and well sites). These activities may slightly increase from present levels, but would not be concentrated in any one area. The exception to this is the Nelsonville Bypass project. The only known site for the grizzled skipper is located within the bypass project area, however mitigation measures have been incorporated to reduce impacts to this species and its habitat. Potentially suitable habitat is available to the grizzled skipper on adjacent NFS lands, but habitat quality could decline in the immediate future without some active timber harvesting to increase light levels.

Some Forest Service management activities may occur in proximity to the Nelsonville Bypass project area, such as OHV trail relocation, timber harvesting and prescribed fire. However, protective measures integrated

into each alternative, in addition to site-specific analysis at the project level, would reduce any cumulative impacts. The added impact of Forest Service activities on NFS lands in Alternatives A-F is not expected to have any cumulative adverse effects on the grizzled skipper, and it is unlikely habitat outcomes in the cumulative effects analysis area would change with implementation of these alternatives, in the short-term or in the long-term (Table 14, found at the end of this RFSS section).

### Determination of Effect

Though the probability is low, each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 15, found at the end of this RFSS section).

### Mature, Closed-canopy Forest Plants -- Umbrella Magnolia and Rock Skullcap

Both of these species have been identified as species potentially threatened by increased exposure to sunlight. The major threat to umbrella magnolia has been identified as opening of canopy by logging operations (Spooner and Schneider, 1994). Threats to rock skullcap are unknown, but may include exposure to sunlight after logging (Spooner, 1983). Taxonomy experts involved in the species viability evaluation process (McCartney and Goodwin, 2003c) identified preferred rock skullcap habitat as closed canopy. However, 2004 field discoveries of new skullcap populations on the WNF were found in ice damaged stands of varying light intensities, and along old logging roads; all populations were healthy and reproductive. One taxonomic expert also found rock skullcap in more exposed habitats in 2004 and believes the species may be able to endure more exposed light habitats than originally thought (R. Gardner, pers. comm.). While these recent observations could indicate that light exposure may not have as detrimental impact as originally believed, rock skullcap will be included in this closed-canopy plants section until further information on this species' light requirements are known. Non-native invasives also pose a threat to both of these species and their habitat.

### Activities with No Impact

Of the management activities projected to occur during the first decade, the following are not likely to have impacts since the activities do not occur in areas with suitable habitat for these species.

- Wetland restoration and enhancement
- Timber stand improvement activities (crop tree release and grape vine control) in young stands
- Site prep for native pine (habitat not suitable for umbrella magnolia)

- Maintenance of wildlife openings
- Restoration of lakes and ponds
- Grazing permits

### Activities with Beneficial Effects

Certain management activities that may occur within the first decade could benefit species habitat. These activities improve habitat by improving or increasing forested conditions, controlling NNIS that degrade habitat and consolidating federal management of lands. Management areas that do not allow vegetation management (e.g. FOF, TRL) would benefit these species by promoting growth of mature, shaded forests. SA, RNA and CA areas are also hands-off management in some cases, though vegetation management can occur (e.g. prescribed burning) if determined necessary for rare species within these areas.

- Land acquisition
- Surface mine reclamation and stabilization of disturbed areas
- Restoration and improvement of stream habitat
- Reforestation
- Control of NNIS (mechanical and biological methods)

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

In each of the alternatives, there are activities that have the potential to negatively impact these RFSS or their habitat. Some of these management activities vary across alternatives, while others do not. Refer to Table 6 for projected outputs for the following activities across alternatives.

- **Construction of roads, trails, recreation facilities and parking lots** have the potential to affect suitable habitat. Construction activities, involving the use of heavy machinery, often result in vegetation removal, soil compaction, erosion, and increased susceptibility for NNIS invasion. Such developments could result in the loss of suitable habitat. During construction and use, unsurfaced roads and trails have the potential to cause soil erosion and spread NNIS. However, each alternative has Forest-wide standards and guidelines to reduce erosion and sedimentation impacts and to provide normal drainage control on designated trails (Goal 2.1 and associated standards and guidelines, REC-29 and Objective 17.3a). Each alternative includes a Forest-wide goal (7.2) to control NNIS populations. Forest-wide standards and guidelines outline combating NNIS establishment and spread through project level prevention and treatment efforts (FH-1),

equipment cleaning (FH-8), and use of native plants for restoration (FH-10 and FH-11).

- **Uneven-aged** methods can open the canopy and increase light penetration into forested stands. An established Forest-wide standard (TES-8) directs the Forest Service to maintain at least 60% canopy cover in all hardwood stands treated with uneven-aged timber harvest methods. Opening the canopy during logging could impact both of these shade loving species. Forest-wide standards and guidelines require filterstrips along riparian systems, which would protect umbrella magnolia habitat in these areas. Increased light penetration has been suggested as a potential threat to rock skullcap, but it is not known for sure (see above discussion). Since 60% of the canopy cover is retained during this management activity, the impacts on skullcap and its habitat may be minimal.
- **Even-aged management** involves harvests from 2-30 acres in size. These methods could impact habitat of these species by increasing light levels to the understory. Known populations of these species would be protected (Goal 5.2, TES-32). Impacts on potential habitat are short-term since stands will regenerate over time, as will suitable habitat for these species.
- Both uneven- and even-aged vegetation management could have impacts on habitat through: vegetation removal, construction of roads, skid trails and log landings, alterations in light environments and increasing the likelihood for NNIS invasion. All skid trails and log landings are temporary in stature and are rehabilitated after use to control any erosion or NNIS concerns. Forest-wide standards and guidelines exist in all alternatives to address non-native invasive species establishment and spread during construction activities.
- Site prep for native pine could disturb habitat for rock skullcap, but the disturbance would be small in scope and a site-level field review would identify suitable habitat to avoid.
- **Prescribed fire** creates a more open understory and may create snags by killing overstory trees; however the largest impact would be the mortality of seedlings and saplings of shade tolerant tree species. Fire could impact seedlings and saplings of umbrella magnolia, however burning in its habitat is likely to be mosaic since preferred habitat is mesic areas, and therefore the likelihood of young magnolias being impacted is reduced. Creation of snags could increase light penetration, however the killing of overstory trees would be similar to natural tree mortality and should not have significant effects on light environments for either species. Direct effects of fire on rock skullcap are unknown. However, since

prescribed burning primarily occurs in fall and early spring, the possibility of direct impacts to rock skullcap plants is low. Decreasing of understory woody vegetation could benefit skullcap by reducing competition, while increased light penetration through sapling and seedling mortality could negatively impact the species.

- The **construction of firelines** using bulldozers for prescribed fire activities could result in soil disturbance, soil compaction, removal of vegetation and increased susceptibility for invasion by NNIS, whereas firelines constructed by hand would only affect the litter layer. The Forest Service attempts to use existing roads and fire breaks to avoid constructing fire line (FIRE-7) and minimize erosion (FIRE-12 and FIRE-13).
- **Mechanical reduction of hazardous fuels** could impact these species or their habitat. Reduction activities involve cutting and possible removal of woody materials on the ground. It is possible that a leaning or standing tree could be felled, either as part of the fuels reduction work or to protect workers from a potential hazard tree. Increased light penetration due to tree removal could occur. However, areas targeted for this treatment would often be areas that have experienced natural disasters (e.g. ice storms) and likely have already altered light regimes, making light penetration from hazard fuel removal minimal in comparison to changes already incurred. Dragging and movement of woody fuels may disturb soils, but would be mitigated by Forest-wide standards and guidelines in all alternatives. Construction of roads, trails and landings during hazard fuel treatment projects would have similar impacts as those discussed for roads and trails.
- **Surface coal mines** could alter and remove surface soils and vegetation, and subsequently degrade existing habitat. Approximately 1,250 acres of NFS land could be affected by surface mining in the future. The Forest Service has no control over this projected activity since private mineral rights are involved. However, the operator would need to follow state regulations for reclamation of the surface.
- **Oil and gas activities** have the potential to affect habitat in a similar manner as roads and trails. Effects from road and well pad construction are long-term since they remain in use until mineral resources are depleted. Once depleted the operators are required to restore the areas they disturbed (Obj. 10.2a and b, MIN-2, MIN-8). Established Forest-wide standards and guidelines incorporated in all alternatives mitigate the effects of oil and gas exploration and development (i.e., filterstrips, stream crossings, stabilizing disturbed areas, NNIS prevention and analysis, NSO (MIN-9) on steep slopes and riparian areas). For reserved and outstanding

rights oil and gas wells, operators must follow state regulations which include best management practices for protecting natural resources. All alternatives project up to 121 acres (0.0005% of the Forest) could be disturbed from oil and gas well development over the next decade. Some potential habitat could be lost; however the amount is not expected to significantly affect the overall amount of habitat or the viability of these RFSS species.

- **Brine or oil spills** could occur during oil and gas well operations, although they are rare. The operator is required to construct berms around the wells to contain any oil leaks. The brine is required to be removed by tank truck. Each alternative has Forest-wide standards and guidelines that require the installation of control valves on all pipelines crossing streams so that supply and flow of oil and gas can be shut down immediately upon detection of a leak until repairs and cleanup have occurred (MIN-3, 4, 5).
- **Road decommissioning and reclamation of orphan gas and oil wells** activities may have initial impacts similar to road construction and oil and gas construction, but over the long-term closures may increase the acres of suitable habitat and benefit the environment by preventing future impacts.
- **Construction of utility corridors**, specifically buried transmission lines, cause ground disturbance, soil compaction, alterations of vegetation structure, and make areas more susceptible to invasion by non-native invasive species. Other **special use permits**, such as road access and grazing permits, have similar effects on local soils and vegetation. Overall, these activities are projected to impact 50 acres over the next decade, or 0.0002% of the Forest. The overall small amount of area impacted, in combination with the probability of affecting potential habitat is unlikely to impact population viabilities for these species.
- **Herbicides** use will primarily involve selective, spot spraying to avoid affecting non-target vegetation. Each alternative contains Forest-wide standards and guidelines that emphasize proper use of herbicides to protect non-target vegetation (FH 17, 18, 19, 20, 21). Although selective vegetation management is preferred for utility or other rights-of-way or easements, use of herbicides may occur in areas with written Forest Supervisor approval. Aerial spraying of herbicides is sometimes conducted on utility corridors that have outstanding rights. Special use permits for utility corridors would contain provisions for all herbicide use and require permittees to abide by Forest-wide standards and guidelines. By following standards and guidelines for herbicide usage, the potential for herbicides to drift onto suitable habitat, or an individual, would be low.

- **Creation of permanent wildlife openings, construction of small lakes, ponds and waterholes** all have the potential to affect species and their habitat. However, creation of openings primarily is from the designation of existing open land on acquired properties (WLF-4, 5, 6). Impounding a stream to create lakes or ponds is unlikely, since most ponds constructed, in the past, were a result of reclamation efforts. Waterhole construction would be built in forested areas already disturbed by other project activities (e.g. timber harvests), thus tree removal would not occur primarily for waterhole construction. While these activities could potentially impact forested habitat, it is unlikely that tree removal or impoundments would occur for their creation.
- Watershed improvements involve **treatment of AMD and closure of subsidences and open portals** that present safety concerns and/or contribute to AMD. These activities would involve vegetation removal, soil disturbance and compaction by machinery, and increased susceptibility to NNIS invasion. Approximately 502 acres are projected for treatment, or 0.002% of the Forest. Improvement activities occur within areas heavily impacted by underground and surface mining activities which often offer low quality habitat. The likelihood that these species would occur initially in these highly disturbed areas are low, however after improvement activities, these areas could provide improved habitat conditions for establishment. NNIS impacts will be lessened by reseeding guidelines (WSH-6, 7) and management (Goal 7.2 and associated standards and guidelines).
- **Installation of bat-friendly gates** involves the removal of a small amount of soil around mine openings in order to sink gates below ground surface. Removal of soil in these areas could directly impact any plants or habitat present. Soils removed during installation are returned afterwards to pre-installation conditions to avoid changing airflows and micro-environments, thus retaining any seedbanks that may exist for the species. Many of the areas impacted by installation are devoid of vegetation due to any combination of dense shade, acid mine drainage, or soil compaction. The small amount of soil disturbance coupled with the low probability of potential habitat occurring in these areas makes the likelihood of impact on these species low.
- Up to 400 acres of **land exchange** could occur in the first decade of the plan. Land exchange can be beneficial (e.g., acquiring potential habitat, or actual populations of RFSS), but could be negative if such habitat was exchanged into private ownership. Each exchange is reviewed by Forest Service biologists to identify any potential impacts to RFSS.

### Summary of Direct and Indirect Effects

As indicated by the historical outcome for these species, closed-canopy forest existed in southeastern, pre-settlement Ohio (Table 13). The combined deforesting activities from timber harvesting, oil and gas production and surface mining in the 1800's and early 1900's reduced these habitats significantly. Since the Depression, forest cover has increased across Ohio from about 15% in 1940 to almost 30% today (Ohio Division of Forestry 2004). Almost 80% of the lands (public and private) within the WNF proclamation boundary are forested (Ohio Land Use Cover, based on Landsat TM 1994). Riparian corridors within the proclamation boundary are primarily forested (i.e., 72.5%) (National Landcover Database, 1992).

These reforestation activities have improved habitat potential on the WNF for umbrella magnolia and rock skullcap in the last half-century. The current habitat outcome for umbrella magnolia remains lower than the historic due to the isolation of populations during the industrial boom, and their restricted ability to disperse and colonize current potential habitat. The rock skullcap, on the other hand, was a species identified by taxonomic experts during the species viability evaluation process to have the ability to disperse and increase if suitable habitat is available. While the alternatives are not likely to change habitat outcomes for the umbrella magnolia; rock skullcap habitat outcomes could be either positively or negatively impacted by the tenth decade of Forest Plan implementation (Table 13). These impacts are driven by the acreages projected for timber harvest in the alternatives.

### Cumulative Effects

Loss of rock skullcap habitat could occur on private lands within the WNF proclamation boundary in the future, primarily from timber harvesting, construction of homes and roads and oil and gas well activities. Likewise the potential surface mining project of 1,250 acres could impact this species. The potential cumulative effect of NFS activities on rock skullcap vary by alternative (Table 14). These impacts mirror those of direct and indirect effects for the alternatives, since activities on non-federal lands are expected to have similar impacts on the species.

For umbrella magnolia, any potential adverse cumulative effects that may occur on NFS lands as a result of implementing any of the alternatives would be mitigated through the implementation of the protective Forest-wide standards and guidelines that are incorporated into all alternatives, especially those protecting riparian habitats (Table 14). Activities that occur on non-federal lands within the WNF proclamation boundary include private oil and gas development, surface mining of coal, clay, and limestone, construction of buildings and other structures, road construction and maintenance, and timber harvest. There is a possibility that any of

these activities could impact suitable habitat or existing populations of this species. Management of non-federal lands are under the discretion of the landowner and conservation measures applied on NFS lands may not be used on these other ownerships. These activities are usually small in nature and scattered across the landscape and would not likely cause a change in future habitat outcomes for the species.

### Determination of Effect

There is a probability that each alternative may impact individuals or habitat, but no alternative is likely to cause a trend toward federal listing or loss of viability for umbrella magnolia (Table 15), since the mesic habitat of this species reduces the potential for timber harvesting activities in suitable habitat. Likewise, while habitat outcomes for rock skullcap may change by the tenth decade across all alternatives, activities are not likely to cause a trend toward federal listing (Table 15) due to rock skullcap's believed ability to establish in undisturbed habitats such as those provided by hands-off management areas (i.e. FOF, RNA). As discussed earlier, impacts on rock skullcap from light alterations may be less than previously thought, since populations have been found in stands with increased light penetration. However, research or monitoring of light alteration effects on the species is needed before legitimizing this assumption; thus, habitat outcomes and effect determinations were based on the belief that alterations of light by logging could negatively impact this species.

### Mature, Open to Semi-open Forest Plants (threatened by overshading) - Striped Gentian, Blue Scorpionweed, Butternut, and Yellow-fringed Orchid

The primary threat to these species is overshading by natural succession and competition from non-native invasive species (Andreas, 1984; Cusick and Burns, 1983; NatureServe, 2004). Additional threats include, fire suppression for striped gentian (McCartney and Goodwin, 2003d), overbrowsing by deer and erosion from flooding for blue scorpionweed (McCartney and Goodwin, 2003a), alterations of water supply, soil compaction and over collection for yellow-fringed orchid (Cusick and Burns, 1983), and overcrowding and harvesting of healthy, canker resistant, butternut trees (NatureServe Explorer, 2004).

### Activities with No Impact

Of the management activities projected to occur during the first decade, the following are not likely to have impacts since the activities do not occur in areas with suitable habitat for these species.

- Timber Stand Improvement (crop tree release and grape vine control) of young stands

- Site prep for native pine (no habitat for the striped gentian)
- Restoration of lakes and ponds
- Wetland restoration or enhancement.

### Activities with Beneficial Effects

Certain management activities that may occur within the first decade could benefit species habitat. These activities improve habitat by returning disturbed areas to vegetated conditions, managing areas to prevent woody overgrowth, controlling NNIS that degrade habitat and consolidating federal management of lands. Management areas that implement vegetation management to create diverse forested areas with more open canopies, such as DCF and HF, would provide suitable habitat for these species.

- Uneven-aged Timber Harvesting
- Prescribed Fire
- Surface mine reclamation and stabilization of disturbed areas
- Restoration and improvement of stream habitat
- Control of NNIS (mechanical and biological methods)
- Maintenance of wildlife openings.
- Land acquisition

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

In each of the alternatives, there are activities that have the potential to negatively impact these RFSS or their habitats. Some of these management activities vary across alternatives, while others do not. Refer to Table 6 for projected outputs for the following activities across alternatives.

- **Construction of roads, trails, recreation facilities and parking lots** have the potential to affect suitable habitat. Construction activities, involving the use of heavy machinery, often result in vegetation removal, soil compaction, erosion, and increased susceptibility for NNIS invasion. Such developments could result in the loss of suitable habitat. During construction and use, unsurfaced roads and trails have the potential to cause soil erosion and spread NNIS. However, Forest-wide standards and guidelines, incorporated in all alternatives, reduce erosion and sedimentation impacts and provide normal drainage control on designated trails (Goal 2.1 and associated standards and guidelines, REC-29 and Objective 17.3a). Forest-wide standards and guidelines outline

combating NNIS establishment and spread through project level prevention and treatment efforts (FH-1), equipment cleaning (FH-8), and use of native plants for restoration (FH-10 and FH-11).

- **Even-aged management** involves harvests from 2-30 acres in size. These methods could impact habitat of species that require semi-open habitat by increasing light levels to the understory. Known populations of these species would be protected (Goal 5.2, TES-32). Unknown populations or suitable habitat could be temporarily impacted until stands and potential habitat could regenerate.
- The removal of trees during **uneven-aged management** would benefit these species by creating more open canopies. However, both uneven- and even-aged vegetation management could impact habitat through: construction of roads, skid trails and log landings, and increasing the likelihood for NNIS invasion. All skid trails and log landings are temporary in stature and are rehabilitated after use to control any erosion or NNIS concerns. Forest-wide standards and guidelines exist in all alternatives to address non-native invasive species establishment and spread during construction activities.
- **Site prep for native pine** (blue scorpionweed, butternut, and yellow-fringed orchid) – soil disturbance associated with this activity could affect potentially suitable habitat, however, the disturbance would be small in scope and pre-project surveys would identify areas to avoid.
- While the use of prescribed fire would benefit all of these species, the **construction of firelines** could impact the species. The **construction of firelines** using bulldozers for prescribed fire activities could result in soil disturbance, soil compaction, removal of vegetation and increased susceptibility for invasion by NNIS, whereas firelines constructed by hand would only affect the litter layer. The Forest Service attempts to use existing roads and fire breaks to avoid constructing fire line (FIRE-7) and minimize erosion (FIRE-12 and FIRE-13).
- **Mechanical reduction of hazardous fuels** could involve cutting and possible removal of woody material on the ground. A leaning or standing tree could be felled, either as part of the fuels reduction work or to protect workers from a potential hazard tree. Increased light penetration due to tree removal would likely benefit these species and their habitat. Dragging and movement of woody fuels may disturb soils, but would be mitigated by Forest-wide standards and guidelines in all alternatives. Construction of roads, trails and landings during hazard fuel treatment projects would have similar impacts as those discussed for roads and trails.

- **Surface coal mines** could alter and remove surface soils and vegetation, and subsequently degrade existing habitat. Approximately 1,250 acres of NFS land could be affected by surface mining in the future. The Forest Service has no control over this projected activity since private mineral rights are involved. However, the operator would need to follow state regulations for reclamation of the surface.
- **Oil and gas activities** have the potential to affect habitat in a similar manner as roads and trails. Effects from road and well pad construction are long-term since they remain in use until mineral resources are depleted. Once depleted the operators are required to restore the areas they disturbed (Obj 10.2a and b, MIN-2, MIN-8). Established Forest-wide standards and guidelines incorporated in all alternatives mitigate the effects of oil and gas exploration and development (i.e., filterstrips, stream crossings, stabilizing disturbed areas, NNIS prevention and analysis, NSO on steep slopes and riparian areas). For reserved and outstanding rights oil and gas wells, operators must follow state regulations which include best management practices for protecting natural resources. All alternatives project up to 121 acres (0.0005% of the Forest) could be disturbed from oil and gas well development over the next decade. Some potential habitat could be lost; however, the amount is not expected to significantly affect the overall amount of habitat or the viability of these RFSS species.
- **Brine or oil spills** could occur during oil and gas well operations, although they are rare. The operator is required to construct berms around the wells to contain any oil leaks. The brine is required to be removed by tank truck. Each alternative has Forest-wide standards and guidelines that require the installation of control valves on all pipelines crossing streams so that supply and flow of oil and gas can be shut down immediately upon detection of a leak until repairs and cleanup have occurred (MIN-3, 4, 5).
- **Road decommissioning and reclamation of orphan gas and oil wells** activities may have initial impacts similar to road construction and oil and gas construction, but over the long-term closures may increase the acres of suitable habitat and benefit the environment by preventing future impacts.
- **Construction of utility corridors**, specifically buried transmission lines, cause ground disturbance, soil compaction, alterations of vegetation structure, and make areas more susceptible to invasion by non-native invasive species. Other **special use permits**, such as road access and grazing permits, have similar effects on local soils and vegetation. Overall, these activities are projected to impact 50 acres over the next decade, or 0.0002% of the Forest. The overall

small amount of area impacted, in combination with the probability of affecting potential habitat, is unlikely to impact population viabilities for these species.

- **Herbicides** use will primarily involve selective, spot spraying to avoid affecting non-target vegetation. Each alternative contains Forest-wide standards and guidelines that emphasize proper use of herbicides to protect non-target vegetation (FH 17, 18, 19, 20, 21). Although selective vegetation management is preferred for utility or other rights-of-way or easements, use of herbicides may occur in areas with written Forest Supervisor approval. Aerial spraying of herbicides is sometimes conducted on utility corridors that have outstanding rights. Special use permits for utility corridors would contain provisions for all herbicide use and require permittees to abide by Forest-wide standards and guidelines. By following standards and guidelines for herbicide usage, the potential for herbicides to drift onto suitable habitat, or an individual, would be low.
- **Creation of permanent wildlife openings, construction of small lakes, ponds and waterholes** all have the potential to affect species and their habitat. However, creation of openings primarily is from designation of existing open land on acquired properties (WLF-4, 5, 6). Impounding a stream to create lakes or ponds is unlikely, since most ponds constructed, in the past, were a result of reclamation efforts. Waterhole construction would be built in forested areas already disturbed by other project activities (e.g. timber harvests), thus tree removal would not occur primarily for waterhole construction. While these activities could potentially impact forested habitat, it is unlikely tree removal or impoundments would occur for their creation.
- **Wetland restoration and enhancement** activities often occur in bottomland areas that have been tilled or ditched to promote agricultural use (ARR-25). Any of these species can occur in open areas, such as roadsides or stream banks. Therefore, there is the possibility that wetland management activities could affect habitat or individuals in the area. However, most agricultural areas are often still recovering from disturbance and other impacts, so the likelihood of these species existing in these areas tends to be low, and the probability for impacts is unlikely. The projection for wetland activities are 150 acres over the next decade, or 0.0006% of the Forest.
- Watershed improvements involve **treatment of AMD and closure of subsidences and open portals** that present safety concerns and/or contribute to AMD. These activities may involve vegetation removal, soil disturbance and compaction by machinery, and

increased susceptibility to NNIS invasion. Approximately 502 acres are projected for treatment, or 0.002% of the Forest. Improvement activities occur within areas heavily impacted by underground and surface mining activities which often offer low quality habitat. The likelihood that these species would occur initially in these highly disturbed areas are low, however after improvement activities, these areas could provide improved habitat conditions for establishment. NNIS impacts will be lessened by reseeding guidelines (WSH-6, 7) and management (Goal 7.2 and associated standards and guidelines).

- **Installation of bat-friendly gates** involves the removal of a small amount of soil around mine openings in order to sink gates below ground surface. Removal of soil in these areas could directly impact any plants or habitat present. Soils removed during installation are returned afterwards to pre-installation conditions to avoid changing airflows and micro-environments, thus retaining any seedbanks that may exist for these species. Many of the areas impacted by installation are devoid of vegetation due to any combination of dense shade, acid mine drainage, or soil compaction by human use. The small amount of soil disturbance coupled with the low probability of potential habitat occurring in these areas makes the chance of impact low.
- Up to 400 acres of land exchange could occur in the first decade of the plan. Land exchange can be beneficial (e.g., acquiring potential habitat, or actual populations of RFSS), but could be negative if such habitat was exchanged into private ownership. Each exchange is reviewed by Forest Service biologists to identify any potential impacts to RFSS.

### Summary of Direct and Indirect Effects

As indicated by the historic and current habitat outcomes, striped gentian and blue scorpionweed are not naturally widespread in distribution across the planning area (Table 13). The two species that were more common historically are butternut, whose current population declines are primarily due to infestation by butternut canker disease, and yellow-fringed orchid which was plentiful enough for collection and use by Native Americans (McCartney and Swiezynski, 2003c). Population declines for the herbaceous species probably occurred during the heavy impacts of timber harvesting, oil and gas development and iron ore and coal mining from the 1800s to the early 1900s. While these species are threatened by natural succession and shading, the full sunlight and heavy soil compaction and erosion conditions during this time period likely eliminated many populations.

Since the Depression, forest cover has increased across Ohio from about 15% in 1940 to almost 30% today (Ohio Division of Forestry, 2004). Almost 80% of the lands (public and private) within the WNF proclamation boundary are forested (Ohio Land Use Cover, based on Landsat TM 1994). Riparian corridors within the proclamation boundary are primarily forested (i.e., 72.5%) (National Landcover Database, 1992). These reforestation activities may have improved habitat potential on the WNF for these species to an extent. Current management plans to create more open, forest communities with fire and vegetation management is likely to increase the amount of suitable habitat for the herbaceous species, however the ability for these species to disperse and colonize these areas will be inhibited current population isolation. The plight of the butternut relies on research efforts to find canker resistant strains that can perpetuate the species.

In all cases, the likelihood is very low that the alternatives and their associated management activities projected to occur in the first decade could affect habitat suitability on NFS lands to the point where habitat outcomes would be decreased (Table 13).

### Cumulative Effects

Habitat quality has improved on the landscape since the Forest Service began acquiring land in southeast Ohio. Some areas remain impacted, but projects to rehabilitate heavily impacted areas (e.g. strip mines, agricultural fields) overtime will continue to provide more areas with suitable habitat for these species.

Loss of suitable habitat could occur on private lands within the WNF proclamation boundary in the future, primarily from construction of roads and homes, oil and gas wells, and surface mining activities. There is a possibility that any of these activities could impact suitable habitat for, or existing populations of, these species. However, with the exception of the potential 1,250 acres of surface mining, these activities would not be expected to increase significantly from current levels. Any potential adverse cumulative effects that may occur on NFS lands as a result of implementing any of the alternatives would be mitigated through the implementation of the protective Forest-wide standards and guidelines that are incorporated into all alternatives (Table 14).

### Determination of Effect

Each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 15).

## Fire-adapted Plants, Open to Semi-open habitat - Juniper Sedge and Yellow Gentian

Threats to these species include overshadowing by natural succession and fire suppression (Cusick, 1993; Andreas, 1981). Non-native invasives also pose a threat to these species and their habitat. Both species have been managed with fire on the WNF, and both have responded well to this management tool (Andreas, 1981; McCartney and Goodwin, 2003b).

### Activities with No Impact

Of the management activities projected to occur during the first decade, the following are not likely to have impacts since the activities do not occur in areas with suitable habitat for these species.

- Restoration and improvement of stream habitat
- Wetland restoration and enhancement
- Timber Stand Improvement (crop tree release and grape vine control)
- Site prep for native pine (no habitat for yellow gentian)
- Restoration and improvement of lake and pond habitat
- Restoration and improvement of stream habitat
- Watershed improvements (treatment of AMD, closure of open mine portals/subsidence).

### Activities with Beneficial Effects

Certain management activities that may occur within the first decade could benefit species habitat. These activities improve habitat by maintaining more open understory, restoring unsuitable habitats to suitable habitat, controlling NNIS that degrade habitat and consolidating federal management of lands. Management areas that implement vegetation management to create diverse forested areas with more open canopies, such as DCF and HF, would provide suitable habitat for these species.

- Prescribed Fire
- Uneven-aged timber management
- Creation of permanent wildlife openings
- Maintenance of wildlife openings
- Surface mine reclamation and stabilization of disturbed areas
- Control of NNIS (mechanical and biological methods)
- Land acquisition.

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

In each of the alternatives, there are activities that have the potential to negatively impact these RFSS or their habitats. Some of these management activities vary across alternatives, while others do not. Refer to Table 6 for projected outputs for the following activities across alternatives.

- **Construction of roads, trails, recreation facilities and parking lots** have the potential to affect suitable habitat. Construction activities, involving the use of heavy machinery, often result in vegetation removal, soil compaction, erosion, and increased susceptibility for NNIS invasion. Such developments could result in the loss of suitable habitat. During construction and use, unsurfaced roads and trails have the potential to cause soil erosion and spread NNIS. However, each alternative has Forest-wide standards and guidelines to reduce erosion and sedimentation impacts and to provide normal drainage control on designated trails (Goal 2.1 and associated standards and guidelines, REC-29 and Objective 17.3a). Forest-wide standards and guidelines outline combating NNIS establishment and spread through project level prevention and treatment efforts (FH-1), equipment cleaning (FH-8), and use of native plants for restoration (FH-10 and FH-11).
- **Even-aged management** involves harvests from 2-30 acres in size. These methods could improve habitat for the gentian by opening the canopy. The increase in light from removing the canopy could be too much for juniper sedge, however, known populations of this species would be protected (Goal 5.2, TES-32). Unknown populations or suitable habitat could be temporarily impacted until stands could regenerate as would potential habitat for these species.
- While **uneven- and even-aged** vegetation management could improve habitat for these species, they also can negatively impact habitat, through construction of roads, skid trails and log landings; and increasing the likelihood for NNIS invasion. Skid trails and log landings are temporary in stature and would be rehabilitated after use to control any erosion or NNIS concerns. Forest-wide standards and guidelines exist in all alternatives to address non-native invasive species establishment and spread during construction activities.
- **Site prep for native pine** (juniper sedge) – soil disturbance associated with this activity could affect potentially suitable habitat, however, the disturbance would be small in scope and pre-project surveys would identify areas to avoid.

- While the use of prescribed fire would benefit these species, the construction of firelines could impact the species. The **construction of firelines** using bulldozers for prescribed fire activities could result in soil disturbance, soil compaction, removal of vegetation and increased susceptibility for invasion by NNIS, whereas firelines constructed by hand only affect the litter layer. The Forest Service attempts to use existing roads and fire breaks to avoid constructing fire line (FIRE-7) and minimize erosion (FIRE-12 and FIRE-13).
- **Mechanical reduction of hazardous fuels** could involve cutting and possible removal of woody material on the ground. A leaning or standing tree could be felled, either as part of the fuels reduction work or to protect workers from a potential hazard tree. Increased light penetration due to tree removal would likely benefit these species and their habitat. Dragging and movement of woody fuels may disturb soils, but would be mitigated by Forest-wide standards and guidelines in all alternatives. Construction of roads, trails and landings during hazard fuel treatment projects would have similar impacts as those discussed for roads and trails.
- **Surface coal mines** could alter and remove surface soils and vegetation, and subsequently degrade existing habitat. Approximately 1,250 acres of NFS land could be affected by surface mining in the future. The Forest Service has no control over this projected activity since private mineral rights are involved. However, the operator would need to follow state regulations for reclamation of the surface.
- **Oil and gas activities** have the potential to affect habitat in a similar manner as roads and trails. Effects from road and well pad construction are long-term since they remain in use until mineral resources are depleted. Once depleted the operators are required to restore the areas they disturbed (Obj 10.2a and b, MIN-2, MIN-8). Established Forest-wide standards and guidelines incorporated in all alternatives mitigate the effects of oil and gas exploration and development (i.e., filterstrips, stream crossings, stabilizing disturbed areas, NNIS prevention and analysis, NSO on steep slopes and riparian areas). For reserved and outstanding rights oil and gas wells, operators must follow state regulations which include best management practices for protecting natural resources. All alternatives project up to 121 acres (0.0005% of the Forest) could be disturbed from oil and gas well development over the next decade.

- **Brine or oil spills** could occur during oil and gas well operations, although they are rare. The operator is required to construct berms around the wells to contain any oil leaks. The brine is required to be removed by tank truck. Each alternative has Forest-wide standards and guidelines that require the installation of control valves on all pipelines crossing streams so that supply and flow of oil and gas can be shut down immediately upon detection of a leak until repairs and cleanup have occurred (MIN-3, 4, 5).
- **Road decommissioning and reclamation of orphan gas and oil wells** activities may have initial impacts similar to road construction and oil and gas construction, but over the long-term closures may increase the acres of suitable habitat and benefit the environment by preventing future impacts.
- **Construction of utility corridors**, specifically buried transmission lines, cause ground disturbance, soil compaction, alterations of vegetation structure and composition, and make areas more susceptible to invasion by non-native invasive species. Other **special use permits**, such as road access and grazing permits, have similar affects on local soils and vegetation. Overall, these activities are projected to impact 50 acres over the next decade, or 0.0002% of the Forest. The overall small amount of area impacted, in combination with the probability of affecting potential habitat, is unlikely to impact population viabilities for these species.
- **Herbicides** use will primarily involve selective, spot spraying to avoid affecting non-target vegetation. Each alternative contains Forest-wide standards and guidelines that emphasize proper use of herbicides to protect non-target vegetation (FH 17, 18, 19, 20, 21). Although selective vegetation management is preferred for utility or other rights-of-way or easements, use of herbicides may occur in areas with written Forest Supervisor approval. Aerial spraying of herbicides is sometimes conducted on utility corridors that have outstanding rights. Special use permits for utility corridors would contain provisions for all herbicide use and require permittees to abide by Forest-wide standards and guidelines. By following standards and guidelines for herbicide usage, the potential for herbicides to drift onto suitable habitat, or an individual, would be low.
- **Waterhole construction** would occur in forested areas already disturbed by other project activities (e.g. timber harvests), thus tree removal would not occur primarily for waterhole construction.
- **Installation of bat-friendly gates** involves the removal of a small amount of soil around mine openings in order to sink gates below ground surface. Removal of soil in these areas could directly impact any plants or habitat present. Soils removed during

installation are returned afterwards to pre-installation conditions to avoid changing airflows and micro-environments, thus retaining any seedbanks that may exist for the species. Many of the areas impacted by installation are devoid of vegetation due to any combination of dense shade, acid mine drainage, or soil compaction by human use. The small amount of soil disturbance coupled with the low probability of potential habitat occurring in these areas makes the likelihood of impact on these species low.

- Up to 400 acres of **land exchange** could occur in the first decade of the plan. Land exchange can be beneficial (e.g., acquiring potential habitat, or actual populations of RFSS), but could be negative if such habitat was exchanged into private ownership. Each exchange is reviewed by Forest Service biologists to identify any potential impacts to RFSS.

### Summary of Direct and Indirect Effects

As indicated by the historical outcome for these species, juniper sedge occurrence is unknown since it is a newly described species within the last decade. Yellow gentian was not common historically since it inhabited prairie extensions, a minority habitat in the predominately forested area of southeast Ohio. Following the Great Depression, fire suppression efforts and reforestation projects turned natural prairie remnant habitats into forested habitats too shaded for the gentian to persist.

While the alternatives overall should improve habitat for these two species, through uneven-aged vegetation management and prescribed fire, the isolation of existing populations will likely prevent the dispersal and establishment of these species to new suitable habitat. Thus the habitat outcomes for these species are not expected to change across the alternatives (Table 13).

### Cumulative Effects

Loss of habitat for these species could occur on private lands within the WNF proclamation boundary, primarily from construction of homes and roads, oil and gas development and surface mining activities. Conversely, the prescribed burning activities of other land management areas (e.g. State Forests) along with timber harvesting on private and state owned properties will continue to create more suitable habitat for these species. Both negative and positive impacting activities that occur on private lands are usually small in nature and scattered across the landscape. Any potential adverse cumulative effects that may occur on NFS lands as a result of implementing any of the alternatives would be mitigated through the implementation of the protective Forest-wide standards and guidelines that are incorporated into all alternatives. Therefore, cumulative effects of

activities are unlikely to change the habitat outcomes for either of these species (Table 14).

### Determination of Effect

Each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 15).

## Pigeon Grape

Pigeon grape typically grows in moist, semi-open habitats in alluvial soil of low woods, thickets, fencerows and stream banks. Threats to pigeon grape include the felling of trees upon which the species grows (Burns, 1982a), fire, and decline in habitat quality due to NNIS invasion (McCartney and Swiezynski, 2003a).

### Activities with No Impact

Of the management activities projected to occur during the first decade, the following are not likely to have impacts since the activities do not occur in areas with suitable habitat for these species.

- Maintenance of wildlife openings
- Site prep for native pine
- Restoration of lakes and ponds
- Wetland restoration and enhancement.

### Activities with Beneficial Effects

- Surface mine reclamation and stabilization of disturbed areas
- Restoration and improvement of stream habitat
- Control of NNIS (mechanical and biological methods)
- Land acquisition.

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

In each of the alternatives, there are activities that have the potential to negatively impact this RFSS or its habitat. Some of these management activities vary across alternatives, while others do not. Refer to Table 6 for projected outputs for the following activities across alternatives.

- **Construction of roads, trails, recreation facilities and parking lots** have the potential to affect suitable habitat. Construction activities, involving the use of heavy machinery, often result in vegetation removal, soil compaction, erosion, and increased susceptibility for NNIS invasion. Such developments could result

in the loss of suitable habitat. During construction and use, unsurfaced roads and trails have the potential to cause soil erosion and spread NNIS. However, each alternative has Forest-wide standards and guidelines to reduce erosion and sedimentation impacts and to provide normal drainage control on designated trails (ARR-4, ARR-10, Goal 2.1 and associated standards and guidelines, REC-29 and Objective 17.3a). Forest-wide standards and guidelines outline combating NNIS establishment and spread through project level prevention and treatment efforts (FH-1), equipment cleaning (FH-8), and use of native plants for restoration (FH-10 and FH-11).

- **Uneven-aged** methods can open the canopy and increase light penetration into forested stands. An established Forest-wide standard (TES-8) directs the Forest Service to maintain at least 60% canopy cover in all stands treated with uneven-aged. Opening the canopy during logging could impact semi-shade environment or remove a tree supporting the species. Each alternative has Forest-wide standards and guidelines that require filterstrips along riparian systems (ARR-5 and 6), which would help protect pigeon grape habitat in most areas. Since 60% of the canopy cover is retained during this management activity, the impacts on pigeon grape habitat would be minimal.
- **Even-aged management** involves harvests from 2-30 acres in size. These methods will impact habitat of these species by increasing light levels to the understory. Known populations of this species would be protected (Goal 5.2, TES-32). The use of even-aged management in riparian areas would not be common and any impacts on potential habitat would be short-term since stands and potential habitat would regenerate over time.
- Both uneven- and even-aged vegetation management could have impacts on suitable habitat, through vegetation removal; construction of roads, skid trails and log landings; alterations in light environments and increasing the likelihood for NNIS invasion. Skid trails and log landings are temporary in stature and are rehabilitated after use to control any erosion or NNIS concerns. Each alternative has Forest-wide standards and guidelines to address non-native invasive species establishment and spread during construction activities.
- **Prescribed fire** creates a more open understory and may create snags by killing overstory trees, however the largest impact would be the mortality of seedlings and saplings of shade tolerant tree species. Fire has been identified as a threat to the species, however burning in riparian areas would likely result in mosaic patterns due to mesic conditions. This would reduce the likelihood of direct

impacts from fire on the species. Creation of snags could increase light penetration, however the killing of overstory trees would likely be similar to natural tree mortality and should not have significant effects on light environments for the species.

- The **construction of firelines** using bulldozers for prescribed fire activities could result in soil disturbance, soil compaction, removal of vegetation and increased susceptibility for invasion by NNIS, whereas firelines constructed by hand would only affect the litter layer. The Forest Service attempts to use existing roads and fire breaks to avoid constructing fire line (FIRE-7) and minimize erosion (FIRE-12 and FIRE-13). Construction of fireline in riparian areas would be unlikely since streams could be used as natural firelines and filterstrip requirements (ARR-5).
- **Mechanical reduction of hazardous fuels** could impact pigeon grape or its habitat if supporting trees were cut. Reduction activities involve cutting and possible removal of woody materials on the ground. It is possible that a leaning or standing tree could be felled, either as part of the fuels reduction work or to protect workers from a potential hazard tree. Pre-project surveys of the treatment area and identified hazard trees would occur to determine if pigeon grape occurred prior to project implementation. Dragging and movement of woody fuels may disturb soils, but would be mitigated by Forest-wide standards and guidelines in all alternatives. Construction of roads, trails and landings during hazard fuel treatment projects would have similar impacts as those discussed for roads and trails.
- **Surface coal mines** could alter and remove surface soils and vegetation, and subsequently degrade existing habitat. Approximately 1,250 acres of NFS land could be affected by surface mining in the future. The Forest Service has no control over this projected activity since private mineral rights are involved. However, the operator would need to follow state regulations for reclamation of the surface.
- **Oil and gas activities** have the potential to affect habitat in a similar manner as roads and trails. Effects from road and well pad construction are long-term since they remain in use until mineral resources are depleted. Once depleted the operators are required to restore the areas they disturbed (Obj. 10.2a and b, MIN-2, MIN-8). Forest-wide standards and guidelines incorporated in all alternatives can mitigate the effects of oil and gas exploration and development (i.e., filterstrips, stream crossings, stabilizing disturbed areas, NNIS prevention and analysis, NSO on steep slopes and riparian areas). For reserved and outstanding rights oil and gas wells, operators must follow state regulations which

include best management practices for protecting natural resources. All alternatives project up to 121 acres (0.0005% of the Forest) could be disturbed from oil and gas well development over the next decade. Some potential habitat could be lost temporarily; however the amount is not expected to significantly affect the overall amount of habitat or the viability of this RFSS species.

- **Brine or oil spills** could occur during oil and gas well operations, although they are rare. The operator is required to construct berms around the wells to contain any oil leaks. The brine is required to be removed by tank truck. Each alternative has Forest-wide standards and guidelines that require the installation of control valves on all pipelines crossing streams so that supply and flow of oil and gas can be shut down immediately upon detection of a leak until repairs and cleanup have occurred (MIN-3, 4, 5).
- **Road decommissioning and reclamation of orphan gas and oil wells** activities may have initial affects on habitat similar to road construction and oil and gas construction, but over the long-term closures may increase the acres of suitable habitat and benefit the environment by preventing future impacts.
- **Construction of utility corridors**, specifically buried transmission lines, cause ground disturbance, soil compaction, alterations of vegetation structure and composition, and make areas more susceptible to invasion by non-native invasive species. Other **special use permits**, such as road access and grazing permits, have similar affects on local soils and vegetation. Overall, these activities are projected to impact 50 acres over the next decade, or 0.0002% of the Forest. The overall small amount of area impacted, in combination with the probability of affecting potential habitat, is unlikely to impact population viabilities for this species.
- **Herbicides** use will primarily involve selective, spot spraying to avoid affecting non-target vegetation. Each alternative contains Forest-wide standards and guidelines that emphasize proper use of herbicides to protect non-target vegetation (FH 17, 18, 19, 20, 21). Although selective vegetation management is preferred for utility or other rights-of-way or easements, use of herbicides may occur in areas with written Forest Supervisor approval. Aerial spraying of herbicides is sometimes conducted on utility corridors that have outstanding rights. Special use permits for utility corridors would contain provisions for all herbicide use and require permittees to abide by Forest-wide standards and guidelines. By following standards and guidelines for herbicide usage, the potential for herbicides to drift onto suitable habitat, or an individual, would be low.

- **Creation of permanent wildlife openings, construction of small lakes, ponds and waterholes** all have the potential to affect species and their habitat. However, creation of openings is primarily from the designation of existing open land on acquired properties (WLF-4, 5, 6). Impounding a stream to create lakes or ponds is unlikely, since most ponds constructed, in the past, were a result of reclamation efforts. Waterhole construction would be built in forested areas already disturbed by other project activities (e.g. timber harvests), thus tree removal would not occur primarily for waterhole construction. While these activities could potentially impact trees supporting pigeon grape, they are unlikely to occur in pigeon grape habitat.
- **Grape vine control and crop tree release** involve the treatment of young, even-aged stands (15-25 years old) by ground crews. While cutting of vines and trees supporting vines could impact this species, all alternatives contain Forest-wide standard and guidelines (VEG-14) which prohibits cutting of pigeon grapes.
- Watershed improvements involve **treatment of AMD and closure of subsidences and open portals** that present safety concerns and/or contribute to AMD. These activities could involve vegetation removal, soil disturbance and compaction by machinery, and increased susceptibility to NNIS invasion. Approximately 502 acres are projected for treatment, or 0.002% of the Forest. Improvement activities occur within areas heavily impacted by underground and surface mining activities which often offer low quality habitat. The likelihood that these species would occur initially in these highly disturbed areas are low, however after improvement activities, these areas could provide suitable habitat conditions for establishment. NNIS impacts will be lessened by reseeding guidelines (WSH-6, 7) and management (Goal 7.2 and associated standards and guidelines).
- **Installation of bat-friendly gates** involves the removal of small amounts of soil around mine openings in order to sink gates below ground surface. Removal of soil in these areas could directly impact any plants or habitat present. Soils removed during installation are returned afterwards to pre-installation conditions to avoid changing airflows and micro-environments, thus retaining any seedbanks that may exist for the species. Many of the areas impacted by installation are devoid of vegetation due to any combination of dense shade, acid mine drainage, or soil compaction by human use. Occasionally, trees occur near or above mine openings that may need to be removed. Pre-implementation evaluation of these sites would determine if trees with pigeon grape occurred. The small amount of soil disturbance coupled with

the small probability of potential habitat occurring in these areas makes this impact insignificant.

- Up to 400 acres of **land exchange** could occur in the first decade of the plan. Land exchange can be beneficial (e.g., acquiring potential habitat, or actual populations of RFSS), but could be negative if such habitat was exchanged into private ownership. Each exchange is reviewed by Forest Service biologists to identify any potential impacts to RFSS.

### Summary of Direct and Indirect Effects

As indicated by the historic and current habitat outcomes, pigeon grape is not widespread in distribution across the planning area (Table 13) This species is primarily confined to forested, riparian areas. During the 1800s and early 1900's areas containing habitat for this species were degraded during the industrial boom of southeast Ohio.

Since the Depression, forest cover has increased across Ohio and along riparian corridors within the proclamation boundary (National Landcover Database, 1992). Reforestation activities have increased the amount of potential habitat for this species. Continues efforts to improve riparian habitats will improve suitable habitat as well, however the ability of this species to disperse and colonize these areas is inhibited by current population isolation.

### Cumulative Effects

Riparian habitat quality has improved on the landscape since the Forest Service began acquiring land in southeast Ohio. Some areas remain impacted, but projects to rehabilitate heavily impacted areas (e.g. strip mines, agricultural fields) overtime will continue to provide more areas with suitable habitat for this species.

Loss of suitable habitat could occur on private lands within the WNF proclamation boundary in the future, primarily from construction of roads and homes, oil and gas wells, and surface mining activities. There is a possibility that any of these activities could impact suitable habitat for, or existing populations of, this species. However, with the exception of the potential 1,250 acres of surface mining, these activities would not be expected to increase significantly from current levels. Any potential adverse cumulative effects that may occur on NFS lands as a result of implementing any of the alternatives would be mitigated through the implementation of the protective Forest-wide standards and guidelines that are incorporated into all alternatives (Table 14).

### **Determination of Effect**

Each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 15).

**Table 13. Comparison of habitat outcomes for Regional Forester sensitive species on NFS lands.**

Species	Historic /Current	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. Emod	Alt. F
Decade		2 5 10	2 5 10	2 5 10	2 5 10	2 5 10	2 5 10	2 5 10
Mammals								
Bobcat	A/B	B B B	B B B	B B B	B B B	B B B	B B B	B B B
Black bear	A/B	B B B	B B B	B B B	B B B	B B B	B B B	B B B
Birds								
Henslow's sparrow	+/D	D E E	D E E	D D D	D D D	D D D	D D D	D D D
Cerulean warbler	A/B	B B B	B B B	B B B	B B B	B B B	B B B	B B B
Amphibians								
Hellbender	E/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Reptiles								
Timber rattlesnake	D/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Fish								
Eastern sand darter	C/D	D D C	D D C	D D C	D D C	D D C	D D C	D D C
Western lake chubsucker	E/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Ohio lamprey	E/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Mussels								
Round hickorynut	C/D	D D C	D D C	D D C	D D C	D D C	D D C	D D C
Salamander mussel	C/D	D D C	D D C	D D C	D D C	D D C	D D C	D D C
Lilliput	D/D	D D D	D D D	D D D	D D D	D D D	D D D	D D D
Little spectaclecase	D/D	D D D	D D D	D D D	D D D	D D D	D D D	D D D
Insects								
Grizzled skipper	E/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Plants								
Pigeon grape	D/D	D D D	D D D	D D D	D D D	D D D	D D D	D D D
Umbrella magnolia	D/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Juniper sedge	-/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Yellow gentian	E/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Rock skullcap	B/C	C C C	C C C	C C C	C C C	C C C	C C C	C C C
Striped Gentian	D/D	D D D	D D D	D D D	D D D	D D D	D D D	D D D
Butternut	B/C	C C C	C C C	C C C	C C C	C C C	C C C	C C C
Blue scorpionweed	D/D	D D D	D D D	D D D	D D D	D D D	D D D	D D D
Yellow-fringed orchid	D/D	D D D	D D D	D D D	D D D	D D D	D D D	D D D
Summary of Habitat Outcome Changes from Current Outcomes								
Positive change		0 0 4	0 0 3	0 0 3	0 0 3	0 0 3	0 0 3	0 0 3
No change		23 22 18	23 22 17	23 23 19	23 23 19	23 23 19	23 23 19	23 23 19
Negative change		0 1 1	0 1 3	0 0 1	0 0 1	0 0 1	0 0 1	0 0 1

+ Habitat for this species did not occur in planning area historically. - Newly described species in 1990's, historical occurrence unknown.

**Table 14. Comparison of habitat outcomes for RFSS in the cumulative effects analysis area.**

Species	Historic /Current	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. Emod	Alt. F
Decade		2 5 10	2 5 10	2 5 10	2 5 10	2 5 10	2 5 10	2 5 10
Mammals								
Bobcat	A/B	B B B	B B B	B B B	B B B	B B B	B B B	B B B
Black bear	A/B	B B B	B B B	B B B	B B B	B B B	B B B	B B B
Birds								
Henslow's sparrow	+/D	D E E	D E E	D D D	D D D	D D D	D D D	D D D
Cerulean warbler	A/B	B B B	B B B	B B B	B B B	B B B	B B B	B B B
Amphibians								
Hellbender	E/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Reptiles								
Timber rattlesnake	D/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Fish								
Eastern sand darter	C/D	D D C	D D C	D D C	D D C	D D C	D D C	D D C
Western lake chubsucker	E/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Ohio lamprey	E/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Mussels								
Round hickorynut	C/D	D D C	D D C	D D C	D D C	D D C	D D C	D D C
Salamander mussel	C/D	D D C	D D C	D D C	D D C	D D C	D D C	D D C
Lilliput	D/D	D D D	D D D	D D D	D D D	D D D	D D D	D D D
Little spectaclecase	D/D	D D D	D D D	D D D	D D D	D D D	D D D	D D D
Insects								
Grizzled skipper	E/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Plants								
Pigeon grape	D/D	D D D	D D D	D D D	D D D	D D D	D D D	D D D
Umbrella magnolia	D/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Juniper sedge	-/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Yellow gentian	E/E	E E E	E E E	E E E	E E E	E E E	E E E	E E E
Rock skullcap	B/C	C C C	C C C	C C C	C C C	C C C	C C C	C C C
Striped Gentian	D/D	D D D	D D D	D D D	D D D	D D D	D D D	D D D
Butternut	B/C	C C C	C C C	C C C	C C C	C C C	C C C	C C C
Blue scorpionweed	D/D	D D D	D D D	D D D	D D D	D D D	D D D	D D D
Yellow-fringed orchid	D/D	D D D	D D D	D D D	D D D	D D D	D D D	D D D
Summary of Habitat Outcome Changes from Current Outcomes								
Positive change		0 0 4	0 0 3	0 0 3	0 0 3	0 0 3	0 0 3	0 0 3
No change		23 22 18	23 22 17	23 23 19	23 23 19	23 23 19	23 23 19	23 23 19
Negative change		0 1 1	0 1 3	0 0 1	0 0 1	0 0 1	0 0 1	0 0 1

+ Habitat for this species did not occur in planning area historically. - Newly described species in 1990's, historical occurrence unknown.

**Table 15. Summary of the determination of effects for RFSS.**

Species	A	B	C	D	E	E <sub>mod</sub>	F
Mammals							
Bobcat	MI	MI	MI	MI	MI	MI	MI
Black bear	MI	MI	MI	MI	MI	MI	MI
Birds							
Henslow's sparrow	LV	LV	MI	MI	MI	MI	MI
Cerulean warbler	MI	MI	MI	MI	MI	MI	MI
Amphibians							
Hellbender	MI	MI	MI	MI	MI	MI	MI
Reptiles							
Timber Rattlesnake	MI	MI	MI	MI	MI	MI	MI
Fish							
Eastern sand darter	MI	MI	MI	MI	MI	MI	MI
Western lake chubsucker	MI	MI	MI	MI	MI	MI	MI
Ohio lamprey	MI	MI	MI	MI	MI	MI	MI
Mussels							
Round hickorynut	MI	MI	MI	MI	MI	MI	MI
Salamander mussel	MI	MI	MI	MI	MI	MI	MI
Lilliput	MI	MI	MI	MI	MI	MI	MI
Little spectaclecase	MI	MI	MI	MI	MI	MI	MI
Insects							
Grizzled skipper	MI	MI	MI	MI	MI	MI	MI
Plants							
Pigeon grape	MI	MI	MI	MI	MI	MI	MI
Umbrella magnolia	MI	MI	MI	MI	MI	MI	MI
Juniper sedge	MI	MI	MI	MI	MI	MI	MI
Yellow gentian	MI	MI	MI	MI	MI	MI	MI
Rock skullcap	MI	MI	MI	MI	MI	MI	MI
Striped gentian	MI	MI	MI	MI	MI	MI	MI
Butternut	MI	MI	MI	MI	MI	MI	MI
Blue scorpionweed	MI	MI	MI	MI	MI	MI	MI
Yellow-fringed orchid	MI	MI	MI	MI	MI	MI	MI

*NI = No impacts*

*BE = Beneficial effects*

*MI = May impact individuals, but it is not likely to cause a trend to federal listing or loss of viability*

*LV = High risk of loss of viability in the planning area, but not likely to cause a trend toward federal listing*

## Species Proposed for RFSS Designation

### Affected Environment

Habitat and behavior information, occurrences in the planning area, and threats to the viability of the species proposed for RFSS designation are identified in Table 16.

**Table 16. Affected environment for species proposed for RFSS designation.**

Species	Habitat and Behavior	Occurrence	Threats to Viability
Blanchard's cricket frog	Breeding occurs in the spring in permanent or semi-permanent lentic systems with shallow slopes toward the water and mud and bank vegetation (Burkett, 1984; Jung, 1993). It feeds primarily out of water (Brown, 1974; Johnson and Christiansen, 1976) on terrestrial invertebrates and has been observed feeding on land up to 51 inches from the shoreline (Dickson, 2002). For resting, this frog prefers permanent water to temporary pools, and avoids areas with thick vegetation near the surface of the ground (Mount, 1975).	Hanging Rock, Brushy Fork, Pleasant Valley Church and Carter Abel areas on the Western edge of the Ironton Ranger District	Natural succession of bank vegetation around occupied sites is an immediate threat; sedimentation of aquatic habitat from nearby land management activities (Johnson, 2003b).
Butterfly pea	Grows in open to semi-open situations in dry to moist soil in upland woods, borders of prairie openings, and barrens (Burns, 1982b; Gleason and Cronquist, 1991). May respond favorably to prescribed fire (McCartney and Goodwin 2003e).	Ironton Ranger District (Lake Vesuvius and Fradd Hollow areas in Lawrence County)	Encroachment of woody vegetation through natural succession in occupied areas; introduction of non-native invasive species (McCartney and Goodwin, 2003e).
Carolina thistle	It is an open forest or open woodland species (McCartney and Swiezynski, 2003d) and thrives in dry soil with moderate to full exposure to sun; therefore, it does not typically grow in wet habitats or in habitats with dense canopy cover (Burns and Cusick, 1983).	Athens Unit (Buffalo Beats RNA in Athens County); Ironton Ranger District (Lawrence County)	Encroachment of woody vegetation through natural succession in occupied areas; introduction of non-native invasive species (McCartney and Swiezynski, 2003d).
Dwarf iris	In the planning area, the dwarf iris has been found growing in open oak woods and on a dry, open roadbank along a ridgetop (McCartney and Swiezynski, 2003e).	Ironton Ranger District (Lawrence and Scioto counties); Athens Unit (Athens County)	Encroachment of woody vegetation through natural succession in occupied areas; overcollection (McCartney and Swiezynski, 2003e).
Featherbells	It is a facultative wetland plant (Reed, 1988) and is not typically found in upland areas; thrives with filtered sunlight; therefore, it does not typically grow in habitats with dense shade (McCartney and Swiezynski, 2003f).	Ironton Ranger district (Gallia and Lawrence counties)	Encroachment of woody vegetation through natural succession in occupied areas; introduction of non-native invasive species (McCartney and Swiezynski, 2003f).

Species	Habitat and Behavior	Occurrence	Threats to Viability
Four-toed salamander	Mossy vernal pools and boggy areas in mature forest (minimum of 50-year old trees) with a damp forest floor is considered optimal habitat in southern Ohio (Johnson, 2003c). Females construct or use existing cavities in or below moss mats along margins of ponds and bogs (Bishop, 1941; Gilbert, 1941; Wood, 1955; Petranka, 1998). Eggs have also been found in leaf litter, rotted wood, under loose bark, clumps of grasses and rushes, mounds of pine needles (Petranka, 1998) and grass tussocks (Johnson, 2003c). Food consists of insects and other arthropods found on the forest floor (Pfungsten and Downs, 1989). It may spend most of the day on the ground hiding under objects, whereas during cold weather, it is found beneath surface objects or buried beneath the substrate (Bishop, 1941). Logs and other downed woody material is an essential habitat component in the range of this salamander (Harris and Gill, 1980; Wallace, 1984; Saugey and Trauth, 1991).	Ironton Ranger District (Pine Creek watershed)	Loss or decline in habitat quality of vernal ponds; sedimentation of vernal pool habitat; loss of mature forest cover and mature forest travel corridors (Johnson, 2003c).
Green salamander	In most parts of its range, it inhabits crevices in rock outcrops that are usually well-shaded by mixed mesophytic forest; however Pfungsten and Downs (1989) reported that many Ohio populations dwell either on south-facing or unshaded outcrops, perhaps due to their being on the northern edge of the species range. Eggs are laid in the rock crevice and the female broods them for three months until they typically hatch in September (Pfungsten and Downs, 1998).	Ironton Ranger District (Hanging Rock area in Lawrence County)	Loss or decline of habitat quality due to microclimate changes to habitat.
Green-faced clubtail	Its flight season in Ohio is from May through July (Glotzhober and McShaffrey, 2002), during which time mating occurs and eggs are laid in rocky rivers and streams with a mixture of gravelly sand and silt among rocks (Dunkle, 2000). Eggs hatch and larvae spend two years in the stream until it emerges in the late spring or early summer (Glotzhober and McShaffrey, 2002).	Marietta Unit (Little Muskingum River watershed)	Changes in water quality and sedimentation of egg and larval habitat; loss riparian forest that reduces shade and increases water temperatures (Schaeffer, 2003a).
Lined sedge	Dry to mesic woods (Gleason and Cronquist, 1991); filtered light to closed canopy habitat (McCartney and Swiezynski, 2003g).	Ironton Ranger District (Lawrence County)	Removal of canopy (i.e., even-aged management); introduction of non-native invasive species (McCartney and Swiezynski, 2003g).
Little headed nutrush	Habitat in Ohio is xeric oak barrens with dolomite or limestone based soils (R. Gardner, pers. comm.). The two current occurrences on the WNF occur in fire-managed areas.	Ironton Ranger District (Lawrence County)	Fire Suppression; non-native invasive species (R. Gardner, pers. comm.).
Marshes St. John's wort	Swamps, floodplain forests, often on rotting logs or about the bases of trees, wet seepage areas by woodland streams, marshy shores, amongst cypress and gum trees on pond or lake shores (Godfrey and Wooten, 1981).	Ironton Ranger District (Gallia County)	Loss of habitat due to alteration of surface hydrology or non-native invasive species (McCartney and Goodwin, 2003f).

Species	Habitat and Behavior	Occurrence	Threats to Viability
Mud salamander	It is considered a fossorial salamander because it uses burrows that lead down into a series of complex submerged channels in perennial seeps, springs, and slow-flowing headwater streams (1 <sup>st</sup> order) (Petranka, 1998; Johnson, 2003d). Eggs are laid in the fall or early winter, and hatch during late-winter (Petranka, 1998). Larvae hatch and remain in aquatic habitats until metamorphosis, which occurs between 1.5 and 2.5 years following hatching (Bruce, 1978). Adults forage in the wet ground immediately bordering the aquatic habitat (Bishop, 1947), but have been known to prey on smaller salamanders and most small invertebrates (Petranka, 1998).	Ironton Ranger District, Gallia area in the Symmes Creek watershed	Alteration of surface and subsurface hydrology resulting from loss of forest canopy cover and road construction (Johnson, 2003d).
Pale straw sedge	It is found in swamps, low woods, and thickets (Gleason and Cronquist, 1991). On the WNF, it typically grows in wet habitats, commonly found in large wetland complexes that were created or altered by beavers, and prefers open areas receiving ample amounts of sunlight (Gardner, 2001; McCartney and Swiezynski, 2003h).	Ironton Ranger District (Lawrence County)	Changes in hydrology of occupied sites; natural succession of occupied sites; introduction on non-native invasive species (McCartney and Swiezynski, 2003h).
Pinxter flower	Typically grows in moist or dry woods and bogs on acidic, humus-laden soils in shaded or sunny conditions (Gleason and Cronquist, 1991, Hilton Pond Center, 2002). However, it will tolerate dry, sandy or rocky soils (Missouri Botanical Garden, 2003). Well-drained soils are essential, poor drainage inevitably leads to root rot (Missouri Botanical Garden, 2003).	Ironton Ranger District (Lawrence County)	Introduction on non-native invasive species; overcollection; encroachment of woody vegetation through natural succession in occupied areas (McCartney and Swiezynski, 2003i).
Rapids clubtail	Its flight season in July is late-May to mid-July (Glotzhober and McShaffrey, 2002), during which time mating occurs and eggs are laid at the heads of riffles in large streams with gravel in the rocky riffles or rapids (Dunkle, 2000). Eggs hatch and larvae spend two years in the stream until it emerges in the late spring or early summer (Glotzhober and McShaffrey, 2002).	Marietta Unit (Little Muskingum River watershed)	Changes in water quality and sedimentation of egg and larval habitat; loss riparian forest that reduces shade and increases water temperatures (Schaeffer, 2003b).
Sheepnose mussel	The sheepnose is a larger stream species, occurring primarily in shallow shoal habitats with moderate to swift currents over coarse sand and gravel, but some individuals may occur in deeper run habitat (USFWS, 2002).	Not within the proclamation boundary, but in the Ohio River in the vicinity of the WNF (Belville-Meldahl pools)	Sedimentation and acid mine drainage (USFWS, 2002).
Smooth beardtongue	Appears to favor edge on the WNF, but has been found in meadows and moist or dry woods (Gleason and Cronquist, 1991) and in low meadows and forest edges, in moist but sandy soil (Radford et al., 1968) in other parts of its range.	Marietta Unit (Monroe County)	Changes in light from encroachment of woody vegetation through natural succession in occupied areas; non-native invasive species; mortality of NFS population from illegal off-road vehicle trail use (McCartney and Goodwin, 2003g).

Species	Habitat and Behavior	Occurrence	Threats to Viability
Sparse-lobed grape fern	Grows in bottomland forests to mesic forests in ravines and semi-shaded, moist sites, but not swamps or wetlands (Steyermark, 1963; McCartney and Goodwin, 2003h).	Ironton Ranger District (Lawrence County)	Changes in microclimate due to canopy reduction; introduction of non-native invasive species (McCartney and Goodwin, 2003h).
Tall nut rush	Habitat is variable within its range, but on the WNF, populations have been found in open oak woods and an oak barren. The Wayne is on the northern edge of its range and therefore it may demand a greater open condition than in other parts of its range due to lower light intensity (J. Dumke and R. Gardner, pers. comm.).	Ironton Ranger District (Lawrence County)	Encroachment of woody vegetation through natural succession in occupied areas; introduction of non-native invasive species (McCartney and Goodwin, 2003i).
Yellow crownbeard	It occurs in open to semi-open habitats in pastures, roadsides, meadows, and floodplains (McCartney and Goodwin, 2003j).	Ironton Ranger District (Gallia and Lawrence counties)	Decline of habitat quality due to encroachment of woody vegetation through natural succession in occupied areas; introduction of non-native invasive species (McCartney and Goodwin 2003j).

### Direct, Indirect and Cumulative Effects

The habitat outcome (also known as viability outcome in the species viability evaluations) was determined for historic, current and likely future environmental conditions for species proposed for RFSS designation on NFS lands for each alternative. The habitat outcome is a judgment, based on scientific information found in the literature and from discussion with taxonomic experts. It should be thought of as an index of the capability of the environment to support population abundance and distribution of these species, but not as an actual prediction of population occurrence, size, density or other demographic characteristics (T. Schenck, pers. comm.). The likely habitat outcomes for species proposed for RFSS designation that could be supported by conditions on NFS lands (i.e., direct and indirect effects of alternatives) and on all lands (i.e., cumulative effects of alternatives) under each alternative are defined in Tables 10 and 11, located in the previous effects analysis for RFSS.

The historical, current and future habitat outcomes were determined by the Forest Service after review of the species data collection forms compiled during the species viability evaluation process, and after discussions with the taxonomic experts. Some species proposed for RFSS designation were not included in the species viability evaluation process, but were only recently documented within the WNF proclamation boundary. Habitat outcomes for these species were determined by the Forest Service after review of literature and discussions with taxonomic experts.

Analysis of direct, indirect, and cumulative effects focused on the risk factors pertinent to the species within the planning area and within the control of the Forest Service. The assessment of future habitat conditions, distribution and quality were based on the knowledge of the species distributional range and life history. Most of these species occur naturally in localized or patchy distributions, and would not occur in the conditions described in habitat outcomes A-C because their natural condition may be D or E. A judgment of historical environmental conditions provides a reference or context within which to evaluate the impacts to evaluate the impacts of the alternatives. The cumulative effects analysis area was defined as all lands within the WNF proclamation boundary.

### **Blanchard's Cricket Frog**

The range of this species continues to constrict and move westward. Natural succession of areas around occupied ponds and wetlands poses the primary threat to this species; however sedimentation of its habitat is also a concern. These threats are best addressed at the project level.

### **Activities with No Impact**

There are some activities that could occur over the next decade that would not affect the integrity of ponds or wetlands located in open areas. These activities include:

- Timber harvesting – suitable habitat would not occur in a forested setting
- Restoration of lentic habitat
- Installation of bat-friendly gates
- Reduction of hazardous field using mechanical methods – suitable habitat would not occur in areas where fuels reduction would be necessary

### **Activities with Beneficial Effects**

National Forest activities which protect and improve water quality in ponds or wetlands that occur in open areas would benefit this species, as would activities that reduce encroachment of woody vegetation around these aquatic habitats.

Each alternative incorporates Forest-wide goals (2.1 and 3.1) and objectives (2.1a-c, 3.1a-d) which promote the restoration and improvement of riparian and watershed health. Each alternative also includes numerous Forest-wide standards and guidelines that protect aquatic resources from potential sources of non-point source pollution.

Beneficial management activities that are projected to occur during the first decade of implementation of the alternatives include:

- Wetland restoration
- Road decommissioning
- Reclamation of orphan or depleted oil and gas wells
- Treatment of abandoned mine land features that contribute to acid mine drainage conditions
- Closure of open mine features that contribute to acid mine drainage conditions
- Surface mine reclamation
- Stabilization of disturbed areas
- Land acquisition
- Land exchange
- Herbicide application to reduce encroachment of woody vegetation
- Development and maintenance of permanent openings adjacent to ponds and wetlands
- Control of non-native invasive species (all methods)
- Construction of ponds, lakes, and waterholes
- Agricultural crop production and grazing in areas with occupied habitat may aid in maintaining appropriate vegetative conditions

### **Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability**

The following activities have the potential to adversely affect water quality or suitable habitat conditions around pond and wetland margins, however Forest-wide standards and guidelines reduce or eliminate potentially adverse effects.

- Reforestation (around occupied or potentially suitable habitat)
- Site prep for native pine
- Construction of roads and trails and recreational facilities
- Development of mineral resources
- Utility corridor development in the vicinity of occupied habitat
- Land exchange may be beneficial, but could impact individuals if unknown occupied habitat was exchanged

### **Summary of Direct and Indirect Effects**

The alternatives would have no effect on the Blanchard's cricket frog in areas where it is known to be present. Forest-wide guidance (TES-36) is

incorporated into the alternatives that allow localized removal of vegetation to reduce woody encroachment to maintain or improve habitat for RFSS. Ground-disturbing activities that could cause sedimentation of aquatic habitats could occur in varying degrees in each alternative. However, the habitat outcomes for the Blanchard's cricket frog are not expected to change with implementation of any alternative, in the short-term or in the long-term (Table 17, found at the end of this section). In addition to incorporating specific goals and objectives for sustaining riparian and ecological processes and aquatic and riparian-dependent plant and animal communities (Goal 3.1, Objectives 3.1a-d), each alternative has incorporated Forest-wide standards and guidelines that minimize the potential for sedimentation of habitat, or changes in water quality (see Goal 2.1, Managing Disturbed Areas and Soil Resources). These include measures on how or when to: stabilize disturbed areas and implement erosion control practices. Each alternative also contains Forest-wide standards and guidelines that specifically address management in riparian corridors, including the use of filterstrips to minimize sedimentation of aquatic habitats (ARR-5 and ARR-6). Past monitoring of vegetation management projects on the Wayne-Hoosier National Forest indicated that projects in compliance with Forest Plan standards and guidelines were not exhibiting significant soil and water resource problems (USDA Forest Service, 1988). A controlled surface use stipulation in riparian areas has been placed on all federal oil and gas leases to ensure aquatic and riparian habitat integrity is maintained during oil and gas development and extraction activities.

### **Cumulative Effects**

Aquatic habitat is limited in abundance in the WNF proclamation boundary, but the majority of ponds and wetlands are found on NFS lands. However, private lands offer some habitat where small ponds occur in cattle pastures or in hayfields that are mowed. The vegetation around the banks of these small ponds is likely to be maintained in suitable conditions for this species by this private land management regime. Ground-disturbing activities do occur on private lands, but the potential for large-scale impacts to this relatively uncommon resource are not expected. No cumulative adverse effects are expected to occur to this species or its habitat as a result of implementing any of the alternatives; therefore it is unlikely habitat outcomes would change with implementation of any alternative, in the short-term or in the long-term (Table 18, found at the end of this section).

### **Determination of Effect**

Though the probability is low, each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 19, found at the end of this section).

## Mud Salamander

### Activities with No Impact

Please refer to the discussion of *Activities with No Impact* for the aquatic RFSS, in the previous section. Those effects would be the same for the mud salamander.

### Activities with Beneficial Effects

Please refer to the discussion of *Activities with Beneficial Effects* for the aquatic RFSS, in the previous section. Those effects would be the same for the mud salamander. In addition, each alternative incorporates specific Forest-wide guidance for the protection of spring habitat (ARR-29).

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

Please refer to the discussion of *Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability* for the aquatic RFSS, in the previous section. Those effects would be the same for the mud salamander.

### Summary of Direct and Indirect Effects

Perennial springs and seeps are not very common on the WNF. Mining and land clearing that occurred since the 1800s may have altered surface and subsurface hydrology and may have subsequently reduced the number of springs and seeps.

Management activities that could affect spring or seep habitat for this species may occur in any of the alternatives. These activities include timber harvesting, road construction or reconstruction, trail construction, construction of recreational facilities, and oil and gas well development.

While these activities are projected to occur in varying amounts in the alternatives, the habitat outcomes for this species proposed for RFSS designation are not expected to change with implementation of any alternative, in the short-term or in the long-term (Table 17, found at the end of this section). In addition to incorporating specific goals and objectives for sustaining riparian and ecological processes and aquatic and riparian-dependent plant and animal communities (Goal 3.1, Objectives 3.1a-c), each alternative has incorporated a Forest-wide guideline specifically for the purpose of protecting spring habitat from potential effects of canopy removal or ground-disturbing activities (ARR-29).

There is a possibility that a 1,200 acre surface mine could occur on the Ironton Ranger District in the future. This activity is outside the control of the Forest Service. A 1999-2000 Forest Service abandoned mine land

survey covered large portions of the Pine Creek watershed and some portions of the Symmes Creek watershed, both on private and public lands. Any springs and seeps were noted, and this information was provided to taxonomic experts who looked for mud salamanders at these sites. None of the springs or seeps contained suitable habitat for the mud salamander. The location of this surface mine is in the Pine Creek watershed, and the trend in lack of suitable habitat elsewhere in the watershed is most likely to be the same for this tract of land. However, in the event the mine becomes a reality, a project-level review of habitat for this species and others would occur.

### **Cumulative Effects**

The two occupied sites within the planning area include a large spring that serves as a water source for local residents and a small spring on NFS lands. Because the large spring is used by people for drinking water, care is taken by the local residents to protect it. Activities that could affect perennial springs and seeps on NFS lands may also occur on private and state-owned lands in the future, but implementation of protective measures are left to the discretion of the land manager or property owner. However, springs and seeps are not common features on the landscape. No cumulative adverse effects are expected to occur to this species or its habitat as a result of implementing any of the alternatives; therefore it is unlikely habitat outcomes would change with implementation of any alternative, in the short-term or in the long-term (Table 18, found at the end of this section).

### **Determination of Effect**

Though the probability is low, each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 19, found at the end of this section).

## **Four-toed Salamander**

### **Activities with No Impact**

Some management activities may occur over the next decade which would not affect forest canopy or the integrity of vernal pools. Such activities include:

- Crop tree release
- Grape vine control
- Herbicide application
- Control of non-native invasive species
- Restoration of lentic or lotic habitat

- Installation of bat-friendly gates
- Agricultural crop production and grazing on existing agriculture lands
- Restoration of lentic and lotic habitat
- Waterhole construction
- Maintenance of existing permanent forest openings

### **Activities with Beneficial Effects**

All alternatives incorporate Forest-wide standards and guidelines to protect vernal pool habitat that is used by this species during reproduction (ARR-23). In addition, occupied habitat would be protected during implementation of all projects (TES-32). In addition to these conservation measures, the following management activities that may occur in the next decade could be beneficial to this species:

- Land acquisition
- Land exchange
- Reclamation of abandoned mine lands, stabilization of disturbed areas, restoration of orphan and depleted wells
- Restoration of wetlands.

### **Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability**

Certain management activities which may occur in the first decade could adversely impact suitable four-toed salamander habitat. These activities include:

- Canopy removal during timber harvest activities (even-aged timber harvesting would reduce canopy levels more so than uneven-aged or thinning methods)
- Site prep for native pine
- Prescribed fire when individuals are active
- Development of permanent openings
- Fishing pond/lake construction
- Road, trail or facilities construction
- Mineral development activities
- Mechanical removal of hazardous fuels
- Development of utility corridors

- Land exchange may be beneficial, but could impact individuals if unknown occupied habitat was exchanged
- Utility corridor construction.

### Summary of Direct and Indirect Effects

This species has been found in two sites on the Ironton Ranger District, both in the Bear Run area. One of the sites is atypical for four-toed habitat. Larvae were found in a roadside ditch on a ridgetop with some cattails, located under a powerline cut and adjacent to scrubby woods (Johnson, 2003c). Loss of mature forest canopy or alteration of vernal pools could affect this species.

Management activities which could reduce canopy cover or affect vernal pools include even-aged timber harvesting, construction of roads, trails, or recreation facilities, development of oil and gas wells, surface mining, and development of utility corridors.

The alternative should have no effect on vernal pool habitat. Each incorporates a measure to protect ephemeral wetlands (i.e., vernal pools) by avoiding them during ground-disturbing activities (ARR-23).

There are 73,388 acres of even-aged mature forest (80+ years) present on the WNF today. Some other NFS acres have been treated with uneven-aged management in recent years, but there are no acres categorized as having three or more age classes. Within 100 years, each alternative would result in a net increase of mature forest habitat. Alternative A allocates all of the WNF to uneven-aged management and to natural succession prescriptions, so it is assumed that the entire landbase would be covered by mature forest at some point in the future (i.e., with the exception of roads, lakes, etc.). The majority of forest cover on the WNF would also be categorized as mature forest habitat in the remaining alternatives (in order of decreasing percent composition): F (86.8%) → C (82.4%) → D (81.9%) → E<sub>mod</sub> (81.2%) → E (80.9%) → B (78.5).

In 100 years, almost 79% of the WNF may be covered by mature forest habitat in Alternative B, but more of the WNF is allocated to even-aged management. Approximately 6,500 acres would be harvested by even-aged methods each decade. Even-aged management can temporarily fragment mature, contiguous forest until the stand once again reaches a successional stage that is no longer an ecological barrier to forest-interior species (Rosenberg et al., 2003). It is possible that dispersal of this species could be adversely affected based upon the potential for periodic habitat fragmentation of mature forest communities on a landscape scale. Therefore the long-term habitat outcome for this species could be reduced (Table 17, found at the end of this section).

Prescribed fire may affect the species or habitat, but no information was found to about this in the literature. However, prescribed fire has the potential to change the microclimate of the forest floor, and can temporarily reduce invertebrate abundance (Boehner, 2000). Prescribed fire is an integral component of Historic Forest and Historic Forest Management Areas, found in Alternatives C-F. Short-term and long-term habitat outcomes could be reduced in Alternatives D-F because a Historic Forest management prescription would be applied in proximity to known locations of this species. NFS lands in this area could be treated with prescribed fire as much as twice per decade. The effects may be reduced to a degree since prescribed fire in mesic areas (i.e., preferred habitat) is more likely to be of a low intensity and more likely to burn in a mosaic pattern because of the moist conditions. Each alternative incorporates guidance (WLF-2) that encourages mosaic pattern burning for these reasons.

### Cumulative Effects

Activities that could affect ephemeral wetlands and mature forest on NFS lands may also occur on private and state-owned lands in the future, but implementation of habitat protection measures are left to the discretion of the land manager or property owner. It is likely that activities on NFS lands would not result in cumulative effects to this species in Alternatives A or C (Table 18, found at the end of this section). However, Alternatives B could have adverse cumulative effects in relation to the ability of individuals to disperse between suitable habitat patches. This would not likely occur until after several decades of alternative implementation. Alternatives D, E and F could have adverse cumulative effects to the habitat quality of this species due to prescribed fire activities. Known occupied areas would be protected (TES-32), but the microclimate could be altered in undocumented sites.

### Determination of Effect

Though the probability is low, each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 19, found at the end of this section).

## Green Salamander

### Activities with No Impact

Certain projected management activities could occur in the next decade but would not likely pose any impact on the green salamander or its habitat. These projects would not occur near or affect rock outcrop habitat:

- Crop tree release
- Grape vine control

- Site prep for native pine
- Prescribed fire
- Mechanical fuels reduction
- Herbicide application
- Maintenance of existing forest openings
- Control of non-native invasive species
- Wetland restoration
- Pond, lake, or waterhole construction
- Restoration of lentic or lotic habitat
- Road decommissioning
- Agricultural crop production and grazing
- Abandoned mine land reclamation and stabilization of disturbed areas.

### **Activities with Beneficial Effects**

The importance of rock outcrop habitat is recognized in each alternative. Forest-wide standards do not allow vegetation management within certain distances of rock outcrops in order to maintain a closed-canopy condition (TES-33 and TES-34). Other beneficial management activities which may occur in the next decade are:

- Reforestation
- Land acquisition
- Land exchange

### **Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability**

Some management activities have the potential to reduce canopy cover near rock outcrop habitat; however the effects would be minimal at most because of the established conservation measures that have been incorporated into each alternative (TES-33 and TES-34):

- Timber harvest
- Development of permanent openings
- Road, trail and facility construction
- Utility corridor development
- Land exchange may be beneficial, but could impact individuals if unknown occupied habitat was exchanged.

### Summary of Direct and Indirect Effects

A population of 18 individuals was recently identified on the WNF. It is limited in its distribution to rock outcrops. Prefers deep moist cracks in limestone cliffs during the day and ventures out onto the cliff face as night approaches in search of food. Alteration of the microclimate of the rock outcrop could affect the species.

Habitat outcomes are not expected to change with the implementation of any alternative, in the short-term or the long-term (Table 17, found at the end of this section). Two established Forest-wide standards (TES-33 and TES-34) protect large and small rock outcrops, rock shelters and rock faces from changes in microclimate that could result from canopy alteration activities.

### Cumulative Effects

The species distribution in the WNF proclamation boundary is limited to Lawrence and Scioto counties (Pfungsten and Downs, 1989; ODNR, 2004). Rock outcrops occur on private lands in the Ironton Ranger District, especially along the Ohio River. Management of these lands are under the discretion of the private landowner, but based on visual observations over the last ten years, only small amounts of forest cover have been impacted in this area. It is possible that some vegetation removal could occur around rock outcrops on private land in the future, but these sites generally occur in steep and inaccessible places. Therefore large-scale impacts are not expected to occur. No cumulative adverse effects are expected to occur to this species or its habitat as a result of implementing any of the alternatives; therefore it is unlikely habitat outcomes would change with implementation of any alternative, in the short-term or in the long-term (Table 18, found at the end of this section).

### Determination of Effect

Though the probability is low, each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 19, found at the end of this section).

## Rapids Clubtail and Green-faced Clubtail

### Activities with No Impact

Please refer to the discussion of *Activities with No Impact* for the aquatic RFSS, in the previous section. Those effects would be the same for the rapids clubtail and the green-faced clubtail.

### Activities with Beneficial Effects

Please refer to the discussion of *Activities with Beneficial Impacts* for the

aquatic RFSS, in the previous section. Those effects would be the same for the rapids clubtail and the green-faced clubtail.

### **Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability**

Please refer to the discussion of *Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability* for the aquatic RFSS, in the previous section. Those effects would be the same for the rapids clubtail and the green-faced clubtail.

### **Summary of Direct and Indirect Effects**

Habitat on the WNF for the rapids clubtail and green-faced clubtail is limited to the Little Muskingum River, and specifically to its larger riffle habitat (Schaeffer, 2003a; 2003b). It was most likely limited in distribution to this stream historically since there are no indications that any other WNF stream system possessed the habitat required by this species.

Management activities that could affect water quality or riffle habitat for these species may occur in any of the alternatives. These activities include timber harvesting, road construction or reconstruction, trail construction, construction of recreational facilities, and oil and gas well development.

While these activities are projected to occur in varying amounts in the alternatives, the habitat outcomes for these two species proposed for RFSS designation are not expected to change with implementation of any alternative, in the short-term or in the long-term (Table 17, found at the end of this section). In addition to incorporating specific goals and objectives for sustaining riparian and ecological processes and aquatic and riparian-dependent plant and animal communities (Goal 3.1, Objectives 3.1 a-c), each alternative has incorporated Forest-wide standards and guidelines that minimize the potential for sedimentation of habitat, or changes in water quality (see Goal 2.1, Managing Disturbed Areas and Soil Resources). These include measures on how or when to: stabilize disturbed areas and implement erosion control practices, construct or improve stream crossings (ARR-7 to ARR-12), and allow or prohibit removal of material from streams (ARR-18). Each alternative also contains Forest-wide standards and guidelines that specifically address management in riparian corridors, including the use of filterstrips to minimize sedimentation of aquatic habitats (ARR-5 and ARR-6). Past monitoring of vegetation management projects on the Wayne-Hoosier National Forest indicated that projects in compliance with Forest Plan standards and guidelines were not exhibiting significant soil and water resource problems (USDA Forest Service, 1988). A controlled surface use stipulation in riparian areas has been placed on all federal oil and gas leases to ensure aquatic and riparian habitat integrity is maintained during

oil and gas development and extraction activities. In addition to these measures, the Little Muskingum River mainstem is included in the River Corridor Management Area, which emphasizes retaining, restoring and enhancing the inherent ecological processes and functions associated with riverine systems.

### Cumulative Effects

The Little Muskingum River watershed has been impacted by past land clearing, agricultural production, and oil and gas development, however over time it has reforested and a significant portion of the mainstem attains Ohio EPA Exceptional Warmwater Habitat status (USDA Forest Service, 2002). A minimal amount of timber harvesting occurs on private lands, but these activities are generally small in size and are scattered across the watershed rather than being concentrated in one area. An evaluation of logging best management practices on private lands indicated that best management practices were employed in at least 80% of all timber harvests and 95% of these best management practices were rated effective at minimizing sedimentation of streams (McClenehen et al., 1999). Oil and gas development on private lands is likely to continue at current levels, or slightly increase in the foreseeable future based on reasonably foreseeable development trends for federal energy minerals. The topography is steep in the Little Muskingum River watershed and it is likely that some sedimentation could occur from township and county roads, or privately-owned roads, in the future. The added impact of Forest Service activities on NFS lands could have a minimal adverse effect on water quality and sedimentation of habitats, but mitigation measures incorporated into each alternative would reduce the cumulative impact to the point where it is unlikely habitat outcomes would change with implementation of any alternative, in the short-term or in the long-term (Table 18, found at the end of this section).

### Determination of Effect

Though the probability is low, each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 19, found at the end of this section).

## Sheepnose

### Activities with No Impact

Please refer to the discussion of *Activities with No Impact* for the aquatic RFSS, in the previous section. Those effects would be the same for the sheepnose.

### Activities with Beneficial Effects

Please refer to the discussion of *Activities with Beneficial Impacts* for the aquatic RFSS, in the previous section. Those effects would be the same for the sheepsnose.

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

Please refer to the discussion of *Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability* for the aquatic RFSS, in the previous section. Those effects would be the same for the sheepsnose.

### Summary of Direct and Indirect Effects

The sheepsnose does not occur within the WNF proclamation boundary (Watters, 1988; Hoggarth, 2001), but exists in the Ohio River downstream of NFS lands. It is a larger stream or river species. Streams within the WNF are primarily small, headwater streams; however larger Ohio River tributaries do pass through the proclamation boundaries. These larger tributaries (i.e., Pine Creek, Storms Creek, Raccoon Creek, Hocking River, and Little Muskingum River) do not possess the habitat qualities desired by the sheepsnose. Its host fish is the sauger (Watters, 1995), and it does occur within the proclamation boundary in Pine Creek and Symmes Creek. Threats to the sheepsnose and its habitat from National Forest management activities are sedimentation of aquatic habitats or changes in water quality from ground disturbing activities. Threats to the sauger and its habitat are the same.

In all cases, the likelihood is very low that the alternatives and the associated management activities projected to occur in the first decade could affect aquatic habitat or populations of sheepsnose or sauger to the point where habitat outcomes would be decreased (Table 17, found at the end of this section). As described for the rapids clubtail and green-faced clubtail, protective measures incorporated into each alternative would minimize the potential for management activities to degrade water quality or aquatic habitat. It is possible that ongoing and future efforts to restore mining-degraded aquatic systems on the Ironton Ranger District could result in the recolonization of currently uninhabitable sections portions of Pine Creek by the sauger.

### Cumulative Effects

Ground-disturbing activities will likely occur on other lands in the WNF proclamation boundary in the future which could result in sedimentation of aquatic habitat, but as explained in the effects analysis for the rapids clubtail and green-face clubtail, efforts are being made by other landowners to minimize sedimentation of aquatic habitats. Efforts by the

Forest Service, other state and federal agencies, conservation organizations, and private landowners continue to result in improved water quality conditions within the planning area. The added impact of Forest Service activities on NFS lands could have a minimal adverse effect on water quality and sedimentation of habitats, but mitigation measures incorporated into each alternative would reduce the cumulative impact to the point where it is unlikely habitat outcomes would change with implementation of any alternative, in the short-term or in the long-term (Table 18, found at the end of this section).

### **Determination of Effect**

Though the probability is low, each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 19, found at the end of this section).

### **Open Habitat, Early Successional Species**

Pale straw sedge, smooth beardtongue and featherbells inhabit disturbed, early successional habitats such as open fields, roadsides, powerline right-of-ways, open woods and forest borders. The primary threat to these species is overgrowth by woody species through succession and non-native invasive species. Pale straw sedge is also threatened by modification of hydrology in known areas of occurrence.

### **Activities with No Impact**

- Timber stand improvement of young stands
- Site prep for native pine (no habitat for smooth beardtongue)
- Restoration of lakes and ponds
- Installation of bat-friendly gates

### **Activities with Beneficial Effects**

Certain management activities that may occur within the first decade could benefit species habitat. These activities improve habitat by maintaining more open habitat, restoring suitable habitat, controlling NNIS that degrade habitat and consolidating federal management of lands.

- Wetland restoration and enhancement would benefit the pale straw sedge by creating or improving potential habitat. These activities would have no impact on smooth beardtongue or featherbells.
- Uneven-aged timber harvesting
- Restoration of stream habitat
- Control of NNIS (mechanical and biological)

- Creation and maintenance of wildlife openings
- Even-aged management
- Watershed improvements (AMD treatment, closure of mine portals/subsidence)
- Land acquisition.

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

Please refer to the discussion of *Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability* for the fire-adapted RFSS, in the previous section, for explanation of impact for those areas not described below: the effects are the same as those of the fire-adapted RFSS.

- **Construction of roads, trails, recreation facilities and parking lots.** Construction activities with heavy machinery would likely result in soil compaction, erosion and increased susceptibility to NNIS invasion that would not be beneficial to these species. However, in areas where NNIS do not occur, roadsides and created edge habitat could be beneficial for these species.
- Site prep for native pine could disturb habitat for pale straw sedge and featherbells, but the disturbance would be small in scope and a site-level field review would identify suitable habitat to avoid.
- **Prescribed fire.** Direct impacts of fire on these species are unknown. Beneficial effects would include the removal of understory woody vegetation and increased light. Prescribed fire construction could directly impact individuals if present, however, it could provide potential edge habitat for the species.
- Mechanical fuel reduction
- Surface Coal mining
- **Oil and gas activities.** These activities would have similar impacts as the above described road construction activities.
- **Road decommissioning and reclamation or orphan gas and oil wells.** Initially these areas would provide habitat for early successional species, however with time, growth of trees and other woody vegetation would reduce the suitability of habitat for these species.
- **Construction of utility corridors.** Impacts from these and other special use permit activities are similar to those of road construction.

- **Surface mine reclamation and stabilization of disturbed areas.** Theoretically the conversion of these areas back to forested areas would decrease potential habitat for these species, however, in most circumstances these areas are currently dominated by barren soils, spoil piles and non-native species that would not provide suitable habitat for these species.
- Herbicides
- Land Exchange.

### Summary of Direct and Indirect Effects

Following the Great Depression, fire suppression efforts and reforestation projects turned many open, disturbed areas back to forested conditions which likely decreased populations by creating environments too shaded for these species to inhabit.

Natural succession of forest communities could result in reduced habitat quality, and loss of undocumented populations of these species. The Forest Service would continue to conduct plant surveys on the WNF in the future, but surveys may not occur as frequently in FOF and FOFMA management areas because surveys are usually done in conjunction with active management project activities. Ground disturbing activities could result in the loss of undocumented populations (e.g., road and trail construction, oil and gas well development), but this is unlikely since Forest Service botanists review active management project areas for suitable habitat or presence of the species.

While the alternatives should improve habitat for these species, through uneven-aged and even-aged vegetation management, the isolation of existing populations will likely prevent the dispersal and establishment of these species to new suitable habitat. While management activities projected to occur in the first decade could affect habitat suitability on NFS lands, Forest-wide standards and guides will prevent effects that would current habitat outcomes (Table 17, found at the end of this section).

### Cumulative Effects

Loss of habitat for these species could occur on private lands within the WNF proclamation boundary, primarily from construction of homes and roads, oil and gas development and surface mining activities. Conversely, timber harvesting on private and state owned properties will continue to create suitable habitat for these species. Both negative and positive impacting activities that occur on private lands are usually small in nature and scattered across the landscape. Any potential adverse cumulative effects that may occur on NFS lands as a result of implementing any of the alternatives would be mitigated through the implementation of the

protective Forest-wide standards and guidelines that are incorporated into all alternatives. Therefore, cumulative effects of activities are unlikely to change the habitat outcomes for either of these species (Table 18, found at the end of this section).

### Determination of Effect

Each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 19, found at the end of this section).

### Mature Open, Semi-Open Woodland Species

Dwarf iris and pinxter flower are two species that occur in open woodlands and are threatened by overcollection and the introduction of non-native species. Dwarf iris is also threatened by shading by woody growth.

### Activities with No Impact

Please refer to the discussion of *Activities with No Impact* for the mature, open to semi-open Forest RFSS, in the previous section. Those effects would be the same for the dwarf iris and pinxter flower.

### Activities with Beneficial Effects

Please refer to the discussion of *Activities with Beneficial Impacts* for mature, open to semi-open Forest RFSS, in the previous section. Those effects would be the same for the dwarf iris and pinxter flower with the exception of prescribed fire, which has a may impact effect on these species.

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

Please refer to the discussion of *Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability* for the mature, open to semi-open Forest RFSS, in the previous section. Those effects would be the same for the dwarf iris and pinxter flower, with the addition of prescribed fire.

- **Prescribed fire** could benefit the species by reducing woody overgrowth and maintaining a more open habitat. Direct effects of fire on the iris are unknown. Pinxter flower typically is top-killed, however it survives by sprouting from the remnant root-crown. The effects of fireline construction are the same as those discussed for the RFSS.

- Site prep for native pine could disturb habitat for dwarf iris and pinxter flower, but the disturbance would be small in scope and a site-level field review would identify suitable habitat to avoid.

### Summary of Direct and Indirect Effects

Historic and current habitat outcomes indicate that these two species are not widespread in distribution across the planning area (Table 17, found at the end of this section). The heavy impacts of timber harvesting, oil and gas development and iron ore and coal mining from the 1800's to the 1900's likely caused population declines. However, forest cover has increased and almost 80% of lands within the WNF proclamation boundaries are forested (Ohio Land Use Cover, based on Landsat TM 1994). Current management plans to create more open, forest communities with fire and vegetation management is likely to increase the amount of suitable habitat for these species, however their ability to disperse and colonize these areas are inhibited by current population isolation.

Threats to viability associated with overcollection are addressed in each alternative by a Forest-wide Goal (5.2) to promote conservation activities that protect, restore, or enhance habitat for RFSS, and a Forest-wide standard (TES-35) that prohibits the collection of RFSS.

In all cases, the likelihood is very low that the alternatives and their associated management activities projected to occur in the first decade could affect habitat suitability on NFS lands to the point where habitat outcomes would be decreased (Table 17, found at the end of this section).

### Cumulative Effects

The cumulative effects for these species are the same as those discussed for similar habitat RFSS above, please refer to this section for cumulative impacts. The cumulative effects are not likely to affect the habitat outcomes for these species (Table 18, found at the end of this section).

### Determination of Effect

Each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 19, found at the end of this section).

### Fire Adapted Plant Species

Several species proposed for RFSS designation are adapted to fire and prescribe burning. They are threatened primarily by encroachment of woody vegetation through natural succession. These are species for which open areas or open woods provide appropriate growing conditions. These species include: butterfly pea, Carolina thistle, little headed nutrush, tall

nut rush, and yellow crownbeard. All of these species are also threatened by the introduction or spread of non-native invasive species.

The Forest Service proactively established three new Special Areas (i.e., Fradd Hollow, Bluegrass Ridge and Handley Branch) because populations of some of these species were found within these areas. These plant populations are considered fire-adapted since they have responded favorably to past prescribed fires in these areas.

### Activities with No Impact

Please refer to the discussion of *Activities with No Impact* for the fire-adapted RFSS, in the previous section. Those effects would be the same for these species of viability concern.

### Activities with Beneficial Effects

Activities that would benefit these species are ones that maintain or create open areas and woodlands. Please refer to the discussion of *Activities with Beneficial Impacts* for the fire-adapted RFSS, as these effects are the same. The one exception is including the creation and maintenance of wildlife openings which would only benefit the yellow crownbeard. The other species tend to occur in more open woodland environments, so wildlife openings would have no impact on them.

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

Please refer to the discussion of *Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability* for the fire-adapted RFSS, in the previous section. Those effects would be the same for the butterfly pea, Carolina thistle, little headed nutrush, tall nut rush, and yellow crownbeard.

### Summary of Direct and Indirect Effects

They species were not common historically. Open area and open woodland habitats decreased during reforestation and fire suppression projects following the Great Depression.

The alternatives would have no effect on any known populations of these species because the alternatives incorporate Forest-wide guidance that allows localized removal of vegetation to reduce woody encroachment may be used to maintain or improve habitat for RFSS (TES-36) and a management area standard (S-FOF-WLF-1 and S-FOFMA-WLF-1) enables the Forest Service to conduct localized management for these plant species if their populations fell within the FOF and FOFMA boundaries.

Natural succession of forest communities could result in reduced habitat quality, and loss of undocumented populations of species. The Forest Service would continue to conduct plant surveys on the WNF in the future, but surveys may not occur as frequently in FOF and FOFMA management areas because surveys are usually done in conjunction with active management project activities. Ground disturbing activities could result in the loss of undocumented populations (e.g., road and trail construction, oil and gas well development), but this is unlikely since Forest Service biologists review active management project areas for suitable habitat or presence of rare species. Thus the habitat outcomes for these species would not change with implementation of any of the proposed Forest Plan alternatives (Table 17, found at the end of this section).

### Cumulative Effects

Activities likely to occur on other lands in the WNF proclamation boundary that could impact these species include natural succession, and ground disturbing activities such as road and trail construction, and oil and gas development. The added impact of Forest Service activities on NFS lands could effect suitable habitats, but mitigation measures incorporated into each alternative would reduce the cumulative impact to the point where it is unlikely habitat outcomes would change (Table 18, found at the end of this section).

### Determination of Effect

Though the probability is low, each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 19, found at the end of this section) of these fire-adapted species.

### Mature Woodland Plant Species

Lined sedge and sparse-lobed grape fern are species threatened by removal of forest canopy that results in unsuitable light intensity levels. Both species do well in filtered light and closed canopy conditions. Lined sedge populations may increase quickly under temporary canopy openings, but will not tolerate full sun or very dense shade. The sparse-lobed grape fern is threatened by soil compaction and drying of habitat from vegetation removal. The introduction of non-native invasive plant species is also a threat to both species.

### Activities with No Impact

Please refer to the discussion of *Activities with No Impact* for the mature woodland RFSS, in the previous section. Those effects would be the same for these species of viability concern.

### Activities with Beneficial Effects

Please refer to the discussion of *Activities with Beneficial Impacts* for the mature woodland RFSS, in the previous section. Those effects would be the same.

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

Please refer to the discussion of *Activities with No Impact* for the aquatic RFSS, in the previous section. Those effects would be the same. The direct effects of fire on these species are unknown. Because of the sparse-lobed grape fern's preference for mesic habitats, its likely that burns would be low intensity and mosaic in pattern, reducing the potential for direct impacts on this species.

### Summary of Direct and Indirect Effects

Activities which have the potential to reduce canopy could affect undocumented species. Such projects may include even-aged vegetation management, oil and gas activity, construction of utility corridors, surface mining, and creation of permanent forest openings. The potential for loss of undocumented populations is minimized because Forest Service biologists review project areas for suitable habitat or presence of these species prior to implementation. If identified, protective measures found in each of the alternatives would be implemented (TES-32 and TES-36). In all cases, the likelihood is very low that the alternatives and their associated management activities projected to occur in the first decade could affect habitat suitability on NFS lands to the point where habitat outcomes would be decreased (Table 17, found at the end of this section).

### Cumulative Effects

Forest canopy removal projects will likely occur on other lands in the WNF proclamation boundary, including timber harvests, oil and gas development, and construction of roads, trails and buildings. Implementation of habitat protection measures are left to the discretion of the land manager or property owner. The added impact of Forest Service activities on NFS lands could have a minimal adverse effect on suitable habitat, but mitigation measures incorporated into each alternative would reduce the cumulative impact to the point where it is unlikely habitat outcomes would change with implementation of any alternative (Table 18, found at the end of this section).

### Determination of Effect

Though the probability is low, each alternative may impact individuals, but no alternative is likely to cause a trend toward federal listing or loss of viability (Table 19, found at the end of this section).

## Marshes St. John's-wort

This mesic species is threatened by alterations of surface hydrology and competition from non-native invasive species. In southern Ohio, it is known to occur primarily in riparian habitats and may follow the preglacial Teays River drainage lines and major tributaries in the Unglaciated Allegheny Plateau.

### Activities with No Impact

Please refer to the discussion of *Activities with No Impact* for the RFSS, pigeon grape, in the previous section. Those effects would be the same for this riparian species, plus timber stand improvement activities which would have no impact on this St. John's wort.

### Activities with Beneficial Effects

Please refer to the discussion of *Activities with Beneficial Impacts* for the RFSS, pigeon grape in the previous section. Beneficial effects are the same for large marsh St. John's wort; in addition wetland restoration would also be considered a benefit for this species since wetlands can provide suitable habitat for this species.

### Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability

Please refer to the discussion of *Activities that May Impact Individuals, but Not Likely to Cause a Trend toward Federal Listing or Loss of Viability* for the RFSS, pigeon grape, in the previous section. Effects would be the same for this species of viability concern with the exception of grape vine control and crop tree release (timber stand improvement activities) was moved to the No Impact section for this species of viability concern.

### Summary of Direct and Indirect Effects

The suspected link of this species to the preglacial Teays river drainage indicates that historically this species was not common. Activities which have the potential to affect surface hydrology could affect undocumented individuals of this species. Timber harvest and prescribed burning could occur in riparian habitats. Other projects with the potential for impact include small lake and pond construction, oil and gas activity, surface mining, construction of utility corridors, road and trail construction and watershed improvement activities. As described for the rapids clubtail and green-faced clubtail, protective measures incorporated into each alternative would minimize the potential for management activities to degrade water quality or aquatic habitat. Likewise, the potential for loss of undocumented populations is minimized because Forest Service biologists will review project areas for suitable habitat, or presence, of this species. If identified, protective measures found in each of the alternative (TES-32

and TES-36) would be implemented.

In all cases, the likelihood is very low that the alternatives and the associated management activities projected to occur in the first decade could affect aquatic habitat or populations of large marsh St. John's-wort to the point where habitat outcomes would be decreased (Table 17, found at the end of this section). It is possible that ongoing and future efforts to restore mining-degraded aquatic systems could increase suitable habitat for this species.

### **Cumulative Effects**

Ground-disturbing activities will likely occur on other lands in the WNF proclamation boundary in the future which could result in sedimentation of aquatic habitat, but efforts are being made by other landowners to minimize sedimentation of aquatic habitats. Efforts by the Forest Service, other state and federal agencies, conservation organizations, and private landowners continue to result in improved water quality conditions within the planning area. The added impact of Forest Service activities on NFS lands could have a minimal adverse effect on water quality and sedimentation of habitats, but mitigation measures incorporated into each alternative would reduce the cumulative impact to the point where it is unlikely habitat outcomes would change with implementation of any alternative (Table 18, found at the end of this section)

### **Determination of Effect**

Though the probability is low, each alternative may impact individuals, or habitat, but none are likely to cause a trend toward federal listing or loss of viability (Table 19, found at the end of this section).

**Table 17. Comparison of habitat outcomes for species proposed for RFSS designation on NFS lands.**

	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. E <sub>mod</sub>		Alt. F		
	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10
<b>Amphibians</b>															
Green salamander	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Mud salamander	D/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Four-toed salamander	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Blanchard's cricket frog	D/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
<b>Mussels</b>															
Sheepnose mussel	*	E	E	E	E	E	E	E	E	E	E	E	E	E	E
<b>Insects</b>															
Rapids clubtail	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Green-faced clubtail	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
<b>Plants</b>															
Marshes St. John's wort	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Smooth beardtongue	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Little headed nutrush	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Butterfly pea	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Tall nut rush	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Sparse-lobed grape fern	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Carolina thistle	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Pinxter flower	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Feather bells	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Lined sedge	C/C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Pale straw sedge	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Dwarf iris	C/C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Yellow crownbeard	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
<b>Summary of Habitat Outcome Changes from Current Outcomes</b>															
Positive change	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No change	19	19	19	19	19	19	19	19	19	18	18	18	18	18	18
Negative change	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

\*The sheepnose does not occur within the WNF proclamation boundary. Habitat outcomes for each of the alternatives are provided for its habitat in the Ohio River and for its host fish (sauger) which occurs within the proclamation boundary. It is not included in the summary of change at the bottom of the table.

**Table 18. Comparison of habitat outcomes for species proposed for RFSS designation on all lands in the cumulative effects analysis area.**

	Alt. A		Alt. B			Alt. C			Alt. D			Alt. E			Alt. E <sub>mod</sub>			Alt. F			
	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10
Decade	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10
<b>Amphibians</b>																					
Green salamander	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Mud salamander	D/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Four-toed salamander	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Blanchard's cricket frog	D/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
<b>Mussels</b>																					
Sheepnose mussel	*	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
<b>Insects</b>																					
Rapids clubtail	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Green-faced clubtail	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
<b>Plants</b>																					
Marshes St. John's wort	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Smooth beardtongue	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Little headed nutrush	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Butterfly pea	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Tall nut rush	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Sparse-lobed grape fern	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Carolina thistle	E/E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Pinxter flower	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Feather bells	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Lined sedge	C/C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Pale straw sedge	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Dwarf iris	C/C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Yellow crownbeard	D/D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
<b>Summary of Habitat Outcome Changes from Current Outcomes</b>																					
Positive change	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No change	19	19	19	19	18	19	19	19	18	18	18	18	18	18	18	18	18	18	18	18	18
Negative change	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1

\*The sheepnose does not occur within the WNF proclamation boundary. Habitat outcomes for each of the alternatives are provided for its habitat in the Ohio River and for its host fish (sauger) which occurs within the proclamation boundary. It is not included in the summary of change at the bottom of the table.

**Table 19. Summary of the determination of effects for Species proposed for RFSS designation.**

	A	B	C	D	E	E <sub>mod</sub>	F
Amphibians							
Blanchard's cricket frog	MI	MI	MI	MI	MI	MI	MI
Four-toed salamander	MI	MI	MI	MI	MI	MI	MI
Green salamander	MI	MI	MI	MI	MI	MI	MI
Mud salamander	MI	MI	MI	MI	MI	MI	MI
Mussels							
Sheepnose	MI	MI	MI	MI	MI	MI	MI
Insects							
Rapids clubtail	MI	MI	MI	MI	MI	MI	MI
Rapids clubtail	MI	MI	MI	MI	MI	MI	MI
Plants							
Butterfly pea	MI	MI	MI	MI	MI	MI	MI
Carolina thistle	MI	MI	MI	MI	MI	MI	MI
Dwarf iris	MI	MI	MI	MI	MI	MI	MI
Featherbells	MI	MI	MI	MI	MI	MI	MI
Lined sedge	MI	MI	MI	MI	MI	MI	MI
Little headed nutrush	MI	MI	MI	MI	MI	MI	MI
Marshes St. John's wort	MI	MI	MI	MI	MI	MI	MI
Pale straw sedge	MI	MI	MI	MI	MI	MI	MI
Pinxter flower	MI	MI	MI	MI	MI	MI	MI
Smooth beardtongue	MI	MI	MI	MI	MI	MI	MI
Sparse-lobed grape fern	MI	MI	MI	MI	MI	MI	MI
Tall nut rush	MI	MI	MI	MI	MI	MI	MI
Yellow crownbeard	MI	MI	MI	MI	MI	MI	MI

---

## List of Preparers

Cheryl Coon, Forest Botanist – M.S. in Plant Biology, University of Maryland, 1998;  
B.A. in Biology, Hiram College, Hiram, Ohio, 1995.

Rebecca Ewing, Forest Biologist – M.S. in Wildlife and Fisheries Sciences, South Dakota  
State University, 1989; B.S. in Zoology, Eastern Illinois University, 1984.

---

## List of Reviewers

Stephen R. Mighton, Endangered Species Specialist - Region 9, USDA Forest Service,  
Milwaukee, Wisconsin.

Katrina Schultes, Biological Technician – M.S. in Wildlife Management (Ecology  
Option), Eastern Kentucky University, 2002; B.S. in Biology (Zoology Option),  
Ball State University, 1993.

Sarena M. Selbo, Endangered Species Biologist - M.S. in Ecology and Evolution, The  
Ohio State University, 2002; B.S. in Biology, University of North Dakota, 1999.

---

## Literature Cited

Andreas, B. 1981. Species Abstract for *Gentiana alba* L. (Yellowish gentian). Ohio  
Endangered and Threatened Vascular Plants. Abstracts of State-listed Taxa. Ohio  
Department of Natural Resources, Division of Natural Areas and Preserves.  
Available: <http://www.dnr.state.oh.us/dnap/Abstracts/G/gentalba.htm> .

Andreas, B.K. 1984. Species Abstract for *Gentiana villosa* (Linnaeus). Ohio Endangered  
and Threatened Vascular Plants. Abstracts of State-listed Taxa. Ohio Department  
of Natural Resources, Columbus, Ohio.

Bajema, R. A., T. L. DeVault, P. E. Scott, and S. L. Lima. 2001. Reclaimed coal mine  
grasslands and their significance for Henslow's Sparrows. *Auk* 118:422-431.

Bishop, S. C. 1941. Salamanders of New York. *New York State Museum Bulletin* 324:1-  
365.

Bishop, S.C. 1943. Handbook of salamanders. Comstock Publishing, Ithaca, New York.  
555 pp.

Bishop, S.C. 1947. Handbook of salamanders. Comstock Publishing, Ithaca, New York.  
555 pp.

Brown, R. L. 1974. Diets and habitat preferences of selected anurans in southeast  
Arkansas. *American Midland Naturalist* 91:468-473.

- Brown, W. S. 1993. Biology, status, and management of the Timber Rattlesnake (*Crotalus horridus*): a guide for conservation. SS Amphibians and Reptiles Herpetological Circular no. 22
- Bruce, R.C. 1978. A comparison of the larval periods of Blue Ridge and Piedmont mud salamanders (*Pseudotriton montanus*). *Herpetologica* 34(4):325-332.
- Burhans, D. E., W. Dijak, and F. R. Thompson III. 2002. Conservation assessment: Cerulean Warbler *Dendroica cerulea*. USDA Forest Service, North Central Research Station, Columbia, Missouri, USA.
- Burkett, R.D. 1984. An ecological study of cricket frog, *Acris crepitans*. In (R.A. Seigel, L.E. Hunt, J.L. Knight, L. Malaret and N.L. Zuschlag, eds.), *Vertebrate Ecology and systematics – a tribute to Henry S. Fitch*. Museum of Natural History, The University of Kansas, Lawrence, Kansas. 89-103.
- Burns, J.F. 1982a. Species Abstract for *Vitis cinerea* Engelm. (Pigeon grape). Ohio Endangered and Threatened Vascular Plants. Abstracts of State-listed Taxa. Ohio Department of Natural Resources, Division of Natural Areas and Preserves. Available: <http://www.dnr.state.oh.us/dnap/Abstracts/U-V/viticine.htm>
- Burns, J.F. 1982b. Species Abstract for *Clitoria mariana* (Linnaeus). Ohio Endangered and Threatened Vascular Plants. Abstracts of State-listed Taxa. Ohio Department of Natural Resources, Columbus, Ohio.
- Burns, J., and A. Cusick. 1983. Species Abstract for *Cirsium carolinianum* Walter (Carolina thistle). Ohio Endangered and Threatened Vascular Plants. Abstracts of State-listed Taxa. Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Columbus, Ohio. Available: <http://www.dnr.state.oh.us/dnap/abstracts/C/cirscaro.htm>.
- Cummings, K. S., and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.
- Cusick, A. 1993. Species Abstract for *Carex juniperorum* Catling, Reznicek, and Crins (Juniper sedge). Ohio Endangered and Threatened Vascular Plants. Abstracts of State-listed Taxa. Ohio Department of Natural Resources, Division of Natural Areas and Preserves. Available at : <http://www.dnr.state.oh.us/dnap/Abstracts/C/CAREJUNI.htm>
- Cusick, A. and J. Burns. 1983. Species Abstract for *Platanthera ciliaris* (L.) Lindl. (Yellow-fringed Orchid). Ohio Endangered and Threatened Vascular Plants. Abstracts of State-listed Taxa. Ohio Department of Natural Resources, Division of Natural Areas and Preserves. Available: <http://www.dnr.state.oh.us/dnap/Abstracts/P/platcili.htm>
- Dettmers, R. P. 1997. Nesting success and habitat preferences of forest-breeding migratory passerines in southeastern Ohio. Ph.D. Dissertation, The Ohio State University, Columbus. 150 p.

- Dettmers, R. and J. Bart. 1999. A GIS modeling method applied to predicting forest songbird habitat. *Ecological Applications* 91:152-163.
- Dickson, N.J. 2002. The natural history and possible extirpation of Blanchard's cricket frog, *Acris crepitans blanchardi*, in West Virginia. M.S. Thesis, Marshall University, Huntington, West Virginia. 143 pp.
- Dunkle, S.W. 2000. Dragonflies through binoculars, a field guide to dragonflies of North America. Oxford University Press, Oxford, New York. 266 pp.
- Ewing, R. 2003a. Species viability evaluation species data collection form for the cerulean warbler. Prepared for the Wayne National Forest revision process. 30 p.
- Ewing, R. 2003b. Species viability evaluation species data collection form for the Henslow's sparrow. Prepared for the Wayne National Forest revision process. 34 p.
- Ewing, R. 2003c. Species viability evaluation species data collection form for the salamander mussel. Prepared for the Wayne National Forest revision process. 23 p.
- Ewing, R. 2003d. Species viability evaluation species data collection form for the timber rattlesnake. Prepared for the Wayne National Forest revision process. 31 p.
- Floridata. 2000. Available: [http://floridata.com/ref/M/magn\\_tri.cfm](http://floridata.com/ref/M/magn_tri.cfm)
- Gale, G. A., L. A. Hanners, and S. R. Patton. 1997. Reproductive success of worm-eating warblers in a forested landscape. *Conservation Biology* 11(1):246-250.
- Gardner, R. 2001. Species Abstract for *Carex albolutescens* Schwein.. (Pale straw sedge). Ohio Endangered and Threatened Vascular Plants. Abstracts of State-listed Taxa. Ohio Department of Natural Resources, Division of Natural Areas and Preserves. Available: <http://www.dnr.ohio.gov/dnap/Abstracts/C/carealbo.htm>
- Gilbert, P.W. 1941. Eggs and nests of *Hemidactylium scutatum* in the Ithaca region. *Copeia* 1941:47.
- Gleason, H.A., and A. Cronquist. 1991. Manual of vascular plants of northeastern United States and adjacent Canada. New York Botanical Garden, Bronx, New York. 910 pp.
- Glotzhober, R., and McShaffrey, D. 2002. The Dragonflies and Damselflies of Ohio. Ohio Biological Survey Bulletin. New Series Volume 14 Number 2. 364 pp.
- Godfrey, R.K., and J. Wooten. 1981. Aquatic and Wetland Plants of the South Eastern United States, Dicotyledons. University of Georgia Press, Athens, Georgia. 933 pp.
- Gordon, M. E., and J. B. Layzer. 1989. Mussels (Bivalvia: Unionidae) of the Cumberland River: Review of life histories and ecological relationships. USDI Fish and Wildlife Biological Report 89(15). 98 pp.

- Hamel, P. B. 2000. Cerulean warbler (*Dendroica cerulea*). In The birds of North America, no. 511 (A. Poole and F. Gill, eds.). The Birds of North America, Philadelphia, Pennsylvania, USA.
- Harris, R.N. and D.E. Gill. 1980. Joint nesting, brooding behavior, and embryonic survival of the four-toed salamander *Hemidactylium scutatum*. *Herpetologica* 36:141-144.
- Hillis, R.E., and E.D. Bellis. 1971. Some aspects of the ecology of the hellbender, *Cryptobranchus a. alleganiensis*, in a Pennsylvania stream. *Journal of Herpetology* 5:121-126.
- Hilton Pond Center. 2003. Website available:  
<http://www.hiltonpond.org/ThisWeek020408.html>.
- Hoggarth, M. A. 2001. The unionidae of the Little Muskingum River watershed in Monroe and Washington Counties, Ohio. Final Report to the Wayne National Forest, Nelsonville. 20 p.
- Holm, E. and N.E. Mandrak. 1996. The status of the eastern sand darter, *Ammocrypta pellucida*, in Canada. *Canadian Field-Naturalist* 110(3): 462-469.
- Hulse, A.C., C.J. McCoy and E.J. Censky. 2001. Amphibians and reptiles of Pennsylvania and the Northeast. Cornell Univ. Press, Ithaca, New York. 419 pp.
- Johnson, B.K., and J.L. Christiansen. 1976. The food and food habits of Blanchard's cricket frog, *Acris crepitans blanchardi* (Amphibia, Anura, Hylidae), in Iowa. *Journal of Herpetology* 10(2): 63-74.
- Johnson, G. 2003a. Species data collection form for the eastern hellbender. Prepared for the Wayne National Forest Species Viability Evaluation Process. 26 p.
- Johnson, G. 2003b. Species data collection form for the Blanchard's cricket frog. Prepared for the Wayne National Forest Species Viability Evaluation Process. 34 p.
- Johnson 2003c. Species data collection form for the four-toed salamander. Prepared for the Wayne National Forest Species Viability Evaluation Process. 26 p.
- Johnson 2003d. Species data collection form for the mud salamander. Prepared for the Wayne National Forest Species Viability Evaluation Process. 23 p.
- Jung, R. 1993. Blanchard's cricket frog (*Acris crepitans blanchardi*) in southwest Wisconsin. *Transactions of the Wisconsin Academy of Science, Arts, and Letters* 1:79-87.
- Larson, E. 2003. Species data collection form for yellow gentian, *Gentiana flavida*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 25 p.

- Martin, W. H., and J. P. Fox. No Date. The status of the timber rattlesnake (*Crotalus horridus*) in the Ironton Ranger District of the Wayne National Forest, Ohio. Challenge Cost-Share Report submitted to the USDA Forest Service. 3 pp. + maps.
- Mayasich, J., and C. Phillips. 2003. Eastern hellbender status assessment report. Project Number NRRI/TR-2003/09. 40 p. + appendices.
- McCartney, D., and M. Goodwin. 2003a. Species data collection form for the blue scorpionweed, *Phacelia ranunculacea*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 24 p.
- McCartney, D., and M. Goodwin. 2003b. Species data collection form for the juniper sedge, *Carex juniperorum*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 23 p.
- McCartney, D., and M. Goodwin. 2003c. Species data collection form for the rock skullcap, *Scutellaria saxatilis*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 24 p.
- McCartney, D., and M. Goodwin. 2003d. Species data collection form for the striped gentian, *Gentiana villosa*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 23 p.
- McCartney, D., and M. Goodwin. 2003e. Species data collection form for the butterfly pea, *Clitoria mariana*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 23 p.
- McCartney, D., and M. Goodwin. 2003f. Species data collection form for the Marshes St. John's wort, *Triadenum tubulosum*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 21 p.
- McCartney, D., and M. Goodwin. 2003g. Species data collection form for the smooth beardtongue, *Penstemon laevigatus*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 22 p.
- McCartney, D., and M. Goodwin. 2003h. Species data collection form for the sparse-lobed grape fern, *Botrychium biternatum*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 24 p.
- McCartney, D., and M. Goodwin. 2003i. Species data collection form for the tall nut rush, *Scleria triglomerata*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 22 p.
- McCartney, D., and M. Goodwin. 2003j. Species data collection form for the yellow crownbeard, *Verbesina occidentalis*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 24 p.
- McCartney, D., and S. Swiezynski. 2003a. Species data collection form for the pigeon grape, *Vitis cinerea*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 23 p.

- McCartney, D., and S. Swiezynski. 2003b. Species data collection form for the umbrella magnolia, *Magnolia tripetala*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 23 p.
- McCartney, D., and S. Swiezynski. 2003c. Species data collection form for the yellow fringed orchid, *Platanthera ciliaris*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 29 p.
- McCartney, D., and S. Swiezynski. 2003d. Species data collection form for the Carolina thistle, *Cirsium carolinianum*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 21 p.
- McCartney, D., and S. Swiezynski. 2003e. Species data collection form for the dwarf iris, *Iris verna*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 25 p.
- McCartney, D., and S. Swiezynski. 2003f. Species data collection form for the featherbells, *Stenanthium gramineum*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 22 p.
- McCartney, D., and S. Swiezynski. 2003g. Species data collection form for the lined sedge, *Carex striatula*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 24 p.
- McCartney, D., and S. Swiezynski. 2003h. Species data collection form for the pale straw sedge, *Carex absolutescens*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 20 p.
- McCartney, D., and S. Swiezynski. 2003i. Species data collection form for the pinxter flower, *Rhododendron nudiflorum*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 23 p.
- McClenahan, J. R., D. B. Houston, and E. N. Norland. 1999. Evaluation of logging best management practices on private forest lands in Ohio. Report by The School of Natural Resources, The Ohio State University and Sylvancare Forestry Consulting. 35 p. + appendices.
- Missouri Botanical Garden. 2003. Website available:  
<http://mobot.mobot.org/W3T/Search/vast.html>.
- NatureServe Explorer: an online encyclopedia of life [web application]. 2004. Version November 2003. Arlington, Virginia, USA: NatureServe. Available at:  
<http://www.natureserve.org/explorer>.
- Nickerson, M.A., and C.E. Mays. 1973. The hellbenders: North American "giant salamanders". Milwaukee Public Museum Publications in Biology and Geology 1:1-106.
- (ODNR) Ohio Department of Natural Resources. 2003a. Search for Ohio Element Occurrence Records: *Phacelia ranunculacea*. Division of Natural Areas and Preserves, Natural Heritage Data Services, Columbus, Ohio.

- (ODNR) Ohio Department of Natural Resources. 2003b. Search for Ohio Element Occurrence Records: *Carex juniperorum*. Division of Natural Areas and Preserves, Natural Heritage Data Services, Columbus, Ohio.
- (ODNR) Ohio Department of Natural Resources. 2003c. The 2003-2004 wildlife population status and hunting forecast. Division of Wildlife, Columbus, Ohio. 57 p.
- (ODNR) Ohio Department of Natural Resources. 2004. The 2004-2005 wildlife population status and hunting forecast. Division of Wildlife, Columbus, Ohio. Available at:  
[http://www.dnr.state.oh.us/wildlife/Hunting/WildlifeStatusReport\\_04/main.htm](http://www.dnr.state.oh.us/wildlife/Hunting/WildlifeStatusReport_04/main.htm) .
- (ODOT) Ohio Department of Transportation. 2002. Timber rattlesnake survey for the Nelsonville Bypass. Project HOC/ATH-US33-17.00/0.00 (PID 14040). 3 pp. + maps and photos.
- Ohio Division of Forestry. 2004. History of Ohio's Forests. Available at:  
<http://www.dnr.state.oh.us/forestry/forest/ohiogreen.htm> .
- Oklahoma University. 2003. Oklahoma Biological Survey. Available:  
[www.biosurvey.ou.edu/shrub/vicic2.htm](http://www.biosurvey.ou.edu/shrub/vicic2.htm).
- Parshall, K. J. 2002b. Species data collection form for the grizzled skipper, *Pyrgus centaureae wyandot*. Prepared for the Wayne National Forest revision process. 20 p.
- Peterjohn, B. G, and D. L. Rice. 1991. The Ohio Breeding Bird Atlas. Ohio Department of Natural Resources, Division of Natural Areas and Preserves. 416 p.
- Petranka, J. W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington D.C. 587 pp.
- Pfingsten, R.A., and F.L. Downs (eds.). 1989. Salamanders of Ohio. Ohio Biological Survey Bulletin, New Series 7(2). 315 pp.
- Plants For a Future. 1997-2000. Plants For a Future – Species Database. Available:  
[www.ibiblio.org/pfaf/cgi-bin/arr\\_html?Vitis+cinerea](http://www.ibiblio.org/pfaf/cgi-bin/arr_html?Vitis+cinerea).
- Radford, A.E., H.A. Ahles and C.R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. University of North Carolina Press, Chapel Hill, North Carolina. 218 pp.
- Reed, P.B., Jr. 1988. National List of Plant Species that Occur in Wetlands: Southeast (Region 1). U.S. Fish and Wildlife Service, Washington, D.C. 52 pp.
- Reinert, H. K. 1984. Habitat variation within sympatric snake populations. Ecology 65:1673-1682.

- Rice, D.L., and M.M. Michael. 2001. The fish fauna and distribution of the Little Muskingum River watershed and selected Ohio River tributaries in the Marietta Purchase Unit of the Wayne National Forest. Ohio Department of Natural Resources, Division of Natural Areas and Preserves. 55 pp. + appendix.
- Rich, A. C., D. S. Dobkin, and L. J. Niles. 1994. Defining forest fragmentation by corridor width: the influence of narrow forest-dividing corridors on forest-nesting birds in southern New Jersey. *Conservation Biology* 1109-1121.
- Robinson, S. K., F. R. Thompson III, T. M. Donovan, R. R. Whitehead, and J. Faaborg. 1995. Regional forest fragmentation and the nesting success of migratory birds. *Science* 267:1987-1990.
- Rodewald, A. D. 2002. Nest predation in forested regions: landscape and edge effects. *Journal of Wildlife Management* 66(3):634-640.
- Roe, K. J. 2002a. Conservation assessment for the lilliput, *Toxolasma parvus*. Department of Biological Sciences, Saint Louis University, St. Louis, MO.
- Roe, K. J. 2002b. Conservation assessment for the round hickorynut, *Obovaria subrotunda*. Department of Biological Sciences, Saint Louis University, St. Louis, MO.
- Roe, K. J. 2002c. Conservation assessment for the salamander mussel, *Simpsonaias ambigua*. Department of Biological Sciences, Saint Louis University, St. Louis, MO.
- Rosenberg, K. V., S. E. Barker, and R. W. Rohrbaugh. 2000. An atlas of Cerulean Warbler Populations. U.S. Fish and Wildlife Service.
- Rosenberg, K. V., R. S. Hames, R. W. Rohrbaugh, Jr., S. B. Swarthout, J. D. Lowe, and A. A. Dhondt. 2003. A land manager's guide to improving habitat for forest thrushes. The Cornell Lab of Ornithology. 29 p.
- Saughey, D.A. and S.E. Trauth. 1991. Distribution and habitat utilization of the four-toed salamander, *Hemidactylium scutatum*, in the Ouachita Mountains of Arkansas. *Proceedings of the Arkansas Academy of Science* 45:88-91.
- Schaeffer, B. 2003a. Species data collection form for the green-faced clubtail. Prepared for the Wayne National Forest Species Viability Evaluation Process. 27 p.
- Schaeffer 2003b Species data collection form for the rapids clubtail. Prepared for the Wayne National Forest Species Viability Evaluation Process. 27 p.
- Schneider, G. 1994. Species Abstract for *Magnolia tripetala* (L.) L. (Umbrella magnolia). Ohio Endangered and Threatened Vascular Plants. Abstracts of State-listed Taxa. Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Columbus, Ohio. Available: <http://www.dnr.state.oh.us/dnap/abstracts/M-N/MAGNTRIP.htm>.

- Smith, C.L. 1985. The inland fishes of New York State. New York State Department of Environmental Conservation. Available:  
<http://www.sarep.cornell.edu/Sarep/fish/Percidae/sanddarter.html>.
- Smith, D. J. and C. R. Smith. 1992. Henslow's Sparrow and Grasshopper Sparrow: a comparison of habitat use in Finger Lakes National Forest, New York. Bird Observer 20:187-194.
- Spooner, D. 1983. Species Abstract for *Scutellaria saxatilis* (Riddell). Ohio Endangered and Threatened Vascular Plants. Abstracts of State-listed Taxa. Ohio Department of Natural Resources, Columbus, Ohio.
- Spooner, D. 1985. Species Abstract for *Phacelia ranunculacea* (Nutt.) Constance. Ohio Endangered and Threatened Vascular Plants. Abstracts of State-listed Taxa. Ohio Department of Natural Resources, Columbus, Ohio.
- Spooner, D. and G. Schneider. 1994. Species Abstract for *Magnolia tripetala* L. (Umbrella magnolia). Ohio Endangered and Threatened Vascular Plants. Abstracts of State-listed Taxa. Ohio Department of Natural Resources, Division of Natural Areas and Preserves. Available:  
<http://www.dnr.state.oh.us/dnap/Abstracts/M-N/MAGNTRIP.htm> .
- Stephens, S. E., D. N. Koons, J. J. Rotella, and D. W. Willey. 2003. Effects of habitat fragmentation on avian nesting success: a review of the evidence at multiple spatial scales. Biological Conservation 115:101-110.
- Steyermark, J.A. 1963. Flora of Missouri. Iowa State University Press, Ames, Iowa. 1725 pp.
- Taber, C.A., R.F. Wilkinson, Jr., and M.S. Topping. 1975. Age and growth of hellbenders in the Niangua River, Missouri. Copeia 1975:633-639.
- Ultsch, G.R. and Duke, J.T. 1990. Gas exchange and habitat selection in the aquatic salamanders *Necturus maculosus* and *Cryptobranchus alleganiensis*. Oecologia 83(2):250-258.
- USDA Forest Service. 1988. Wayne National Forest monitoring and evaluation report. 9 p.
- USDA Forest Service. 2001. Pine Creek ecosystem analysis. Wayne National Forest, Ohio.
- USDA Forest Service. 2002. Little Muskingum River ecosystem analysis and hydrologic condition analysis, Wayne National Forest, Ohio.
- (USFWS) U. S. Fish and Wildlife Service. 2002. Status assessment for the sheepnose, *Plethobasus cyphus*, occurring in the Mississippi River system (U. S. fish and Wildlife Service Regions 3, 4, and 5). 83 p.
- Vitz, A. C. 2003. Use of regenerating clearcuts by mature-forest birds during the post-breeding period. M. S. Thesis, The Ohio State University, Columbus. 132 p.

- Wallace, R.S. 1984. Use of sphagnum moss for nesting by the four-toed salamander, *Hemidactylium scutatum* Schlegl. (Plethodontidae). Proceedings of the Pennsylvania Academy of Science 58:237-238.
- Watters, G. T. 1988. The naiad fauna of selected streams in Ohio: (I) Stillwater River of Miami River; (II) stream systems of south central Ohio from the Little Miami River to the Hocking River, excluding the Scioto River proper. Final report to the Ohio Department of Natural Resources, Division of Wildlife, Columbus. 439 pp.
- Watters, G. T. 1995. A Guide to the Freshwater Mussels of Ohio. Ohio Division of Wildlife, Division of Wildlife.
- Williams, R.D., J.E. Gates, C.H. Hocutt, and G.J. Taylor. 1981. The hellbender: a nongame species in need of management. Wildl. Soc. Bull. 9(2):94-100.
- Wood, J.T. 1955. The nesting of the four-toed salamander, *Hemidactylium scutatum* (Schlegel), in Virginia. The American Midland Naturalist 53:381-389.
- Wu, J. 2003a. Species data collection form for the eastern sand darter. Prepared for the Wayne National Forest Species Viability Evaluation Process. 29 p.
- Wu, J. 2003b. Species data collection form for the little spectaclecase mussel. Prepared for the Wayne National Forest Species Viability Evaluation Process. 27 p.
- Wu, J. 2003c. Species data collection form for the Ohio lamprey. Prepared for the Wayne National Forest Species Viability Evaluation Process. 27 p.
- Wu, J. 2003d. Species data collection form for the western lake chubsucker. Prepared for the Wayne National Forest Species Viability Evaluation Process. 28 p.

---

## References

- Wayne National Forest Fish Database developed for the 2002 Watershed Integrity Analysis for the Wayne National Forest.
- March 1, 2004 memo from Forest Supervisor Mary Reddan to Fish and Wildlife Service Field Supervisor Mary Knapp regarding reinitiation of formal consultation on the 1988 Forest Plan.
- Ohio Land Use Cover (LandSat TM). 1994.
- National Land Cover Database. 1992.

---

## Personal Communications

- Lynda Andrews, District Wildlife Biologist. Wayne National Forest, Athens Ranger District.

Judy Dumke. Taxonomic expert with input into Species Viability Evaluations.

Ryan Evans, Database Administrator. Western Pennsylvania Conservancy, 209 Fourth Avenue, Pittsburgh, PA 15222

Mike Freidhof, Assistant District Ranger for Natural Resources. Wayne National Forest, Ironton Ranger District.

Rick Gardner. Heritage Botanist. Ohio Department of Natural Resources, Department of Natural Areas and Preserves. 2045 Morse Rd. Building F-1, Columbus, Ohio.

Phil Perry, Forest Silviculturist. Wayne National Forest.

Francis Rothwein, District Wildlife Biologist. Ouachita National Forest, Cold Springs Ranger District.

Ted Schenck, Regional Planning Biologist. USDA Forest Service Eastern Region, Milwaukee, Wisconsin – transferred to the Rocky Mountain Regional Office.

Sarena Selbo, Endangered Species Biologist, U. S. Fish and Wildlife Service, Division of Ecological Services. 6950 Americana Parkway, Suite H, Reynoldsburg, OH 43068-4127.

SVE Sedges Panel. Comprised of Judy Dumke and Rick Gardner.

Angela Zimmerman, Endangered Species Biologist. U. S. Fish and Wildlife Service, Division of Ecological Services. 6950 Americana Parkway, Suite H, Reynoldsburg, OH 43068-4127.



## Appendix G

# Oil and Gas Management

This appendix contains an evaluation of the reasonably foreseeable future development for oil and gas resources under the Wayne. The Division of Mineral Resources of the Milwaukee Field Office Bureau of Land Management prepared this Reasonably Foreseeable Development Scenario for the WNF, completing it in January 2004.

Lease-specific oil and gas Notifications and Stipulations, which may be added to the standard BLM lease terms for specific parcels that might be leased on the WNF, are listed in Appendix H of the Plan.

---

## Reasonably Foreseeable Development Scenario for Oil and Gas

Increased national demand for energy has increased the price producers receive at the wellhead. Consequently there is increased industry interest in drilling wells on federally owned surface in the WNF. Federally owned surface in the WNF overlies a mix of mineral estate that is classified as either federal, reserved, outstanding, or a combination thereof. Based upon a survey of local oil and gas producers, a forecast of the total number of new wells and associated surface disturbance that will likely occur on federal surface over the next 10 years, regardless of mineral classification, is shown in the following table for each of the three organizational units of the Forest

**Table G - 1. New wells and associated surface disturbance that will likely occur on federal surface over the next 10 years.**

	<b>Athens Unit</b>	<b>Marietta Unit</b>	<b>Ironton Unit</b>
Number of new wells drilled over next 10 years	24	110	100
Miles of new access road needed	5	21	19
Total acres of surface disturbed by oil & gas drilling activity before reclamation	27	135	110
Total acres of surface needed to support drilled wells that are completed for production (excess disturbance reclaimed)	11	59	51
Number of depleted wells plugged over next 10 years	82	26	0
Total acres reclaimed by plugging depleted wells	45.1	14.3	0

Federally owned minerals make up about 40 percent of the mineral ownership in the WNF. The significance of the amount of federal minerals lies in the fact that it represents the only class of mineral estate the Forest Service has control over whether or not to make the lands available for oil and gas development. The above projection of activity assumes that:

- All federal minerals in the Forest are available for lease (unless precluded by law)
- All federal minerals are timely leased upon request with only standard lease stipulations
- Drilling permits on federal minerals are timely processed
- Oil and gas prices remain at or above current levels.

### **Petroleum Geology of the WNF**

In the case of the WNF, neither the petroleum geology nor its interpretation has changed since it was described in the 1992 Amendment #8 to the WNF and Resource Management Plan. There are three major oil and gas exploration targets on the Forest: the Berea Sandstone, the Ohio Shale, and the “Clinton”-Medina. There also continues to be a number of shallow secondary production zones, particularly in the Marietta Unit, that offer operators a chance to complete a producing well even if they fail to find commercial quantities of oil and gas in one of the three major targets. And finally, there continues to be a remote possibility for commercial potential in the deeper formations such as the Trenton-Black River Dolomite, the Glenwood Sandstone, the Beekmantown Dolomite, the Rose Run Sandstone, and the Mt. Simon Sandstone. For a more complete discussion of the petroleum geology of the WNF, please refer to Appendix B of Amendment #8 – WNF Land and Resource Management Plan.

The extensive history of oil and gas development in the WNF has generated enough geologic data to suggest there is potential for occurrence of hydrocarbons virtually everywhere in the Forest. The geologic analysis necessary to determine specific areas of the Forest considered “high” potential is beyond the scope of this report. However, the definition of “developmental well” used by the American Association of Petroleum Geologists (AAPG) can be used to make a simplified determination of areas that are high potential and therefore more likely to be drilled upon. AAPG defines a “developmental well” as a well completed in a known oil and gas bearing formation within one mile of any well completed in the same formation. Alternately, a well drilled to a formation not usually known to be oil and gas bearing, or is located more than one mile from the nearest well completed in the same formation is classified as an “exploratory well.” The significance of developmental versus exploratory wells is in their respective success rates. In Ohio, the statewide success rate for developmental wells in 2002 was 86.5 percent versus 46.5 percent

for exploratory wells. In the WNF, there is 127,400 acres, or 53.2 percent of the entire Forest, within one mile of an existing producing well, and therefore, can be considered to be high potential for hosting a well location. Of course, as new wells are completed the high potential area expands.

### **Mineral Ownership and Leasing**

Table 3.1 in Chapter 3 of the Draft EIS summarizes the complex surface and mineral ownership situation in the Wayne. Presently, of the 239,497 acres of surface managed by the Forest Service, 60 percent of the mineral estate is privately owned and 40 percent is federally owned. The percentages of mineral ownership in the Forest will change over time as some mineral rights revert from private to federal ownership and as new mineral estate is acquired by the Forest Service. While the Forest Service has complete discretion over most surface disturbing activities on federal surface/federal minerals, it is restricted in its ability to control when and where mineral development occurs on federal surface/Private minerals. Regardless of the degree of Forest Service authority over the two basic types of mineral ownerships, the projections of new drilling activity contained in this report are made without regard to mineral ownership.

For both federal and private minerals, a lease is generally the legal instrument that conveys the right to drill on a tract of land. No lease, no drilling. We know that just over 21 percent (139 leases) of the 96,246 acres of federally owned minerals are presently leased. There are 307 existing leases on the 143,251 acres of privately owned mineral estate beneath federal surface. Although there is no available estimate of how acreage is encompassed by the 307 leases, it is reasonable to assume it is considerably more than the amount of federal minerals leased. Regardless of the current status of leased lands, the projections of new drilling activity contained in this report assume that all lands are leased in accordance with federal guidelines for preparing base development scenarios.

## Well Spacing

The State of Ohio has rules governing the location of wells, or “spacing” requirements. Spacing establishes how many wells can be drilled within a given field or pool. Spacing requirements vary by depth as reflected in Table G - 2:

**Table G - 2. State of Ohio Spacing Requirements.**

Depth to oil & gas pool	0 to 1,000 Ft.	1,000 to 2,000 Ft.	2,000 to 4,000 Ft.	Over 4,000 Ft.
Minimum acres of tract or drilling unit hosting well	1	10	20	40
Minimum distance between other wells in the same pool	200'	460'	600'	1,000'
Minimum distance from any boundary of subject tract or drilling unit	100'	230'	300'	500'

The distance and acreage requirements shown above apply to the actual location of the bottom of the drilled well, or bottomhole location. Given the availability of directional drilling techniques, it is possible for a surface location to be offset from its intended bottomhole location. The State may grant exceptions to its spacing requirements but such exceptions are rare and must be technically justified. In addition to the above bottomhole restrictions, the wellheads of all newly drilled wells, regardless of depth:

- Cannot be closer than 50 feet to the traveled portion of a road which is considered to be the berm of the roadway
- Must have a 100-foot minimum setback requirement from homes.

It is important to keep in mind that the spacing requirements are *minimum* distances and acreages. Factors such as terrain, surface/mineral ownership issues, economics, and operator preference can contribute to the actual well spacing being greater than State minimums. For example, even though the State spacing requirements for Clinton wells in Lawrence County call for a minimum drilling unit size of 20 acres, one operator in the area reports using drilling units 60 to 70 acres in size.

In areas of the WNF where there are multiple potentially productive zones at varying depths, the potential exists for a higher density of wells due to overlapping spacing units. Two wells could be located side by side and still satisfy spacing requirements because they are completed at different depths. However, operators will seek to produce multiple formations within a single wellbore whenever possible rather than incur the expense of drilling another well.

The majority of the foreseeable drilling targets within the WNF are between 2,000 to 4,000 feet deep, which means most new wells will be drilled on a minimum density of one well per 20 acres. In addition, there is growing interest in drilling to the Clinton-Medina Formation in the Marietta Unit, which lies over 4,000 feet deep and requires a minimum density of one well for every 40 acres.

### Directional/Horizontal Drilling

The Oil and Gas Potential Analysis contained in the 1992 Amendment #8 to the WNF Forest Plan concluded that directional or horizontal drilling would not be economically feasible in the Forest. It further stated that given the unwillingness of operators to use directional drilling methods, applying no surface occupancy restrictions on tracts over 20 acres in size would in effect, prevent the tract from being developed.

Since 1992, there have been a dozen wells drilled and completed using directional drilling methods in the 12 county area where the WNF is located. None of these wells were drilled on the Forest. Ten of the 12 wells were drilled to target formations over 4000 feet deep while the remaining two wells used horizontal drilling technology in formations that were 2,200 to 2,700 feet in depth. The operators of the two shallower horizontal wells reported technical problems that needed to be resolved before use of horizontal techniques can be considered economically feasible. This kind of operator feedback coupled with the fact that only 12 wells out of 1,704 permitted during the 10 year period were directional wells, suggest that this type of technology is still not yet economically feasible within the WNF.

### Typical Surface Disturbance

#### Access Roads

Each new well will require an adequate access road to accommodate the large, heavy equipment needed to drill the well. Adequate access can be provided by:

- Using existing roads, some of which may need upgrading
- Constructing a new road
- A combination of both.

Experience has shown that in areas, such as the WNF, where wells only produce marginally economic quantities, operators tend to seek surface locations that minimize the amount of access road that needs to be constructed. For analysis purposes, it will be assumed that an average of 1000 feet of new access road will be constructed for each new well drilled. Road construction will require clearing a width of 24 feet to provide a “running” surface of 16 feet. If the involved well is completed for production, disturbance beyond the “running” surface will be re-vegetated

leaving 0.38 acres of net surface disturbance for the average road. The access road remains in place to provide all weather access to the well and its facilities for the life of the well.

### Well Pads/ Production Facilities

Typically a new well drilled in the WNF will require, on average, a 0.69-acre well-pad area (150 by 200 ft.) to be cleared and leveled. Wells drilled to formations over 5,000 feet deep use a larger drill rig and would need a 1.1 acre (250 by 200 ft.) well pad area cleared.

If commercial quantities of oil and/or gas are discovered, roughly a 50-by-50 foot portion of the disturbed well pad is used to set up the piping, tanks, and production equipment necessary to produce the well. Additional area of the pad will also be used as a turnaround area used for inspection and maintenance vehicles/equipment. This report assumes that about 25 percent of the disturbed pad area (0.17 acres) will remain in use for the producing life of the well. The balance of the pad area not needed for production is then revegetated.

In some instances, the production facilities are remotely located from the wellhead in order to be closer to an all weather road. Whenever this occurs, well fluids are transported from the wellhead to the facility by a pipeline. The pipeline may be buried or laid on the surface.

### Dry Holes

If oil and gas are not found in commercial quantities, the drilled wellbore is plugged with cement. The well pad and access road are restored to original contour and all disturbed area reseeded. The operator must ensure that vegetation is satisfactorily established over the affected areas to stabilize the soil and prevent erosion.

## Typical Oil and Gas Operations

### Drilling Operations

Initially, heavy earth moving equipment is used to build the access road and well pad. Topsoil is stockpiled for use in reclaiming areas not needed during the production phase. A large “reserve” pit is dug on the well pad. Material excavated from the pit during construction is stockpiled on-site to backfill the pit when drilling is finished.

The majority of wells will be drilled by a rotary rig. Less commonly, wells will be drilled by a cable tool rig. Both types of rigs are powered by diesel engines. During drilling, the mast of a rotary rig extends from 80 to 100 feet in height. Since drilling is a continuous operation until the total depth of the well is reached, the lights and engine noise from the rig are evident throughout the day and night. It takes a rotary rig about 3 to 5 days to drill a typical well on the WNF.

Cable-tool rigs use a weighted tool which chips away at the rock as the percussion tool is moved up and down on the end of a steel cable. A small amount of water is poured into the hole to suspend the cuttings while drilling progresses. After about 5 feet of hole have been drilled, the bit is pulled to the surface and a “bailer” is lowered to the bottom of the drilled hole to remove the cuttings. The cuttings are then dumped into the reserve pit. Cable tool rigs use less equipment than rotary rigs and can operate in about half the space as a rotary rig. Cable tool rigs take over four times as long to drill a well as a rotary rig, which is why their use is not common.

Rotary rigs use a toothed, tricone cutting bit mounted on successive lengths of rotating drill pipe to drill the hole. Either a water-based mud (with additional conditioning agents as needed) or compressed air is used as the circulating agent. In a mud based system, pumps direct mud down the drill pipe, back up the hole, and out to the reserve pit where the rock fragments will settle. In a compressed air system, air compressors direct air down the drill pipe, thereby forcing the rock cuttings up the well bore and into the reserve pit. The air compressors are either self-contained as a part of the drill rig or a separate independently-powered component. Even with air drilling systems, the operator will keep drilling clay (i.e. bentonite) and a tank of water at the drill site in case conditions require converting to a mud-based system.

As the well is deepened, using one of the above methods, steel pipe called casing will be periodically cemented into the hole along its length to seal the rock formations and their native fluids from the drilling (and later producing) environment. Federal regulations require casing to be installed in a manner that will protect fresh water zones and isolate other zones which contain oil, gas, and water. Casing is also used to seal off potentially valuable minerals, such as coal seams, and other underground features, such as caves, vugs, or large fractures.

Federal regulations require that the rigs be equipped with blow-out preventers which are capable of preventing the hole from an uncontrolled flow in case a high pressure zone is encountered. Drilling in the Wayne has not encountered high pressure zones. Anticipated pressures are 0.4 to 0.5 psi per foot of drilling depth or less. No other unusual or difficult geologic conditions are anticipated while drilling.

During drilling and immediately after total depth is reached, a variety of testing devices are placed down the hole on a wire cable. These are used to determine rock characteristics and to ascertain the presence of hydrocarbons. In the event of a commercial discovery, the drill rig is moved off the site and a smaller truck mounted rig and two to three 400-barrel tanks are moved onto the site to begin the completion phase. Specialized trucks pump water or nitrogen mixed with sand or a mild acid into the well to fracture the producing formation to increase its flow rate. A large amount of the fluid volume that is pumped into the well is “flowed

back” into the tanks that were brought on site. Completing a well usually begins shortly after the hole is drilled, but may be delayed for several weeks pending availability of equipment. The truck mounted completion equipment is typically removed from the site in one to three days. The tanks may remain for a longer period until the well is “cleaned up”, that is, most of the injected fluid is recovered. Either during or shortly after the completion process, the production facility is constructed. At this time, the reserve pit is backfilled and the portion of drill pad not necessary for the production phase is revegetated. Then the access road is often upgraded at this time to provide all-weather, year-round access to the wellhead and production facility. This includes revegetating the portion of the roadway beyond the running width.

### Production Operations

The typical producing oil well and its associated production facility consists of one or two 100-barrel steel oil/water storage tanks surrounded by an earthen dike, a pump-jack and motor to bring the oil to the surface, an electric line to run the motor, a separator (a vessel that separates the raw well stream into oil, gas, and water), and if gas is being produced with the oil, a gas meter. If an electric source isn't readily available, pumpjack motors can be run by natural gas drawn off the well. A typical producing gas well and its facility typically consist of an assortment of valves on the wellhead, a 100-barrel tank for produced water, a separator, and a gas meter.

Hydrocarbons are transported from the wellbore to the production equipment by means of varying lengths of 2-inch diameter pipe. Where feasible, pipelines are buried at least 24 inches below the ground surface. There may be a permanent flare to dispose of small quantities of natural gas that are not economic to sell. When natural gas can be marketed, gathering pipelines transmit the gas from the production facility to secondary collector lines and on to main transmission lines. Given the long history of gas production in the WNF, there is already a well developed pipeline infrastructure in place which should minimize the need for lengthy gathering lines to service new wells.

Water produced along with the oil and gas is generally salty and sometimes sulphurous. Federal and State regulations require this saltwater, or brine, to be properly disposed of. The most common method of disposal in Ohio is for the brine to be trucked to a State-licensed disposal well where it is injected into underground formations already containing brine. A less common disposal method allowed in certain townships is road spreading of brine for the purpose of dust and ice control. Producing wells in the WNF typically produce only small amounts of brine.

Access to the site will probably be through a locked gate located at the start of the lease access road. The company employee, called a “pumper”, regularly inspects and maintains the well and facility. Tanker trucks will pick up oil and/or salt water from the production tanks on a schedule determined by the volumes produced.

Occasionally, producing oil and gas wells experience mechanical problems in the wellbore that require a process called a “workover”. A workover involves bringing a smaller service rig to the location to perform any needed service on the well. Workovers take place on the existing well pad and sometimes may require a small pit to contain any fluids circulated from the wellbore. After the workover is complete, any fluids remaining in the pit are vacuumed out and disposed of in accordance with State requirements. The pit is then backfilled and revegetated as appropriate.

### **Abandonment and Final Reclamation**

Permanent abandonment of depleted producing wells is required by both Ohio and federal regulations to occur quickly after all oil and gas operations have ceased. If there will be an excessive interval of time between one phase of activity and another, federal and State regulations require that the well be temporarily plugged.

Because of the shallow depths and lack of geologic hazards, well plugging operations can typically be completed within three days on wells located in the WNF. Activity at the site will entail use of a smaller truck mounted service rig and several large trucks which will be used for the retrieval of well casing and the placement of cement plugs and hydrostatic mud in the bore hole. All horizons of hydrocarbon occurrence, unusual water flows, and fresh water zones will be sealed from the bore hole by the cement plugs. Remaining surface equipment is removed at this time. Surface restoration and reclamation should be completed within 1 year of well abandonment.

### **Production History and Life Expectancy of Producing Fields**

The average life expectancy of producing wells within the Wayne is fifteen to thirty years, with the notable exception of the Ohio Shale, where life expectancy is twenty five to forty years. Numerous examples can be given on both ends of the life expectancy spectrum, including wells that have been produced continuously since the early 1900s to economic wells which never produce due to legal hindrances.

With the exception of the Ohio Shale, all of the formations underlying the Wayne will produce at a relatively high rate for the first few years, and after experiencing a rapid decline in production they will continue to produce at a low rate for the remainder of a well's life. Production from the Ohio Shale is typified by a relatively long well life with only a minor decline in production throughout its production history. Production will

usually continue until the operator determines that the well will no longer produce enough hydrocarbons to pay for the day to day operating expenses.

### General Development Trends

Information on well completions in the 12 counties where the WNF is located were examined for development trends that may impact Forest lands. The 30-year period from 1973 to 2002 were broken up into three separate 10-year periods to look at timeframes that are equivalent to Forest planning periods. The results of this breakdown are as follows:

- **For the period 1973 to 1982** – A total of 1,861 wells were completed in the twelve subject counties. Of this total, 600 wells, or 32.24 percent, were completed within the Forest proclamation boundary. Of the wells drilled within the Forest proclamation boundary, 121 wells, or 20.17 percent, were completed on surface managed by the Forest Service.
- **For the period 1983 to 1992** – A total of 4,924 wells were completed in the twelve subject counties. Of this total, 1,073 wells, or 21.79 percent, were completed within the Forest proclamation boundary. Of the wells drilled within the Forest proclamation boundary, 213 wells, or 19.85 percent, were completed on surface managed by the Forest Service.
- **For the period 1993 to 2002** – A total of 1,180 wells were completed in the twelve subject counties. Of this total, 330 wells, or 27.97 percent, were completed within the Forest proclamation boundary. Of the wells drilled within the Forest proclamation boundary, 22 wells, or 6.67 percent, were completed on surface managed by the Forest Service.

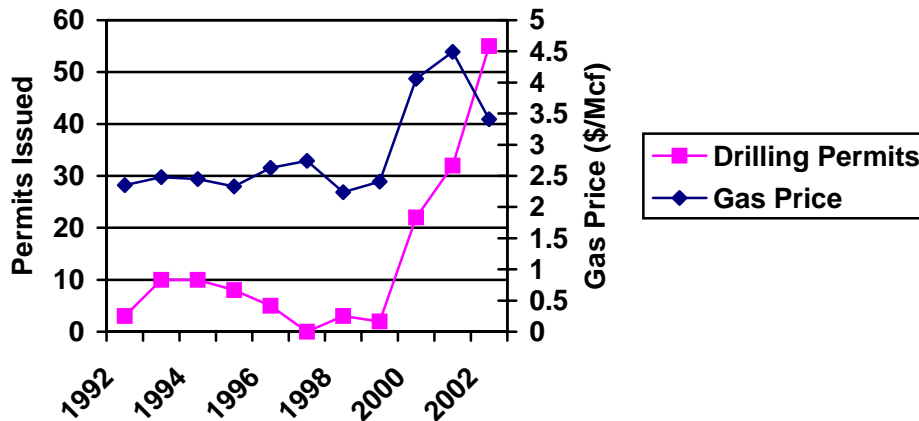
This information suggests that for the past 10 years, oil and gas drilling on federally owned surface has been lagging behind the average drilling pace on Forest Service surface of the previous twenty years. From this, one could conclude that there is increased potential for drilling sites on federally owned surface in the WNF. Whether or not that potential is realized will depend on the availability of WNF lands, the ability of Forest Service and BLM to respond to requests to drill, and energy prices.

### Development Forecast for the Ironton Unit

Two principal potentially productive targets present throughout the Ironton Unit are the Ohio Shale, and the Clinton-Medina. Secondary targets present throughout the Ironton Unit consist of the Glenwood, the Beekmantown, the Rose Run, and the Mt. Simon formations. In addition, the Ironton Unit has the potential for minor production from the Berea and other shallow zones as they are intersected in wells being drilled to one of the aforementioned primary or secondary targets. Natural gas is produced

from these target formations, except for formations above the Berea where oil may also be produced.

In 1992, there were no wells on federal surface ownership in the Ironton Unit. At that time, the Forest plan projected that by the year 2000 there would be 5 wells on Forest Service surface. That projection proved to be fairly accurate as there were actually 6 wells located on Forest Service surface in 2000. For the period 1992 -1999, both the projected and actual well totals for the Ironton Unit reflected low natural gas prices that did not exceed \$2.74 per thousand cubic feet (Mcf). However, beginning in 2000, the average annual wellhead price jumped to \$4.06/Mcf, which sparked a significant increase in drilling activities in Gallia, Jackson, and Lawrence Counties. The connection between drilling permits issued in the three aforementioned counties and natural gas pricing since 1992 is shown in the **Figure G - 1**:



**Figure G - 1. Gas Price vs. Permits Issued in Gallia, Jackson, and Lawrence Counties.**

Still, the majority of the increase in activity in the three-county area over the last three years has not been on Forest Service surface. This is likely due to the fact that only 4.2 percent of federal mineral estate in the Ironton Unit is presently leased even though the Ironton Unit has more federally owned mineral estate than the Athens and Marietta Units combined. However, current gas prices coupled with the amount of undeveloped mineral estate within the Ironton Unit leads one to reasonably expect an increase of activity on Forest Service surface. This was demonstrated in February 2003, when applications were filed to drill 6 wells to test the Clinton formation on existing federal leases in Aid Township, Lawrence County. Later in 2003, a request was submitted to the Bureau of Land Management to lease an additional 11,000 acres for oil and gas in the Ironton Unit.

One major operator has a significant lease position in the area and possess the financial and technical resources to initiate and sustain an active

drilling program. Although only a relatively small number of companies currently operate in the vicinity of the Ironton Unit, positive drilling results would likely spur additional leasing and drilling interest in the Unit. Members of the industry were surveyed about their future development plans on federally owned surface. Based on that survey it is reasonable to expect up to 100 wells could be drilled on Forest Service surface in the Ironton Unit over the 10-year planning period.

### Success Ratio

All of the wells drilled in Lawrence and Gallia Counties in 2002 were classified as “developmental” wells, as defined on page 2 of this report. Developmental wells in Lawrence County enjoyed a 95.6 percent success ratio (i.e. percent productive) while those in Gallia County were 88.9 percent productive. Should any exploratory wells (as defined on page 2) be drilled in the area, it is expected they would experience a success ratio similar to the statewide average for exploratory wells which was 46 percent in 2002.

Assuming all of the projected wells drilled in the Ironton Unit would be developmental wells, the local success ratios suggest that we could expect 8 of the projected total wells drilled would be unproductive or “dry holes”. Dry holes are immediately plugged upon completion of drilling and the associated well pad and access road would be reclaimed to a stabilized vegetated state.

### Abandonment of Depleted Producers

With only 10 producing wells currently in the Ironton Unit, it would not be meaningful to perform a statistical analysis based on the history of depleted producing wells plugged in the local counties over the past 10 years. This report assumes that there will be no depleted producing wells plugged over the planning period.

### Projected Surface Disturbance

Using the number of new wells projected in the aforementioned section and the typical amount of surface disturbance associated with drilling new wells less than 5,000 feet in depth, it is estimated that oil and gas activity in the Ironton Unit for the planning period will result in:

- 19 miles of new access road construction
- 41 gross acres of surface disturbance for road construction
- 17 miles of roads equating to 35 net acres of surface disturbance to service 92 producing wells
- 69 gross acres of surface disturbance for well pad construction
- 16 net acres of surface disturbance for turnaround/production facility areas to service 92 producing wells.

### Gas Storage Potential

The development scenario in the 1992 Amendment #8 to the WNF Land and Resource Management Plan discussed the potential for gas storage but concluded that gas storage operations would not likely occur before 2020. Since then, the BLM has had no expressed interest in gas storage within the Ironton Unit. Accordingly, it is reasonable to expect that there would be no gas storage related activities on the Ironton Unit over the course of the planning period.

### Development Forecast for the Marietta Unit

The three major exploration targets within the Marietta Unit are, in descending order, the Berea, the Ohio Shale, and the Clinton-Medina. More than any other unit of the Forest, the Marietta Unit has a number of shallow targets that serve as “back-up” completion formations in the event a well is not successful in being completed in its primary target. In Monroe County, the major targeted reservoir for 2002 drilling activity was the Ohio Shale at an average depth of 2,490 feet. The Clinton-Medina has just recently become a regular target in Washington County as the price of gas has increased. The average depth drilled to reach the Clinton-Medina in Washington County in 2002 was 5,395.

In 1992, there were 634 wells on federal surface in the Marietta Unit (including outstanding, reserved, and federal mineral rights). At that time, it was projected that by the year 2000 there would be 700 wells on Forest Service surface. As of 2003, there are actually 921 wells located on Forest Service surface, 45 percent more wells than existed in 1992, and 31.6 percent more than projected. Remarkably, from 1992 to 2000, only 7 new wells were drilled on Forest Service surface during the period. The remainder of the increase in the well total was existing wells on lands purchased by the Forest Service during the period.

Despite a 140-year long history of oil and gas production, Washington and Monroe Counties have continued to experience significant drilling activity over the past 10 years. Washington County has consistently been one of the top 10 Ohio counties for permits issued and wells drilled. Monroe County ranked 12<sup>th</sup> in wells drilled in 2001 and moved up to 5<sup>th</sup> in 2002. With only 7 wells on federal surface over the last 8 years, the extensive drilling in Washington and Monroe Counties has not significantly impacted the WNF. This lack of drilling activity in the Marietta Unit is most likely attributed to operator’s disdain for the additional paperwork and operating requirements associated with being on Forest Service surface and their unwillingness to wait for the necessary authorization to begin their projects (The average time to receive a drilling permit from the Ohio Division of Oil and Gas was 12.6 days in 2002 compared to Forest Service processing times requiring from 60 days to one year.). However, given the continuing prospect of higher energy prices, the prospect of

higher revenues will be incentive enough for operators to brave the federal bureaucracy.

Seven local producers with extensive experience in operating in the Marietta Unit were surveyed in order to project how much drilling activity could be expected on Forest Service surface over the next 10 years. Their responses were optimistic about the prospect of drilling wells on Forest Service surface, reflecting the belief that energy prices will remain strong for some time. Taking into account the thoughts of these producer's, current prices, and the strong industry interest in Washington and Monroe Counties, it is reasonable to expect that up to 11 wells per year could be drilled on Forest Service surface in the Marietta Unit. Over the 10-year planning period, this would yield up to 110 total new wells drilled.

### Success Ratio

Any well drilled within the Marietta Unit would be classified as a developmental well as the entire Unit is within one mile of an existing producing well. In 2002, developmental wells in Monroe County had a 96.4 percent completion rate, while Washington County had a 100 percent completion rate. Even wells drilled to the Clinton formation, which generally are exploratory wells in the Marietta Unit and subject to a lower success ratio, would likely be completed in a shallower zone if commercial quantities of hydrocarbons are not found in the Clinton. This report will assume that 98 percent of new wells drilled in the Marietta Unit, or 108 wells, will be completed as producers.

### Abandonment of Depleted Producers

Although wells in the Marietta Unit have unusually long producing lives, Washington and Monroe Counties had 281 wells plugged from 1993 to 2002. Assuming a similar rate of plugging and considering the Marietta Unit occupies about 9 percent of the total area of these two counties, this report projects that 26 depleted producers would be plugged over the life of the plan. Using 0.55 acres as the average amount of net surface disturbance associated with a producing well (e.g., 0.38 acres of road and 0.17 acres of well pad), plugging 26 depleted producers will result in 14.3 acres of restored surface over the life of the plan.

### Projected Surface Disturbance

Of the total number of wells projected for the Marietta Unit, it is estimated that 30 percent, or 33 wells, would be drilled deeper than 5,000 feet which would require a 1.1-acre drill pad to be constructed. The remaining 77 wells would be less than 5,000 feet in depth and require construction of the smaller 0.69-acre drill pad. Using these wells estimates and assuming an average 1,000 feet of new access road is constructed per well, it is estimated that oil and gas activity in the Marietta Unit for the planning period will result in:

- 21 gross miles of new access road construction
- 46 gross acres of surface disturbance for road construction
- 20 net miles of roads equating to 41 net acres of surface disturbance to service 108 producing wells
- 89 gross acres of surface disturbance for well pad construction
- 18 net acres of surface disturbance for turnaround/production facility areas to service 108 producing wells.

As noted in the previous section, the land reclaimed by plugging depleted producers will offset the surface disturbance associated with drilling new wells and produce a net gain in reclaimed surface.

### Development Forecast for the Athens Unit

The principal exploration targets of the Athens Unit are, in descending order, the Berea and Clinton-Medina formations. The Clinton-Medina is less than 4,000 feet deep in the Athens Unit equating to a minimum drilling unit size of 20 acres per well. There is potential for production from formations shallower than the Berea, but to date no significant production has been established from these zones in the area. There is also potential for production deeper than the Clinton-Medina, but drilling below the Clinton has been rare for the area and is not expected in the foreseeable future.

In 1992, there were 413 wells located on Forest Service surface in the Athens Unit (including outstanding, reserved, and federal mineral rights). At that time, it was projected that by the year 2000 there would be 453 wells on Forest Service surface. As of 2003, there are actually 315 wells located on Forest Service surface, a reduction of 23.7 percent from the number of wells than existed in 1992. The number of new wells drilled has not kept pace with the number of wells plugged in the Athens Unit. For example, in 2002 there were only four new wells drilled in Athens, Hocking, Perry, and Vinton Counties combined. Alternately, there were 46 wells plugged in Perry County alone in 2002 and a total of 165 well pluggings in the county over the last three years.

Seven producers with a history of operating in the area were surveyed in order to project how much drilling activity could be expected on Forest Service surface in the Athens Unit over the next 10 years. Their combined response indicates that it would be reasonable to expect a total of 24 new wells to be drilled in the Athens Unit over the next 10 years.

### Success Ratio

In 2002, the three developmental wells drilled in the four counties within the Athens Unit were all completed as producers for a 100 percent success ratio. Although three wells are not enough to provide for a reliable

statistical average, it is reasonable to assume that developmental wells drilled within the Athens Unit would have a success ratio no less than the 2002 statewide average of 83.6 percent. Should exploratory wells be drilled within the Athens Unit, one could reasonably expect the success rate to be close to the 2002 statewide average of 46 percent. Assuming that all of the projected wells drilled in the Athens Unit are developmental wells and applying the statewide success ratio, it is reasonable to expect 20 of the 24 projected wells would be completed as producers.

### **Abandonment of Depleted Producers**

Athens, Hocking, and Perry Counties had 1,047 wells plugged from 1993 to 2002. Assuming a similar rate of plugging and considering the Athens Unit occupies nearly 8 percent of the total area of these two counties, this report projects that 82 depleted producers would be plugged over the life of the plan. Using 0.55 acres as the average amount of net surface disturbance associated with a producing well (e.g., 0.38 acres of road and 0.17 acres of well pad), plugging 82 depleted producers will result in 45.1 acres of restored surface over the life of the plan.

### **Projected Surface Disturbance**

Using the number of new wells projected in the aforementioned section and the typical amount of surface disturbance associated with drilling new wells less than 5,000 feet in depth, it is estimated that oil and gas activity in the Athens Unit for the 10-year planning period will result in:

- 5 gross miles of new access road construction
- 10 gross acres of surface disturbance for road construction
- 4 net miles of roads equating to 8 net acres of surface disturbance to service 20 producing wells
- 17 gross acres of surface disturbance for well pad construction
- 3 net acres of surface disturbance for turnaround/production facility areas to service 20 producing wells.

As noted in the previous section, the land reclaimed by plugging depleted producers will more than offset the surface disturbance associated with drilling new wells and produce a net gain of 24.1 acres in reclaimed surface.

## Appendix H

---

**Management Area Numbers/Names Crosswalk**

1988 Forest Plan	Is this Management Area in the Revised Plan	Revised Forest Plan Management Area Name
2.1	Yes	River Corridor
2.2	Yes	Diverse Continuous Forest
2.3	Yes	Diverse Continuous Forest with OHVs
3.1	Yes, combined w/ 3.3 and 6.1	Forest and Shrubland Mosaic
3.2	Yes	Forest and Shrubland Mosaic with OHVs
3.3	Yes, combined w/ 3.1 and 6.1	Forest and Shrubland Mosaic
6.1	Yes, combined w/ 3.1 and 3.3	Forest and Shrubland Mosaic
6.2	Yes	Future Old Forest
7.1	Yes	Developed Recreation
8.1	Yes	Research Natural Areas
8.2	Yes	Special Areas
9.1	No	--
9.2	Yes	Candidate Areas
--	New	Future Old Forest with Mineral Activity
--	New	Timbre Ridge Lake
--	New	Grassland-Forest Mosaic
--	New	Historic Forest
--	New	Historic Forest with OHVs



## Appendix I

---

### Literature Cited

- Abrams, M. D. 1992. Fire and the development of oak forests. *Bioscience* 42:346-353.
- Abrams, M. D. and G. J. Nowacki. 1992. Historical variation in fire, oak recruitment, and post-logging accelerated succession in central Pennsylvania. *Bulletin of the Torrey Botanical Club* 119:19-28.
- Abrams, M. D. 1998. The red maple paradox. *Bioscience* 48(5): 355-364.
- Allen, J. D. 1995. *Stream ecology: structure and function of running waters*. Chapman & Hall, London. 388 p.
- Anderson, R.C., R.M. Anderson, and G. Houseman. 2002. Wild American ginseng. *Native Plants Journal* 3(2):93-105.
- Anderson, R L., J L. Knighten, M. Windham, K. Langdon, F. Hedrix, and R. Roncadori. No date. Dogwood Anthracnose and its Spread in the South. USDA Forest Service, Southern Region, Forest Health Protection.
- Annand, E. M, and F. R. Thompson. 1997. Forest bird response to regeneration practices in central hardwood forests. *Journal of Wildlife Management* 61(1):159-171.
- Apsley, D. K., and B. C. McCarthy. 2003. White-tailed deer herbivory on forest regeneration following fire and thinning treatments in southern Ohio mixed oak forests. Pages 461-471 in *Proceedings of the 14<sup>th</sup> Central Hardwoods Forest Conference*. USDA Forest Service GTR-NE-316.
- Aquilani, S. M., D. C. LeBlanc, and T. E. Merrill. 2000. Effects of prescribed surface fires on ground- and shrub-nesting Neotropical migratory birds in a mature Indiana oak forest, USA. *Natural Areas Journal* 20:317-324.
- Artman, V. L., E. K. Sutherland, and J. F. Downhower. 2001. Prescribed burning to restore mixed-oak communities in southern Ohio: effects on breeding-bird populations. *Conservation Biology* 15(5):1423-1434.
- Bajema, R. A., T. L. DeVault, P. E. Scott, and S. L. Lima. 2001. Reclaimed coal mine grasslands and their significance for Henslow's sparrows. *Auk* 118:422-431.
- Balsler, D., and A. Baumgard. 2004. Entomophaga: a new tool in gypsy moth management. Available at:  
[www.dnr.state.oh.us/forestry/Health/ONLAArticle97.html](http://www.dnr.state.oh.us/forestry/Health/ONLAArticle97.html)
- Beard, C., and M. Beard. 1930. *The Rise of American Civilization*. Macmillan, New York.

- Bender, J. 2000. Barrens management and restoration: a Kentucky example. Pages 110 in Proceedings: Workshop on Fire, People, and the Central Hardwoods Landscape. USDA Forest Service General Technical Report NE-274.
- Bennett, K. P., A. C. Dibble, and W. A. Patterson III. 2003. Using fire to control invasive plants: what's new, what works in the Northeast? Workshop Proceedings. Available at <http://www.ceinfo.unh.edu/forestry/documents/WPUFCI03.pdf>.
- Birch, T. W. 1994. Private Forest-land Owners of the Northern United States, 1994. Northeast Forest Experiment Station, USDA-Forest Service, Resource Bulletin NE-136.
- Bodine, J., and T. M. Koontz. 2003. Impacts of federal lands on local government tax bases. Environmental Communication, Analysis, and Research for Policy Working Group. Policy Summary Series #JB2002. The Ohio State University, School of Natural Resources.
- Boerner, R. 2000. Effects of fire on the ecology of the forest floor and soil of central hardwood forests. Pages 56-63 in Proceedings: Workshop on Fire, People, and the Central Hardwoods Landscape. USDA Forest Service General Technical Report NE-274.
- Brothers, T.S., and A. Spingarn. 1992. "Forest Fragmentation and Alien Plant Invasion of Central Indiana Old-Growth Forests. Conservation Biology 6(1): 91-100.
- Brooks, M. L., C. M. D'Antonio, D. M. Richardson, J. B. Grace, J. E. Kelley, J. M. DiTomaso, R. J. Hobbs, M. Pellant, and D. Pyke. 2004. Effects of Invasive Alien Plants on Fire Regimes. Bioscience 54(7): 677-688.
- Brose, P, Van Lear D, "Effects of Seasonal prescribed Fires on Hardwood Advanced Regeneration in Shelterwood Stands", from **General Technical Report NC-188**, from 11th Central Hardwood Forest Conference, held at The University of Missouri, Columbia, Missouri, March 23 - 26, 1997. North Central Forest Experiment Station, U.S. Department of Agriculture, Forest Service
- Brown, M. S. 1922. Epoch-Making Papers in United States History. Macmillan, New York.
- Burger, J. A. 1985. Physical impacts of harvesting and site preparation on soil. Maintaining Forest Site Productivity, Proceedings of the Appalachian Society of American Foresters. Blacksburg, VA.
- Burns, R. M., and B. H. Honkala. 1990. Silvics of North America: Volume 2 Hardwoods, Forest Service Agricultural Handbook 654. Washington D.C.
- Cadenasso, M.L., and S. T. A. Pickett. 2000. Effect of Edge Structure on the Flux of Species into Forest Interiors. Conservation Biology 15(1): 91-97.
- Carmen, W.H. 1965. Black oak site quality in relation to soil and topography in southeastern Ohio. Soil Sci. Soc. Am. Proc. 29:308-312.

- Carr, D.S. & D. R. Williams. 1993. Understanding the role of ethnicity in outdoor recreation experiences. *Journal of Leisure Research* 25:22-38.
- Carter, K. K., and A. G. Snow Jr. 1990. Virginia pine. Pages 513-519 in *Silvics of North America, Volume I. Conifers*. USDA Forest Service Agriculture Handbook 654.
- Chalfoun, A. D., F. R. Thompson, and M. J. Ratnaswamy. 2002. Nest predators and fragmentation: a review and meta-analysis. *Conservation Biology* 16(2):306-318.
- Charron, D. and D. Gagnon. 1991. The demography of northern populations of *Panax quinquefolium* (American ginseng). *The Journal of Ecology* 79:431-445.
- Christen, D., and G. Matlack. 2004. Do invasives use roadsides as corridors or as habitat in the Wayne National Forest? Proceedings from: Ohio Invasive Plant Research Conference, Columbus, Ohio.
- (COS) Committee of Scientists. 1999. Sustaining the people's lands; recommendations for stewardship of the national forests and grasslands into the next century. Final report to the U. S. Department of Agriculture.
- Conrey, R. C. Y. and L. S. Mills. 2001. Do highways fragment small mammal populations? Pages 448-457 in *ICOET 2001 Proceedings*.
- Cordell, H. Ken et al. 1999. *Outdoor Recreation in American Life: A National Assessment of Demand and Supply*. Sagamore Publishing. Urbana, IL.
- Cordell, H. Ken et al. 2001. *Footprints on the Land: An Assessment of Demographic Trends and the Future of Natural Lands in the United States*. Sagamore Publishing. Urbana, IL.
- Crow, T. R., M. E. Baker, and B. V. Barnes. 2000. Diversity in riparian landscapes. Pages 43-66 in Verry, E. S., J. W. Hornbeck, and C. A. Dolloff, eds. *Riparian management in forests of the continental eastern United States*. Lewis Publishers, Boca Raton.
- Crowell, D. L. 1997. Coal and electricity. Ohio Division of Geological Survey Geo Facts No. 16. 2 p. Available at [http://www.dnr.state.oh.us/odnr/geo\\_survey](http://www.dnr.state.oh.us/odnr/geo_survey).
- Dean, T. W., and W. D. Speas. 2002. *Along the Ohio Trail: A Short History of Ohio Lands*.
- Dettmers, R. P. 1997. Nesting success and habitat preferences of forest-breeding migratory passerines in southeastern Ohio. Ph.D. Dissertation, The Ohio State University, Columbus. 150 p.
- Dettmers, R. 2003. Status and conservation of shrubland birds in the northeastern US. *Forest Ecology and Management* 185:81-93.
- Dickson, J. G. 2004. Wildlife and upland oak forests. Pages 106-115 in *Upland oak ecology symposium: history, current conditions, and sustainability*. USDA Forest Service General Technical Report SRS-73.

- Dolan, B. J., and G. R. Parker. 2004. Understory response to disturbance: an investigation of prescribed burning and understory removal treatments. Pages 285-291 in Upland oak ecology symposium: history, current conditions, and sustainability. USDA Forest Service GTR-SRS-73.
- Dolloff, C. A. 1994. Large woody debris – the common denominator for integrated environmental management of forest streams. Pages 93-108 in Cairns, J. Jr., T. V. Crawford, H. Salwasser, eds. Implementing integrated Environmental Management. Blacksburg, VA: Center for Environmental and Hazardous Materials Studies, Virginia Polytechnic Institute and State University.
- Dyer, J. M. 2001. Using witness trees to assess forest change in southeastern Ohio. Canadian Journal of Forest Resources, Volume 31: 1708-1718.
- Eckerle, K. P., and C. F. Thompson. 2001. Yellow-breasted chat (*Icteria virens*). In The Birds of North America, No. 575 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Egan, A., A. Jenkins, and J. Rowe. 1996. Forest roads in West Virginia, USA: identifying issues and challenges. Journal of forest Engineering 8(1):33-40.
- Ehrenfeld, J.G. 2003. Effects of Exotic Plant Invasions on Soil Nutrient Cycling Processes. Ecosystems 6(6): 503-523.
- Ewing, R. 2003a. Analysis of the management situation for wildlife and fisheries resources and management indicator species. Unpublished report. 32 p.
- Ewing, R. 2003b. Species viability evaluation species data collection form for the Henslow's sparrow. Prepared for the Wayne National Forest revision process. 34 p.
- Ewing, R. 2003c. Wayne National Forest breeding bird survey, 2003. Unpublished report.
- Ewing, R. 2003d. Species viability evaluation species data collection form for the yellow-breasted chat. Prepared for the Wayne National Forest revision process. 27 p.
- Ewing, R. 2003e. Species viability evaluation species data collection form for the ruffed grouse. Prepared for the Wayne National Forest revision process. 36 p.
- Ewing, R. 2003f. Species viability evaluation species data collection form for the cerulean warbler. Prepared for the Wayne National Forest revision process. 30 p.
- Ewing, R. 2003g. Species viability evaluation species data collection form for the worm-eating warbler. Prepared for the Wayne National Forest revision process. 31 p.
- Ewing, R., and P. Stachler. 2002. Watershed integrity analysis for the Wayne National Forest in support of the USDA Forest Service East-Wide Watershed Assessment. Unpublished Report. 66 p.

- Fischer, B. C. 1979. Managing light in the selection method. In Proceedings – Regenerating Oaks in Upland Hardwood Forests, Purdue University, February 22 and 23, 1979.
- Finney, A.R., N. Halowaychuk, M.R. Heddleson. 1962. The influence of microclimate on the morphology of certain soils of the Allegheny Plateau of Ohio. *Soil Sci. Soc. Am. Proc.* 26: 287-292.
- Forman, R. T. T., and L. E. Alexander. 1998. Roads and their major ecological effects. *Annu. Rev. Ecol. Syst.* 29:207-231.
- Fralish, J. S. 2004. The keystone role of oak and hickory in the central hardwood forest. Pages 78-87 in Upland oak ecology symposium: history, current conditions, and sustainability. USDA Forest Service General Technical Report SRS-73.
- Frost, C. “Presettlement Fire Frequency Regimes of the United States: A First Approximation”, Tall Timbers Fire and Ecology Conference Proceedings, No. 20, pgs 70 – 81, 1998.
- Gagnon, Daniel. 1999. An analysis of the sustainability of American ginseng harvesting from the wild: the problem and possible solutions. Final report to the Office of Scientific Authority of the U.S. fish and Wildlife Service.
- Gale, G. A., L. A. Hanners, and S. R. Patton. 1997. Reproductive success of worm-eating warblers in a forested landscape. *Conservation Biology* 11(1):246-250.
- Gibbons, J. W. 2003. Terrestrial habitat: a vital component for herpetofauna of isolated wetlands. *Wetlands* 23(3):630-635.
- Goebel, C.G. and Hix, D.M. 1996. Development of mixed-oak forests in southeastern Ohio: a comparison of second-growth and old-growth forest. *Forest Ecology and Management* 84 (1996) 1-21.
- Gottschalk, K. W. 1993. Silvicultural guidelines for forest stands threatened by the gypsy moth. GTR-NE-171. Radnor, PA: U. S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 49 p.
- Gottschang, J. L. 1981. A Guide to the Mammals of Ohio. Ohio State University Press, Columbus, Ohio. 176 pp.
- (GAO) Government Accounting Office. 2002. U.S. General Accounting Office. Invasive species: Clearer Focus and Greater Commitment Needed to Effectively Manage the Problem, GAO-03-1. Washington, DC, October 2002. Available: <http://www.gao.gov/new.items/d031.pdf> Accessed October 20, 2004.
- Gram, W. K., P. A. Porneluzi, R. L. Clawson, J. Faaborg, and S. C. Richter. 2003. Effects of experimental forest management on density and nesting success of bird species in Missouri Ozark forests. *Conservation Biology* 17(5):1324-1337.
- Gregory, S. V., F. J. Swanson, W. A. McKee, and K. W. Cummins. 1991. An ecosystem perspective of riparian zones. *Bioscience* 41(8):540-550.

- Griffith, D. M., D. M. DiGiovanni, T. L. Whitzel, and E. H. Wharton. 1993. Forest statistics for Ohio, 1991. USDA Forest Service Resource Bulletin NE-128. 169 p.
- Grove, S. L. 2003. Species viability evaluation species data collection form for the Louisiana waterthrush. Prepared for the Wayne National Forest revision process. 26 p.
- Hackney E.E. and J.B. McGraw. 2001. Experimental demonstration of an allele effect in American ginseng. *Conservation Biology* 15(1): 129-136.
- Hamel, P. B. 2000a. Cerulean warbler (*Dendroica cerulea*). In *The birds of North America*, no. 511 (A. Poole and F. Gill, eds.). The Birds of North America, Philadelphia, Pennsylvania, USA.
- Hanners, L. A. and S. R. Patton. 1998. Worm-eating warbler (*Helmitheros vermivorus*). In *The Birds of North America*, No. 367 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, Pennsylvania, USA.
- Haufler, J. B. 1999. Strategies for conserving terrestrial biological diversity. Pages 17-34 in R. K. Baydack, H. Campa, III, and J. B. Haufler, eds. *Practical Approaches to the Conservation of Biological Diversity*. Island Press, Washington D. C.
- Hengeveld, J. D. 1991. Birds. Pages 9-16 in *Field Survey of the Vertebrate Fauna at the Atterbury Reserve Forces Training Area, 1990*. Indiana Department of Natural Resources, Indianapolis, Indiana, USA.
- Hicks, R. 1998. *Ecology and management of central hardwood forests*. John Wiley and Sons, New York.
- Hutchinson, T., and S. Sutherland. 2000. Fire and understory vegetation: a large-scale study in Ohio and a search for general response patterns in central hardwood forests. Pages 64-74 in *Proceedings: Workshop on Fire, People, and the Central Hardwoods Landscape*. USDA Forest Service General Technical Report NE-274.
- Hutchinson, T. F., D. Rubino, B. C. McCarthy, and E. K. Sutherland. 2003. History of forests and land-use. Pages 17-28 in E. K. Sutherland et al. eds. *Characteristics of mixed-oak ecosystems in southern Ohio prior to the reintroduction of fire*. USDA Forest Service General Technical Report NE-299.
- Hutchinson, T, Sutherland, E, and Yaussy, D. “Effects of Repeated Prescribed Fires on the Structure, Composition, and Regeneration of Mixed-Oak Forest in Ohio”, available at [www.sciencedirect.com](http://www.sciencedirect.com), *Forest Ecology and Management*, 218 (2005) 210 – 228. 2005.
- Hutchinson, T., J. Rebbeck, and R. Long. 2004. Abundant establishment of *Ailanthus altissima* (tree-of-heaven) after restoration treatments in an upland oak forest. In: *Proceedings, 14<sup>th</sup> Central Hardwood Forest Conference; 2004 March 16-19*, pg. 514.

- Ice, G. G., G. W. Stuart, J. B. Waide, L. C. Irland, and P. V. Ellefson. 1997. 25 years of the Clean Water Act: how clean are forest practices? *Journal of Forestry* (1997):9-13.
- (INHS) Illinois Natural History Survey. 1983. The declining grassland birds. The Illinois Natural History Survey Report 1983:1-2.
- Irwin, E., and J. Reece. 2002. Urbanization and sprawl in Ohio: tracking Ohio's urban growth and land use change. The Exurban Change Project, College of Food, Agricultural, and Environmental Sciences, The Ohio State University, Columbus, Ohio, Report EX-4.
- Jenkins, M. A., and G. R. Parker. 1998. Composition and diversity of ground-layer vegetation in silvicultural openings of southern Indiana forests. *The American Midland Naturalist*: Vol. 142 (1):1–16.
- Johnson, C.Y. 1998. A consideration of collective memory in African-American attachments wildland recreation places. *Human Ecology* 5:5-15.
- Johnson, K. M., and C. L. Beale. 1998. The rural rebound: recent nonmetropolitan demographic trends in the United States. *The Wilson Quarterly*, Spring. <http://www.luc.edu/depts/sociology/johnson/p99webn.html>, accessed 9/29/03.
- Kalisz, P. J., and J. E. Powell. 2000. Effects of prescribed fire on soil invertebrates in upland forests on the Cumberland Plateau of Kentucky, USA. *Natural Areas Journal* 20:336-341.
- Kennedy, I.R. 1986. Acid Soil and acid rain: The impact on the environment of nitrogen and sulphur cycling. Letchworth, Hertfordshire, England: Research Studies Press., New York : Wiley, c1986
- Kilgo, J. C., K. V. Miller, and W. P. Smith. 1999. Effects of group-selection timber harvest in bottomland hardwoods on fall migrant birds. *Journal of Field Ornithology* 70(3):404-413.
- Kriesel, W. 1996. The Economic Impacts of Outdoor Recreation at the Wayne National Forest, Ohio.
- Larson, E. 2003. Species viability evaluation species data collection form for the yellow gentian. Prepared for the Wayne National Forest revision process. 25 p.
- Lawson, E. R. 1990. Shortleaf pine. Pages 316-326 in *Silvics of North America, Volume I. Conifers*. USDA Forest Service Agriculture Handbook 654.
- Little, S. and P. W. Garrett. 1990. Pitch pine. Pages 456-462 in *Silvics of North America, Volume I. Conifers*. USDA Forest Service Agriculture Handbook 654.
- Loewenstein, E. F., and J. M. Guldin. 2004. Conversion of successional stable even-aged oak stands to an uneven-aged structure. Pages 264-268 in *USDA Forest Service GTR-SRS-73*.

- Loftis, D. L. 2004. Upland oak regeneration and management. Pages 163-167 in USDA Forest Service GTR-SRS-73 pp.
- Lonsdale, W. and A. Lane. 1994. tourist vehicles as vectors of weed seeds in a Kakadu National Park, northern Australia. *Biological Conservation* 69:277-283.
- Lorimer, C. G. 1992. Causes of the oak regeneration problem. In Oak Regeneration: Serious Problems, Practical Recommendations Symposium Proceeding, Knoxville, Tennessee, September 8-10, 1992. Department of Forestry, School of Natural Resources, University of Wisconsin, Madison, WI 53706.
- Luginbuhl, J., J. Green Jr., M. Poore, and J. Mueller. 1996. Use of goats as biological agents for the control of unwanted vegetation. Presented at the International Workshop “Los Arboles en los Sistemas de Producción Ganadera,” Indio Hatuey Pasture and Forage Experimental Station, Mantanzas. Available: [http://www.cals.ncsu.edu/an\\_sci/extension/animal/meatgoat/MGVeget.htm](http://www.cals.ncsu.edu/an_sci/extension/animal/meatgoat/MGVeget.htm)
- Luginbuhl, J., T. Harvey, J. Green Jr., M. Poore, and J. Mueller. 1999. Use of goats as biological agents for the renovation of pastures in the Appalachian region of the United States. *Agroforestry Systems* 44: 241-252.
- Manies, K. L., D. J. Mladenoff, and E. V. Nordheim. 2001. Assessing large-scale surveyor variability in the historic forest data of the original U.S. Public Land Survey. *Canadian Journal Forest Research* 31:1719-1730.
- MarketVision Research Inc. 1997. Summary of County Impact: Lawrence County, Ohio.
- McCarthy, B. C. 1995. Eastern old-growth forests. *The Ohio Woodland Journal* 2:8-10.
- McCartney, D., and M. Goodwin. 2003. Species data collection form for the juniper sedge, *Carex juniperorum*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 23 p.
- McCartney, D., and S. Swiezynski. 2003. Species data collection form for the Carolina thistle, *Cirsium carolinianum*. Prepared for the Wayne National Forest Species Viability Evaluation Process. 21 p.
- McClenahan, J. R., D. B. Houston, and E. N. Norland. 1999. Evaluation of logging best management practices on private forest lands in Ohio. Report by The School of Natural Resources, The Ohio State University and Sylvancare Forestry Consulting. 35 p. + appendices.
- McCormac, J. S. 2001. Survey of short-eared owls, northern harriers, and grassland passerines. Summary report, Project Number WANR18, funded by the Ohio Biological Survey, Columbus, OH. 60 p. + appendices.
- McGraw, James B. 2001. Evidence for the decline in stature of American ginseng plants from herbarium specimens. *Biological Conservation* 98(1): 25-32.

- McQuattie, C. J.; Rebbeck, J; Yaussey, D. A. “Effects of Fire and Thinning on Growth, Mycorrhizal Colonies, and Leaf Anatomy of Black Oak and Red Maple Seedlings”, GTR-NE-316. Proceedings of the 14<sup>th</sup> Central hardwood Forest Conference. 2004
- Merritt, R. W., and K. W. Cummins. 1984. An introduction to the aquatic insects of North America. Kendall Hunt Publishing Company, Dubuque. 722 p.
- Meyer, J. L., L. A. Kaplan, D. Newbold, D. L. Strayer, C. J. Woltemade, J. B. Zedler, R. Beilfuss, Q. Carpenter, R. Semlitsch, M. C. Watzin, P. H. Zedler. 2003. Where Rivers Are Born. Available at <http://www.amrivers.org>.
- Michigan Entomological Society. 2002. The emerald ash borer has been found in ash trees in the following Ohio counties: Lucas, Defiance, Paulding, Wood, and Franklin , Newsletter V47[3&4]). ([www.ohioagriculture.gov/pubs/divs/plnt/curr/eab/PLNT-eabindex2.stm](http://www.ohioagriculture.gov/pubs/divs/plnt/curr/eab/PLNT-eabindex2.stm)).
- Miller, G. W., J. E. Johnson, and J. E. Baumgras. 1997. Deferment cutting in central Appalachian hardwoods: an update. Hardwood Symposium Proceedings.
- Moritz, M.A., Odion, D.C., “Examining the strength and possible cause of the relationship between fire history and Sudden Oak Death”, Ecosystem Ecology, Oecologia. 2005
- Nantel P., D. Gagnon and A. Nault. 1995. Population viability analysis of American ginseng and wild leek harvested in stochastic environments. Conservation Biology 10(2): 608-621.
- National Invasive Species Council. 2001. Meeting the Invasive Species challenge: National Invasive Species Management Plan. 80 pp. Available: <http://www.invasivespecies.gov/council/mpfinal.pdf>
- (NPS) National Park Service. 1995. Economic Impacts of Protecting Rivers, Trails, and Greenway Corridors.
- (NPS) National Park Service. 2003a. The effects of deer browsing on white-flowered trillium in Cuyahoga Valley National Park. Available at: <http://www.nps.gov/cuva/management/rmprojects/trillium.htm> . Accessed on October 26, 2004.
- (NPS) National Park Service. 2003b. White-tailed deer population distribution monitoring report. Available at: <http://www.nps.gov/cuva/management/rmprojects/pellet.htm> . Accessed on November 4, 2004.
- Natural Resource Council. 1992. Restoration of aquatic systems: science, technology, and public policy. National Academy Press, Washington, D. C. 552 p.
- NatureServe. 2004. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.0. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer> .

- NatureServe. 2005. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.5. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: September 29, 2005 ).
- Nyland, R. D. 1996. *Silvicultural Concepts and Applications*. McGraw Hill Companies, Inc., New York.
- (OBS) Ohio Biological Society. 1966. Natural vegetation of Ohio at the time of the earliest land surveys. Map with text adapted from Robert. Gordon's *The Natural Vegetation of Ohio in Pioneer Days*. 2 p.
- Ohio Department of Development. No date. Office of Strategic Research, Ohio County Profiles, <http://www.odod.state.oh.us/research/Files/s0.html>.
- (ODNR) Ohio Department of Natural Resources. 2002. Ohio Wildlife Population Status Report and Hunting Forecast: 2002-2003.
- (ODNR) Ohio Department of Natural Resources. 2003a. Ohio Wildlife Population Status Report and Hunting Forecast: 2003-2004.
- (ODNR) Ohio Department of Natural Resources. 2003b. Oil and gas history. Available at:  
<http://www.dnr.state.oh.us/mineral/oil/o1.html#Ohio%20Oil%20and%20Gas%20History>.
- (ODNR) Ohio Department of Natural Resources. 2004a. Ohio Wildlife Population Status Report and Hunting Forecast: 2004-2005. Available at:  
[http://www.dnr.state.oh.us/wildlife/Hunting/WildlifeStatusReport\\_04/main.htm](http://www.dnr.state.oh.us/wildlife/Hunting/WildlifeStatusReport_04/main.htm) . Accessed on November 4, 2004.
- ODNR, 2005. Ohio Department of Natural Resources. 2005. "MANAGING OHIO'S FOREST RESOURCES - CHALLENGES & OPPORTUNITIES" Available at:  
<http://www.ohiosaf.org/Managing.htm>
- (ODNR) Ohio Department of Natural Resources, Division of Wildlife. 2004b. Ginseng: Ohio's Green Gold. Available at:  
<http://www.dnr.state.oh.us/wildlife/Resources/Ginseng/ginseng.htm>. Access on November 13, 2004.
- (ODNR) Ohio Department of Natural Resources, Division of Wildlife. 2004c. Overview of Ohio's Ginseng Laws. Available at:  
<http://www.dnr.state.oh.us/wildlife/Resources/Ginseng/ginsenglaws.htm>. Access on November 13, 2004.
- (ODNR) Ohio Department of Natural Resources and (TNC) The Nature Conservancy. 2001. *Fighting Invasive Plants in Ohio Pamphlet*.
- (ODNR) Ohio Department of Natural Resources, 2003, Oil and Gas History, Ohio Department of Natural Resources, Division of Mineral Resources Management website.

- Ohio Division of Forestry. 2004. History of Ohio's Forests. Available at: <http://www.dnr.state.oh.us/forestry/forest/ohiogreen.htm> .
- Ohio EPA. 2003. Ohio primary headwater streams. Available at: <http://www.epa.state.oh.us/dsw/wqs/headwaters/index.html>.
- Ohio EPA. 2004. Watershed assessment unit summaries. 2004 Integrated Report, Appendix D.2.
- (OOGA) Ohio Oil and Gas Association. 2002. Comment letter in response to Notice of Intent to Prepare an Environmental Impact Statement for the Revision of Land and Management Plan – Wayne National Forest.
- Owen, S. F., M. A. Menzel, and J. W. Edwards. 2004. Bat activity in harvested and intact forest stands in the Allegheny Mountains. *Northeastern Journal of Applied Forestry* 21(3):154-159.
- Parendes, L.A., and J.A. Jones. 2000. Role of light availability and dispersal in exotic plant invasion along roads and streams in the H. J. Andrews Experimental Forest, Oregon. *Conservation Biology* 14: 64-75.
- Perkey, A. W., G. W. Miller, and T. M. Schuler. 1999. Regeneration results using two-aged management. *Forest Management Update*, Number 19, USDA Forest Service Northeastern Area State and Private Forestry.
- Peterjohn, B. G, and D. L. Rice. 1991. *The Ohio Breeding Bird Atlas*. Ohio Department of Natural Resources, Division of Natural Areas and Preserves. 416 p.
- (PIF) Partners in Flight. 2004. *Partners In Flight Conservation Plan for the Ohio Hills Physiographic Region*. Available at: [http://www.blm.gov/wildlife/pl\\_22sum.htm](http://www.blm.gov/wildlife/pl_22sum.htm).
- Patterson, C. J., and D. A. James. 2004. Use of tree species by summer birds in Ozark upland oak-hickory forest. Pages 120-122 in *Upland oak ecology symposium: history, current conditions, and sustainability*. USDA Forest Service General Technical Report SRS-73.
- Petry, J. 2000. *Policy Brief, Current Agricultural Use Valuation*. Ohio Legislative Budget Office.
- Pimentel, D., L. Lach, R. Zuniga, and D. Morrison. 2000. Environmental and economic costs of non-indigenous species in the United States. *Bioscience* 50(1): 53.
- Pruitt, L. Henslow's sparrow status assessment. 1996. U. S. Fish and Wildlife Service, Bloomington, Indiana, USA.
- Reiss, T. L. No date. *Cost of Community Service Study*, Shelby County, Ohio.

- Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Iñigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenberg, C. M. Rustay, J. S. Wendt, and T. C. Will. 2004a. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY. 84 p.
- Rich, A. C., D. S. Dobkin, and L. J. Niles. 1994b. Defining forest fragmentation by corridor width: the influence of narrow forest-dividing corridors on forest-nesting birds in southern New Jersey. *Conservation Biology* 1109-1121.
- Robbins, C. S., D. K. Dawson, and B. A. Dowell. 1989. Habitat area requirements of breeding forest birds of the middle Atlantic States. *Wildlife Monographs* 103:1-34.
- Robinson, S. K., F. R. Thompson III, T. M. Donovan, R. R. Whitehead, and J. Faaborg. 1995. Regional forest fragmentation and the nesting success of migratory birds. *Science* 267:1987-1990.
- Rock, J. 2000. Managing rare plant populations with fire in Great Smoky Mountains National Park. Pages 116-119 in *Proceedings: Workshop on Fire, People, and the Central Hardwoods Landscape*. USDA Forest Service General Technical Report NE-274.
- Rodewald, A. D. 2002. Nest predation in forested regions: landscape and edge effects. *Journal of Wildlife Management* 66(3):634-640.
- Rodewald, A. D., and M. D. Abrams. 2002. Floristics and avian community structure: implications for regional changes in eastern forest composition. *Forest Science* 48(2):267-272.
- Rodewald, A. D. and R. H. Yahner. 2000. Bird communities associated with harvested hardwood stands containing residual trees. *Journal of Wildlife Management* 64(4):924-932.
- Rodewald, A. D., and A. C. Vitz. 2004. Edge and area sensitivity of shrubland birds. Final Report prepared for the Ohio Department of Natural Resources, Ohio Division of Wildlife. 53 p.
- Rodewald, P. G., and K. G. Smith. 1998. Short-term effects of understory and overstory management of breeding birds in Arkansas oak-hickory forests. *Journal of Wildlife Management* 62(4):1411-1417.
- Rodewald, P. G., and M. C. Brittingham. 2002. Habitat use of mixed species landbird flocks during fall migration. *Wilson Bulletin* 114(1):87-98.
- Rommé, R. C., K. Tyrell, and V. Brack, Jr. 1995. Literature summary and habitat suitability index model – components of summer habitat for the Indiana bat, *Myotis sodalis*. Final report for the Indiana Department of Natural Resources; Federal Aid Project E-1-7, Study No. 8. 39 p.

- (RSW) Roper/Starch Worldwide Inc. 2000. Outdoor Recreation in America: Addressing Key Societal Concerns. Internet Website: [www.funoutdoors.com/research/statistics](http://www.funoutdoors.com/research/statistics).
- Rosenberg, K. V., and R. Dettmers. 2004. Partners in Flight Landbird Conservation Plan for Physiographic Area 22 (Ohio Hills). Cornell Lab of Ornithology, Ithaca, New York. 57 p.
- Rosenberg, K. V., R. W. Rohrbaugh, Jr., S. E. Barker, J. D. Lowe, R. S. Hames, and A. A. Dhondt. 1999. A land manager's guide to improving habitat for scarlet tanagers and other forest-interior birds. The Cornell Lab of Ornithology. 23 p.
- Rosenberg, K. V., R. S. Hames, R. W. Rohrbaugh, Jr., S. B. Swarthout, J. D. Lowe, and A. A. Dhondt. 2003. A land manager's guide to improving habitat for forest thrushes. The Cornell Lab of Ornithology. 29 p.
- Rudolf, P. O. 1990. Red pine. Pages 442-455 in *Silvics of North America, Volume I. Conifers*. USDA Forest Service Agriculture Handbook 654.
- Ruffner, C. M., and J. W. Groninger. 2004. Oak ecosystem restoration and maintenance in southern Illinois. Pages 177-181 in *USDA Forest Service GTR-SRS-73*.
- Russell, F. Leland, D. B. Zippin, and N. L. Fowler. 2001. Effects of white-tailed deer (*Odocoileus virginianus*) on plants, plant populations and communities: a review. *The American Midland Naturalist* 146(1):1-26.
- Sander I. L., P. S. Johnson, and R. F. Watt. 1976. A Guide for Evaluating the Adequacy of Oak Reproduction. USDA Forest Service GTR-NC-23.
- Sander, I. L., and D. L. Graney. 1992. Regenerating oaks in the central states. In *Regeneration: Serious Problems, Practical Recommendations Symposium Proceeding*, Knoxville, Tennessee, September 8-10, 1992.
- Sauer, J. R., J. E. Hines, and J. Fallon. 2003. The North American Breeding Bird Survey, Results and Analysis 1966 - 2002. Version 2003.1, USGS Patuxent Wildlife Research Center, Laurel, MD. Available at: <http://www.mbr-pwrc.usgs.gov/bbs/bbs2002.html>.
- Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966 - 2003. Version 2004.1. [USGS Patuxent Wildlife Research Center](http://www.mbr-pwrc.usgs.gov/bbs/bbs2004.html), Laurel, MD
- Schlarbaum S.E., F. Hebard, P. C. Spaine, J. C. Kamalay. 1997. Three American Tragedies: Chestnut Blight, Butternut Canker, and Dutch Elm Disease., In: *Proceedings, Exotic Pests of Eastern Forests*; 1997 April 8-10; Nashville, TN. Tennessee Exotic Pest Plant Council: 45-54.
- Shannon, C.E. & Warren Weaver. 1949. *The Mathematical Theory of Communication*. Urbana: The University of Illinois Press.

- Shifley, S. R. 2004. Oak growth and response to thinning. Pages 198-205 in GTR-SRS-73. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station.
- Signell, S, Abrams, M, Hovis, J, and Henry, S. “Impact of Multiple Fires on Stand Structure and Tree Regeneration in Central Appalachian Oak Forests”, available at [www.sciencedirect.com](http://www.sciencedirect.com), Forest Ecology and Management, 218 (2005) 146 – 158. 2005.
- Smith, H. C. 1984. Guidelines for Controlling Wild Grapevines. USDA Forest Service Publication NE-548. Newtown Square, PA. 15 p.
- (SAF) Society of American Foresters. 1998. The Dictionary of Forestry. 1998. John A. Helms, editor.
- Spetich, M. A., ed. 2004. Upland oak symposium: history, current conditions, and sustainability. USDA Forest Service GTR-SRS-73. 311 p.
- Stein, B., L. Kutner, and J. Adams. 2000. Precious heritage: the status of biodiversity in the United States. Oxford University Press, New York, New York. 399 pp.
- (SRG) Strategic Research Group. 2002. Wayne National Forest Recreation Feasibility Study – Executive Summary. Unpublished.
- Sutherland, E. K. “History of Fire in a Southern Ohio Second-Growth”, from General Technical Report NC-188, from 11th Central Hardwood Forest Conference, held at The University of Missouri, Columbia, Missouri, March 23 - 26, 1997. North Central Forest Experiment Station, U.S. Department of Agriculture, Forest Service
- Sutherland, E. K. 1997. The history of fire in a southern Ohio second growth mixed-oak forest. Pages 172-183 in Proceedings: 11<sup>th</sup> central hardwoods conference. USDA Forest Service General Technical Report NC-188.
- Sutherland, E. K., and T. F. Hutchinson. 2003. Characteristics of mixed-oak forest ecosystems in southern Ohio prior to the reintroduction of fire. USDA Forest Service GTR-NE-299. 159 p.
- Sutherland, E. K., T. F. Hutchinson, and D. A. Yaussy. 2003. Introduction, study area description, and experimental design. Pages 1-16 in Characteristics of mixed-oak forest ecosystems in southern Ohio prior to the reintroduction of fire. USDA Forest Service General Technical Report NE-299.
- Swanson, D. 1996. Nesting ecology and nesting habitat for the Henslow’s sparrow. Ohio Fish and Wildlife Report 13:1996.
- Swanston, D. N. 1991. Natural processes. Pages 139-180 in W. R. Meehan, editor. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19.

- Stephens, S. E., D. N. Koons, J. J. Rotella, and D. W. Willey. Effects of habitat fragmentation on avian nesting success: a review of the evidence at multiple spatial scales. *Biological Conservation* 115:101-110.
- Taylor, D.E. 1989. Blacks and the environment: toward an explanation of the concern and action gap between blacks and whites. *Environment and Behavior* 21:175-205.
- (TNC) The Nature Conservancy. 1999. Species management abstract for the Henslow's sparrow (*Ammodramus henslowii*). The Nature Conservancy, Arlington, Virginia, USA.
- (TNC) The Nature Conservancy. 2003. Recommendations for biodiversity conservation submitted to the U.S. Forest Service for the Wayne National Forest Land and Resource Management Plan. 18 p.
- (TNC) The Nature Conservancy 2004. Ohio's Invasive Plant Range Report, available online at:  
<http://nature.org/wherewework/northamerica/states/ohio/science/art6435.html>  
Accessed August 6, 2004.
- Thompson, F. R., W. D. Dijak, T. G. Kulowiec, and d. a. Hamilton. 1992. Breeding bird populations in Missouri Ozark forests with and without clearcutting. *Journal of Wildlife Management* 56(1):23-30.
- Thompson, F. R., D. M. Finch, J. R. Probst, G. D. Gaines, and D. S. Dobkin. 1999. Multi-resource and multi-scale approaches for meeting the challenge of managing multiple species. In R. Bonney, D. N. Pashley, R. J. Cooper, and L. Niles, eds. *Strategies for bird conservation: the Partners in Flight planning process*. Cornell Lab of Ornithology. Available at <http://birds.cornell.edu/pifcapemay>.
- Trani, M. K., R. T. Brooks, T. L. Schmidt, Victor A. Rudis, and C. M. Gabbard. 2001. Patterns and trends of early successional forests in the eastern United States. *Wildlife Society Bulletin* 29(2):413-424.
- University of Kentucky. 2003. State of Kentucky's forests: past, present, and future. Department of Forestry, Lexington, Kentucky. Available:  
<http://www.uky.edu/Classes/AEC/445G/forestry.html>.
- US Census Bureau. 2000. Projections of the Resident population by race, Hispanic origin, and nativity. Retrieved January 8, 2003 from  
<http://www.census.gov/poplation/projections/nation/summary/np-t5-b.txt>.
- USDA Soil Conservation Service. 1984. Soil and water conservation district resources inventory. U.S. Dep. Agric., Soil Cons. Serv., Washinton, D.C.
- USDA Forest Service. 1989. Highlights of the 1989 forest inventory: Pennsylvania. U.S. Forest Service, Northeastern Forest Experiment Station, Newton Square, Pennsylvania. Available: <http://www.fs.fed.us/ne/fia/states/pa/pahilite.html>.

- USDA Forest Service. 1990. Wayne National Forest's Little Muskingum River - Eligibility Determination for the Wild and Scenic River System. 17 pp. Unpublished.
- USDA Forest Service. 1991. Highlights of the 1991 forest inventory: Ohio. U.S. Forest Service, Northeastern Forest Experiment Station, Newton Square, Pennsylvania. Available: <http://www.fs.fed.us/ne/fia/states/oh/ohhilite.html>.
- USDA Forest Service. 1995. Ecological Units of the Eastern United States: First Approximation. Map and associated tables.
- USDA Forest Service. 1999a. Wayne National Forest Ecological Classification Handbook. Technical Guide. 77 pp.
- USDA Forest Service. 1999b. Asian longhorned beetle - a new introduction, USDA Forest Service Northeastern Area State and Private Forestry Pest Alert NA-PR-01-99.
- USDA Forest Service. 2000a. Early successional habitat and open lands assessment for the eastern and southern regions. Unpublished report.
- USDA Forest Service. 2000b. Highlights of the 1989 forest inventory: West Virginia. U.S. Forest Service, Northeastern Forest Experiment Station, Newton Square, Pennsylvania. Available: <http://www.fs.fed.us/ne/fia/states/wv/wvhilite.html>.
- USDA Forest Service. 2002a. The Recreation Agenda. Internet Website: [www.fs.fed.us](http://www.fs.fed.us).
- USDA Forest Service. 2002b. National Survey of Recreation and the Environment. Internet Website: [www.srs.fs.fed.us/trends/NSRE](http://www.srs.fs.fed.us/trends/NSRE).
- USDA Forest Service. 2003. Gypsy moth in North America. Northeastern Research Unit, Morgantown, WV. <http://www.fs.fed.us/ne/morgantown/4557/gmoth/spread>.
- USDA Forest Service. 2004. National Visitor and Use Monitoring Survey. Final Report.
- U.S. Department of Commerce. 2002. REIS: Regional Economic Information System 1969-2000. CD-ROM.
- (USDOE) U. S. Department of Energy. 2002. A holistic approach to addressing environmental issues in Appalachia. Sequestration and Environmental and Water Resources Project Facts. <http://www.netl.doe.gov>.
- U. S. Environmental Protection Agency. No date. Level IV Ecoregions of Indiana and Ohio. Poster available at [http://www.epa.gov/wed/pages/ecoregions/ohin\\_eco.htm](http://www.epa.gov/wed/pages/ecoregions/ohin_eco.htm). Accessed from web site on July 21, 2004.
- (USFWS) U.S. Fish and Wildlife Service. 2002. Convention permit applications for ginseng harvested in 2002, Annual report and Amendment of Non-Detriment Finding for ginseng Harvested in 2002. Available at: <http://international.fws.gov/animals/ginfin02.html>. Accessed November 13, 2004.

- (USFWS) U.S. Fish and Wildlife Service. 2004. Convention permit applications for ginseng harvested in 2003-2004, Report. Available at: <http://international.fws.gov/ginseng/2003-2004ginsengfinding.htm>. Accessed November 13, 2004.
- Van Lear, D.H. 2004. Upland oak ecology and management. Pages 65-71 in USDA Forest Service GTR-SRS-73.
- Van Lear, D. H., and Brose, P. H. 1998. Responses of hardwood advance regeneration to seasonal prescribed fires in oak-dominated shelterwood stands. *Canadian Journal Forest Research* 28(3):331-339.
- Van Lear, II, D., and J. M. Watt. 1992. The role of fire in oak regeneration. In *Oak Regeneration: Serious Problems, Practical Recommendations Symposium Proceeding*, Knoxville, Tennessee, September 8-10, 1992.
- Van Lear, D. H., P. H. Brose, and P. D. Keyser. 2000. Using prescribed fire to regenerate oaks. Pages 97-102 in *Proceedings: Workshop on Fire, People, and the Central Hardwoods Landscape*. USDA Forest Service General Technical Report NE-274.
- Vannote, R. L., G. W. Minshall, K. W. Cummins, J. R. Sedell, and C. C. Cushing. 1980. The river continuum concept. *Canadian Journal of Fisheries and Aquatic Sciences* 37: 130-137.
- Wendel, G. W., and H. C. Smith. 1990. Eastern white pine. Pages 476-488 in *Silvics of North America, Volume I. Conifers*. USDA Forest Service Agriculture Handbook 654.
- Vitz, A. C. 2003. Use of regenerating clearcuts by mature-forest birds during the post-breeding period. M. S. Thesis, The Ohio State University, Columbus. 132 p.
- Wargo, P.M., Houston, D.R., LaMadeleine, L.A. "Oak Decline", Forest Insect and Disease Leaflet 165, U.S. Department of Agriculture. 1983
- Weaver, K. M. 2000. Black bear ecology and the use of prescribed fire to enhance bear habitat. Pages 89-96 in *Proceedings: Workshop on Fire, People, and the Central Hardwoods Landscape*. USDA Forest Service General Technical Report NE-274.
- Whitaker, D. M. 2003. Ruffed grouse (*Bonasa umbellus*) habitat ecology in the central and southern Appalachians. M. S. Thesis. Virginia Polytechnic Institute and University, Blacksburg, VA.
- Woods and Poole Economics. 2002. The 2002 State Profile: State and County Projections to 2025. Pages 72, 142, 186, 206, 212, 220, 244, 248, 254, 260, 278, 296, and 300.
- Woodward, A. A., A. D. Fink, and F. R. Thompson III. 2001. Edge effects and ecological traps: effects on shrubland birds in Missouri. *Journal of Wildlife Management* 65(4):668-675.

Yaussy, D. A., comp. 2000. Proceedings: workshop on fire, people, and the central hardwoods landscape. USDA Forest Service GTR-NE-274. 129 p.

Zar, J. H. 1996. Biostatistical Analysis. New Jersey: Prentice Hall.

---

## References

USDA Forest Service. 1987. Draft Environmental Impact Statement for the Land and Resource Management Plan, Wayne Nation Forest.

USDA Forest Service. 1988. Land and Resource Management Plan, Wayne National Forest.

USDA Forest Service. 1988. Final Environmental Impact Statement for the Land and Resource Management Plan, Wayne Nation Forest.

Ohio Land Use Cover (LandSat TM). 1994.

National Land Cover Database. 1992

Smoke Management Guide for Prescribed and Wildland Fire, 2001 Edition, PMS 420-1, NFES 1279, a publication of the National Wildfire Coordination Group.

---

## Personal Communications

Neil Martin, MLRA (Major Land Resource Area) Project Leader. Ohio Department of Natural Resources; Rt. 9, Box 286C; Marietta, OH 45750-9614; Fax:(740) 374-5340; Phone: (740) 376-0252, ext. 233; E-mail: neil-martin@oh.nacdnet.org

Mike Tonkovich, Ph.D., Research Wildlife Biologist (Deer), Ohio Division of Wildlife. Waterloo Wildlife Research Station, New Marshfield, Ohio.



## Appendix J

# Glossary, Acronyms, and Scientific Names

---

## Glossary

### A

**accessibility** - The ability of a site, facility or activity to be enjoyed by persons of varying physical and mental abilities.

**adaptive management** - A strategy that views decision making as part of an on-going process. As projects and treatments are implemented and vegetation changes across the landscape, scientific findings and the needs of society may indicate some practices are more effective than others. Monitoring the results of actions will provide a flow of information that may indicate the need to change or adapt the types and combination of treatments.

**administrative use** – in reference to off-highway vehicles, administrative use includes management activities conducted by the Forest Service, search and rescue missions conducted by authorized officials, and operation and maintenance of oil and gas facilities where approved by the Forest Service.

**advanced regeneration** - Seedlings or saplings that develop or are present in the understory, normally considered when planning regeneration treatments.

**Advisory Council on Historic Preservation** – A federal advisory body that advises the President and Congress on national historic preservation policies, encourages private and public interest in historic preservation, and review and comments on federal undertakings that might have an effect on properties listed on or eligible for the National Register of Historic Places.

**affected environment** - The area that will be affected or created by the alternatives under consideration in the NEPA process

**age class** – 1) A grouping of stands according to their age by an interval of years, usually 10 years. 2) A distinct aggregation of trees within a stand, originating from a single natural event or regeneration activity. (See cohort.)

**airshed** - A geographic area that shares the same air.

**algific** – Continuous cold air drainage from subterranean vents or cold groundwater flow from neighboring bedrock.

**all terrain vehicle** - Any motorized off-highway vehicle 50 inches or less in width, can be straddled, travels on 3 or more low-pressure tires (10 pounds per square inch (PSI) or less, or as recommended by the vehicle manufacturer.)

**allowable sale quantity** - The amount of timber that may be sold from the area of suitable timberland covered by the forest plan for a time period specified by the plan. The ASQ is based on a 10-year period, although it may be expressed on an “average annual ASQ” basis.

**aquatic ecosystem** - Refers to the interaction between the following biotic and abiotic components: the stream channel, lake and estuary beds, water, biotic community, and associated habitat features. Included are perennial, intermittent and scoured ephemeral streams and lakes with intermittently, semi-permanently and seasonally flooded channels. In the absence of flowing water, intermittent and scoured ephemeral streams may have pools, or surface water may be absent altogether.

**archaeology** – The scientific study of the physical characteristics of heritage resources in order to describe and explain past lifeways and cultures.

**artificial regeneration** – 1) A group or stand of young trees created by direct seeding or by planting of seedlings or cuttings, 2) The process for establishment of such regeneration. (See regeneration.)

**aspect** - The direction a slope faces. For example, a hillside facing east has an eastern aspect.

## **B**

**background** -The landscape area located from 4 miles to infinity from the observer.

**bankfull** – The incipient elevation on the streambank where flooding begins.

**barrier** - 1) Any feature or condition that restricts movement of organisms or prevents establishment of organisms that have migrated there. 2) A natural or artificial obstruction used to stop or check a fire or to provide a control line from which to work. See firebreak.

**basal area** - 1) The cross-sectional area of a single stem, including the bark, measured at breast height (4.5 feet above the ground; see diameter at breast height). 2) The cross-sectional area (at breast height) of a group of stems within an area (such as a stand), usually expressed in square feet per acre. (See stand.)

**bench** - Normally a long, narrow, relatively level ledge or gently inclined strip of land bounded by steep slopes above and below, and formed by differential erosion of rocks and soils that are bedrock controlled.

**beneficial effects** – The effects determination made for federally listed species when contemporaneous positive effects occur without any adverse effects the species.

**biological assessment** - Information prepared by, or under the direction of, a federal agency to determine whether a proposed action is likely to: 1) adversely affect listed species or designated critical habitat; 2) jeopardize the continued existence of species that are proposed for listing; or 3) adversely modify proposed critical habitat.

**biological control** - The use of natural means, or agents, to control unwanted pests. Examples include introduced or naturally occurring insects, bacteria, or fungi that act as predators, parasites, or disease agents of pests. Biological controls can sometimes be alternatives to mechanical or chemical means.

**biological diversity** - The variety of life in an area, including the variety of genes, species, plant and animal communities and ecosystems, and the interaction of these elements. The term is often abbreviated to biodiversity. (See habitat diversity.)

**biological evaluation** - A documented USDA Forest Service review of internal programs or activities in sufficient detail to determine how an action or proposed action may affect any threatened, endangered proposed or sensitive species.

**biological opinion** - A document that includes: 1) the opinion of the US Fish and Wildlife Service as to whether or not a federal action is likely to jeopardize the continued existence of listed species, or result in the destruction or adverse modification of designated critical habitat; 2) a summary of the information on which the opinion is based; and 3) a detailed discussion of the effects of the action on listed species or designated critical habitat.

**board foot** - A measurement term for lumber or timber. It is the amount of wood contained in an unfinished board 1 inch thick, 12 inches long, and 12 inches wide. The conversion factor used in the preparation of this document is: 6.0 board feet per cubic foot.

**browse** - Twigs, leaves, and young shoots of trees and shrubs eaten by animals. Browse is often used to refer to the shrubs eaten by big game species, such as white-tailed deer.

## C

**canopy** - The part of any stand of trees represented by the tree crowns. It usually refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multi-storied forest.

**cavity** - A hole in a tree, often used by wildlife species for nesting or roosting.

**chemical control** - The use of pesticides to control pests or undesirable species. Contrast with biological control and mechanical control.

**clearcut** - A regeneration method in which all or almost all of the trees are removed in one cutting.

**coarse woody debris** – Defined in this document as pieces of wood (branches, whole trees, root wads, etc.) that are at least 4 inches in diameter and 3 feet in length, within a stream channel. Coarse woody debris contributes to habitat complexity by forming pools, encouraging scour from stream banks, partitioning the water column and providing cover for aquatic species. Coarse woody debris serves as a refuge for fish and the hard substrates and associated invertebrate production is an important food source. Coarse woody debris also influences flow velocity, channel shape and sediment storage and routing. Also referred to as large woody debris.

**collector roads** - Roads that serve small land areas and are usually connected to a forest development road, a county road, or a state highway.

**communications site** - An area of National Forest System land designated through the land and resource management planning process. A communications site may be limited to a single communications facility, but most often encompasses more than one. Each site is identified by name, usually a local prominent landmark, such as John's Creek Communications site.

**community** - In ecology, the collection of species that characteristically occur together under a specified set of conditions. Often, the term is used to refer only to vegetation.

**concern level** - In scenery management, the measure of the degree of public importance placed on landscapes as viewed from travelways and use areas. Concern levels are ranked as 1 for high, 2 for moderate, and 3 for low. (Similar to Sensitivity Level under the Visual Management System.)

**concessionaire** - The permitted, private operator of a USDA Forest Service recreation facility.

**congeneric** – Species that belong to the same genus.

**conifer** - A tree that produces cones, such as a pine, spruce, or fir tree. Also known as softwood.

**controlled surface use stipulation** – A mineral leasing stipulation that identifies standards that an operator must meet to mitigate potential adverse effects to surface resources.

**coppice harvesting** – A method of regenerating a stand in which all trees in the previous stand are cut and the majority of regeneration is from sprouts or root suckers.

**corridor** – 1) A feature of the landscape that connects similar areas. 2) A linear strip of land developed for locating transportation or utility rights-of-way within its boundaries.

**Council on Environmental Quality** - An advisory council to the President, established by the National Environmental Policy Act of 1969. The CEQ reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

**cover** - 1) Any feature that conceals wildlife or fish. Cover may be dead or live vegetation, boulders, or undercut stream banks. Animals use cover to escape from predators, rest or feed. 2) The kind of and nature of vegetation which casts a shadow on the ground. Can describe any or all vertical layers of vegetation.

**critical habitat** - Areas formally designated for the survival and recovery of federally listed threatened or endangered species.

**crown** - The part of a tree or woody plant bearing live branches and foliage.

**crown height** - The distance from the ground to the base of the crown of a tree.

**cultural resources** – The physical remains of sites, structures, networks, or objects used by humans in the past. They can be historic, prehistoric, archaeological, or architectural in nature (see heritage resources).

**cumulative effect or impact** - Impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

**currently suitable roost tree** - In Indiana bat management, a live or dead tree of any diameter, having one or more characteristics that make it immediately available for Indiana bat roosting. Characteristics include sloughing bark, or cavities with openings to the outside, large splits or cracks in the bole, or large broken limbs.

**cutting cycle** - The planned interval between regeneration cuts occurring within two-aged or uneven-aged stands. (See rotation.)

## D

**decision criteria** - The rules and standards used to evaluate alternatives to a proposed action on National Forest System land. Decision criteria are designed to help a decision-maker identify a preferred choice from the array of alternatives.

**desired landscape character** – Appearance of the landscape to be retained or created over time, recognizing that the landscape is a dynamic and constantly changing community of plants and animals.

**developed recreation** - Recreation that takes place at defined areas where constructed facilities are provided for such use. Developed recreation sites include campgrounds, picnic areas, boat ramps and interpretive sites. Contrast with dispersed recreation.

**diameter at breast height** - The diameter of a tree 4.5 feet above the ground on the uphill side of the tree.

**discountable effect** – The effects determination made for federally listed species when effects are unlikely to occur.

**dispersed recreation** - Recreation that takes place in less developed settings where few, if any, constructed facilities are provided. Trail use, rock climbing, boating, hunting and fishing are examples of dispersed recreation. Contrast with developed recreation.

**distance zones** – Landscape areas denoted by specified distances from the observer. Used as a frame of reference with which to discuss landscape attributes or the scenic effects of human activities in the landscapes.

**disturbance** - A discrete event, either natural or human induced, causing change in the condition of an ecological system, community, or population structure; and changes resources, substrate availability, or the physical environment.

**duff** - The fermentation and humus layer of the forest floor material lying below the litter and above mineral soil; it consists of partially decomposed organic matter whose origins can still be visually determined as well as the fully decomposed humus layer. This layer does not include the freshly cast material in the litter layer. Contrast with litter.

## E

**ecology** - 1) The interrelationships and interconnectedness of living things to one another (biotic) and to their environment (abiotic). 2) The study of these interrelationships and interconnections.

**ecoregion** - An area over which the climate is sufficiently uniform to permit development of similar ecosystems on sites that have similar properties. Ecoregions contain many landscapes with different spatial patterns of ecosystems.

**ecosystem** - An arrangement of biotic and abiotic components and the forces that move among them.

**edge** - The junction between two dissimilar habitat types or successional stages.

**edge effect** - Ecological characteristics associated with this junction that positively or negatively affect species living there.

**endangered species** - A plant or animal species that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior/Secretary of Commerce in accordance with the Endangered Species Act of 1973.

**environmental analysis** - 1) An analysis of actions and their predictable long and short-term environmental effects. Environmental analyses include consideration of physical, biological, social, and economic factors. 2) A general term that could refer to an environmental assessment or an environmental impact statement.

**environmental assessment** – An environmental analysis, conducted under the National Environmental Policy Act, used to determine the environmental significance of the proposed alternative actions. A finding of no significant impact permits the deciding official to choose an alternative and submit this decision to the public for comment. A finding of a significant impact would trigger an environmental impact statement. (See environmental impact statement.)

**environmental impact statement** - A disclosure statement revealing the environmental impacts of a proposed action, which is required for major federal actions under Section 102(2)(C) of the National Environmental Policy Act. A draft EIS is released to the public and other agencies for review and comment. The statement provides full and fair discussion of significant environmental impacts and informs the decision maker and the public of the reasonable alternatives, which would avoid or minimize adverse impacts or enhance the quality of the human environment.

**ephemeral stream** - A stream that flows only in direct response to precipitation, receives no water from springs, and does not have a continuous supply from surface sources. Ephemeral streams have a functional channel with streambed and banks which are annually cleared of debris and leaf litter.

**epicormic branching** - A new branch arising spontaneously from a dormant bud on the stem, branch, or bole of a tree, often following exposure to increased light.

**eradication** – In silviculture, elimination of gypsy moth from an area infested as a result of artificial movement of gypsy moth life stages from the generally infested area.

**ericads** - A plant, most often a low shrub, belonging to the Heath Family (Ericaceae) including blueberries and huckleberries.

**erosion** - The wearing away of the earth's surface by running water, wave action, moving ice and wind, or processes of mass wasting. Geologic erosion refers to natural erosion processes occurring over long (geologic) time spans. Accelerated erosion generically refers to erosion in excess of what is presumed or estimated to be naturally occurring levels.

**European settlement** - In an ecological context, the era of European settlement in the area of the Wayne National Forest is regarded as beginning around 1700 A.D. The era of pre-European settlement is generally defined as 1000 to 1700.

**evaluation of heritage resources** – A process by which the significance and integrity of an historical property are judged, and eligibility for listing on the National Register of Historic Places is determined.

**even-aged management** - See even-aged silvicultural system.

**even-aged silvicultural system** - A planned sequence of treatments designed to maintain and regenerate a stand with one age class. The range of tree ages is usually less than 20 percent of the rotation; i.e. clear-cutting, seed-tree, shelterwood, and coppice methods. (Also referred to as even-aged management.)

**existing landscape character** - A term used in scenery management to refer to a word picture that includes cultural values, positive attributes, and sense of place. It can serve as a baseline for developing alternatives in land and resource plan revision and to develop Landscape Character Themes. (See Landscape Character Theme.)

**existing scenic integrity** - A term used in scenery management to refer to the wholeness or intactness of the landscape. It is the base line used to judge deviations from desirable positive landscape character. It is expressed in terms of Very High, High, Moderate, Low, Very Low, and Unacceptably Low. (Similar to Existing Visual Condition under the Visual Management System.)

## F

**Facility Development Level** - In recreation management, the degree to which a recreation facility is designed and constructed to provide facilities and amenities for the public. A ranking of 1 through 5 is given - with 1 being the lowest development level and 5 being highest development level.

**feature** – Topographical evidence of disturbance created by previous mining activities such as subsidence, open portals, highwalls, slumps, and seeps.

**federally listed species** – Refers to one or more species listed by the U. S. Fish and Wildlife Service as endangered (E), threatened (T) or proposed for federal listing as threatened or endangered (P).

**filterstrips** – A filterstrip is primarily a sediment and nutrient trapping tool. The width of the filterstrip necessary to protect the riparian area (including the aquatic and riparian ecosystems) and water quality will vary, depending on many factors: e. g. topography; aspect; landform; climate; soil and parent geology slope; condition of the vegetative community; aquatic community; hydrologic regime; management activity and resource objectives. Filterstrip requirements may vary from a minimum of 50 to 100 feet.

**final cut** - In a stand being managed under the seed tree or shelterwood regeneration method, the removal of the last seed bearers or shelter trees after regeneration of new trees has been established.

**fire intolerant species** - A species with morphological characteristics that give it a higher probability of being injured or killed by fire than a fire-tolerant species, which has a “relatively low” probability of being injured or killed by fire.

**fire regime** – Patterns of fire occurrence, size, severity and effects in a given area or ecosystem. A natural (historical) fire regime is a general classification of the role fire would play across a landscape in the absence of modern human intervention, but including the influence of aboriginal burning.

**Fire Regime Condition Class** – The ecological condition of the vegetation and fire regime of a landscape. FRCC is measured by describing the degree of departure from historical fire regimes, possibly resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, canopy closure and fuel loadings. The three classes are defined as:

**Condition Class 1** - Fire regimes are within a historical range, and the risk of losing key ecosystem components is low. Species composition and structure are intact and functioning.

**Condition Class 2** - Fire regimes have been moderately altered from the historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals. This results in moderate changes to one or more of the following - fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.

**Condition Class 3** - Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range.

**fire suppression** - All the work of extinguishing or confining a fire beginning with its discovery and continuing until the fire is completely extinguished.

**firebreak** - A natural or constructed barrier used to stop or check fires that may occur, or to provide a control line from which to work. (See fireline.)

**fireline** - The part of the fire control line along which mineral soil has been exposed. See firebreak.

**fire-tolerant species** - A plant species with morphological characteristics that give it a lower probability of being injured or killed by fire than a fire-intolerant species, which has a relatively high probability of being injured or killed by fire.

**flood prone area** – An area along streams which generally includes the active floodplain and the low terrace. It is delineated on-the-ground by the elevation that corresponds to twice the maximum depth of the bankfull channel as taken from the established bankfull stage.

**floodplain** – The lowland and relatively flat areas joining inland and coastal water including the debris cones and flood-prone areas of offshore islands and, at a minimum, that area subject to a 1 percent (100-year recurrence) or greater chance of flooding in any given year.

**fluvial deposits** - Deposits formed by streams and rivers.

**foreground** - In scenery management, the detailed landscape generally found within one-half mile of the observer.

**forest** - In ecology, a mostly closed high canopy contiguous area of trees with a moderate to high basal area (60-120 or more square feet/ acre). In forestry, land at least 10 percent stocked by forest trees of any size, including land that formerly had such tree cover and that will be reforested. The minimum area for classification of forest is one acre, and at least 120 feet wide. Also referred to as forestland, forest land or forested land. When capitalized in this document, the word Forest refers to the Wayne National Forest.

**forest canopy**-The cover of branches and foliage formed collectively by tree crowns

**forest development road (FDR)** - Road under the jurisdiction of the USDA Forest Service.

**forest health** - 1) The perceived condition of a forest derived from concerns about such factors as its age, structure, composition, function, vigor, presence of unusual levels of insects or disease, and resilience to disturbance. Note that perception and interpretation of forest health are influenced by individual and cultural viewpoints, land management objectives, spatial and temporal scales, the relative health of the stands that comprise the forest, and the appearance of the forest at a point in time. 2) A condition where biotic and abiotic influences do not threaten resource management objectives now or in the future. Ill health is associated with declines in biological diversity, loss of primary productivity, reversal of successional patterns, widespread and severe disease, and loss of nutrient capital. A healthy forest can be envisioned as one with the capacity for renewal and

resilience to a range of disturbances, while meeting the current and future needs of people.

**forest land** – (See forest.)

**Forest Supervisor** - The official responsible for administering National Forest System lands on one or more national forests. A Forest Supervisor reports to a Regional Forester.

**forest type** - A category of forest defined by its vegetation, particularly its dominant species, as based on a percentage cover of trees. Also referred to as forest cover type.

**forestland** – (See forest.)

**fragmentation** -The breaking up of contiguous areas into progressively smaller patches. The process of fragmentation occurs across a range of landscape patterns. At one extreme, it is represented by small disturbance patches, which disrupt the continuity of a habitat. At the other extreme, widespread habitat conversion causes isolation of the remnant original habitat into patches.

**fuel loading** - The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area. This may be available (consumable) fuel or total fuel and is usually dry weight. Also referred to as fuel load.

**fuel reduction** - The manipulation or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance of a fire to control efforts once a fire is ignited. Also referred to as fuels management.

**fuels management** - Manipulation, including combustion, or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.

**fuels** - In fire management, flammable natural fuels such as leaf litter or logging slash.

**fuelwood** - Wood used for conversion to some form of energy, for example in homes or in cogeneration plants.

**function** - A the process within an ecosystem through which the elements interact, such as succession, the food chain, fire, weather, and the hydrologic cycle.

## **G**

**generally infested area (gypsy moth)** - The area where gypsy moth lives permanently.

**geographic information system** - 1) A database designed to handle geographic data. 2) A set of computer operations that can be used to analyze geographic data. Also referred to as computerized mapping.

**goal** - In planning, a concise statement that describes a desired future condition to be achieved with no specific date by which it is to be attained. It is normally expressed in broad, general terms. Goal statements form the principal basis from which objectives are developed.

**graminoid** - Any grass-like herbaceous flowering plant, including grasses, sedges and rushes; usually with long narrow leaves and inconspicuous flowers.

**grazing permit** - A document authorizing livestock to use NFS lands or other lands under Forest Service control for livestock.

**grazing** - The consumption of standing forage by livestock or wildlife.

**group selection** - An uneven-aged regeneration method in which trees are removed periodically in small groups. On the Wayne National Forest, the group size is between one-quarter and two acres.

**guideline** - Statements describing a preferred or advisable course of action that is generally expected to be carried out. Because guidelines are discretionary, deviation from a guideline does not require an amendment to the Forest Plan, but the rationale for such deviation should be documented in the project record.

**gully erosion** - Gully erosion occurs where water concentrates and flows as a stream, cutting down into the soil along the line of flow. Gullies form in exposed natural drainage ways, in horse and highway vehicles trails, in log skid roads, vehicle ruts, etc. In contrast to rills, they cannot be obliterated by ordinary tillage equipment. Deep gullies cannot be crossed with common types of vehicles or equipment (e.g. passenger cars, 4-wheel trucks, and farm tractors).

## H

**habitat** - The physical and biological environment for a plant or animal species in which all the essentials for its development, existence, and reproduction are present.

**habitat capability** - The ability of a land area or plant community to support a given species of wildlife.

**habitat diversity** - The diversity of wildlife habitat types within a given area. See biological diversity.

**heritage resources** - the physical remains of sites, structures, networks, or objects used by humans in the past. They can be historic, prehistoric, archaeological, or architectural in nature. Generally a synonym for cultural resources, although heritage resources may be more broadly inclusive (see also cultural resources).

**hibernaculum** - Defined in this document as a place where bats hibernate during the winter.

**Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER)** – Federal programs to document and record important architectural, engineering and industrial sites throughout the United States. A complete set of HABS/HAER documentation on a given site consists of measured drawings, large-format photographs, and a detailed written history that becomes a lasting archival record which is housed at the Library of Congress in perpetuity.

**historic range of variability** - The natural fluctuation of components of healthy ecosystems over time. The range of conditions and processes which are likely to have occurred prior to settlement by people of European descent.

**historic property** – Any prehistoric or historic district, site, building, structure, or object included on, or eligible for inclusion on the National Register of Historic Places, including artifacts, records, and material remains relate to such a property or resource.

**Hydrologic Unit Code** - A cataloging system developed by the US Geological Survey and the Natural Resource Conservation Service to identify watersheds, and to standardize hydrological unit delineations for geographic description and data storage purposes. They are typically reported at the large river basin or smaller watershed scale.

## I

**insignificant effect** – The effects determination made for federally listed species when effects, relating to the size of the impact, should never reach the scale where take occurs.

**integrated pest management** - The planned use of a variety of preventive, suppressive, or regulatory tactics and strategies that are ecologically and economically efficient and socially acceptable, to maintain destructive pests at tolerable levels.

**Interdisciplinary Team** - A team of individuals with skills from different disciplines that focuses on the same task or project.

**interior forest habitat** - High canopy forest conditions suitable to meet the requirements of area-sensitive species that are adversely impacted by forest edge, including microclimate change (warmer, windier), increased predation, increased brood parasitism, and increased competition.

**intermediate cutting** – An intermediate treatment involving the of trees from a stand sometime between the establishment of the stand and the regeneration cut(s). See intermediate treatments.

**intermediate treatment** - An inclusive term for any treatment designed to enhance growth, quality, vigor, and composition of the stand between establishment of the stand and the regeneration cut(s). (See intermediate cutting. Types of intermediate treatments include thinning, release, and improvement cuttings.)

**intermittent stream** - A stream that normally flows in response to a seasonally fluctuating water table in a well-defined channel (flowing 10-90 percent of an average year). The channel will exhibit signs of annual scour, sediment transport and other stream channel characteristics, absent perennial flows. Intermittent streams typically flow during times of elevated water table levels and may be dry during significant periods of the year, depending on precipitation cycles. Intermittent streams do not maintain fish populations or aquatic insects that have larvae with multi-year life cycles. Contrast with ephemeral stream and perennial stream.

**interpretation** - The conveyance of information to the public on topics such as natural and heritage resources or general forest information through various methods to better help visitors relate to, experience, understand and enjoy the natural environment and their recreation experience.

**interpretive site** - A site designated primarily for providing the public interpretive materials and programs.

**invasive species** - A species that can move into an area and become dominant either numerically or in terms of cover, resource use, or other ecological impacts. An invasive species may be native or non-native.

**irretrievable impact** - A category of impact in the National Environmental Policy Act to be analyzed in environmental impact statements. Refers to commitments of resources that are lost for a period of time. For example, while an area is used as a developed recreation site, some or all of the timber production there is irretrievably lost. If the recreation area closes, timber production could resume; the loss of timber production during the time that the area was devoted to developed recreation is irretrievable. However, the loss of timber production during that time is not irreversible, because it is possible for timber production to resume if the area is no longer used as a recreation area. Contrast with irreversible impact.

**irreversible impact** - A category of impact in the National Environmental Policy Act to be analyzed in environmental impact statements. Refers to commitments of resources that cannot be reversed, except perhaps in the extreme long term. For example, once coal has been removed, it will not be replaced within any measurable time period. Contrast with irretrievable impact.

**“Is not likely to adversely affect”** – The appropriate conclusion when effects on federally listed species are expected to be discountable, insignificant, or beneficial.

**“Is likely to adversely affect”** – The appropriate finding if any adverse effect to federally listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial.

**issues** - Topics of unresolved conflict or special concern involving management of the National Forest.

## J

## K

**keystone species** - A species whose influence on ecosystem function and diversity are disproportionate to their numerical abundance.

## L

**landing** – A cleared area in the forest to which logs are yarded or skidded for loading onto trucks for transport.

**Landscape Character Goal** - In scenery management, the visual and cultural image of a geographical area. It uses base information from ecological unit descriptions supplemented with existing land use patterns or themes. It is the adopted desired future appearance of the area and represents trade-off analysis with other resources. Levels include Natural Evolving, Natural Appearing, Pastoral/Agricultural, Historic, Transitional, Suburban, and Urban.

**landscape character** - Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique.

**landscape visibility** - In scenery management and forest planning, the visible landscape as seen from roads, trails and visitor use areas. Visibility mapping is based on terrain only, displaying the areas in distance zones of foreground, middle-ground, and background. It is mapped during leaf-off conditions from places of varying concern levels. Visibility maps are similar to old system maps that

depicted what areas are seldom seen or seen, from where, at what distances and from what sensitivity level travelway or use area and variety class.

**landscape** - A large land area composed of interacting ecosystems that are repeated due to factors such as geology, soils, climate, and human influences throughout the area. Landscapes are generally of a size, shape, and pattern that are determined by interacting ecosystems.

**Landscape Character Description**-A combination of objective information and subjective values assigned to a landscape, which gives a visual and cultural image of a geographic area.

**Landscape Character Theme** - In scenery management, the visual and cultural image of a geographical area. It uses base information from ecological unit descriptions supplemented with existing land use patterns or themes, or Existing Landscape Character. It is the potential desired future appearance of the area and represents trade-off analysis with other resources. Levels include Natural Evolving, Natural Appearing, Pastoral/Agricultural, Historic, Transitional, Suburban, and Urban.

**landtype** - A unit of ecological land classification based on similar bedrock geology, soils and landform, which repeats on the landscape.

**large woody debris** – see coarse woody debris.

**lentic** – Of or relating to or living in still waters (as lakes or ponds).

**litter** - The top layer of the forest floor directly above the duff layer, which includes freshly fallen or only slightly decomposed plant material, including leaves, needles, bark flakes, cone scales, fruits (including acorns and cones), dead matted grass and other vegetative parts that are little altered in structure by decomposition. Contrast with duff.

**long-term effects** - Those effects, which will usually occur beyond the next ten years.

**long-term sustained-yield capacity** - The highest uniform wood yield from lands being managed for timber production that may be sustained under specified management intensity, consistent with multiple-use objectives.

**lotic** – Of or in running water such as a stream or river.

## **M**

**management indicator species (MIS)** - 1) A species whose condition can be used to assess the impacts of management actions on a particular area. 2) A species whose population changes are believed to indicate the effects of management activities, and is monitored to track population numbers and habitat conditions, as a way of monitoring biodiversity.

**manual site preparation:** The killing or retardation of competing vegetation to prepare an area for reforestation, using hand or power tools such as chainsaws.

**mature forest-** Trees that have attained full development, especially height, and are in full seed production.

**mature timber-** Generally used in an economic sense to indicate that a forest has attained harvest age.

**mean annual increment -** In forestry, a measurement of the average total increase in size or volume of a tree or stand (including the standing crop plus thinnings) up to a given age.

**mechanical control -** The use of mechanical means to control undesirable vegetation.

**mechanical site preparation -** The killing or retardation of competing vegetation to prepare an area for reforestation, using heavy equipment. See specific mechanical methods: chopping, disking, scarification, shearing, shredding, raking, and ripping. See site preparation, manual site preparation, chemical site preparation, and mechanical control.

**mesic -** Refers to moist to moderately moist soil conditions. Under mesic conditions, soil moisture is predictably adequate for plant growth during the growing season.

**mesophytic -** Of or adapted to a moderately moist environment.

**microclimate -** The climate of a small site. It may differ from the climate at large of the area due to aspect, tree cover (or the absence of tree cover), or exposure to winds. (Contrast with macroclimate.)

**middleground -** The zone between the foreground and the background in a landscape, or the area within ½ mile to 4 miles of the observer.

**mineral materials -** Mineral commodities having a low value per ton such as sand, gravel, stone, clay and other similar materials. Such mineral materials are saleable minerals in accordance with the Mineral materials Act of 1947.

**mineral soil -** Soil that consists mainly of inorganic material, such as weathered rock, rather than organic matter.

**mitigation -** Collective actions taken to avoid, minimize, or rectify the negative impact of a land management practice.

**mixed mesophytic forest -** A forest containing tree (mostly hardwood) and plant species, which normally grow in moderately moist soils, typically in coves, or in riparian areas.

**mixed stand** - A stand consisting of two or more over-story tree species, usually a combination of hardwood and softwood species, having at least 30% stocking of each. (Also mixed forest.)

**monitoring and evaluation** - the periodic evaluations of forest management activities to determine how well objectives were met and how management practices should be adjusted.

**mortality** - 1) The death rate of a species within a given population or community. 2) In forestry, the quantity of formerly merchantable trees that have died within a specified period of time.

**mosaic** - In this document, areas with a variety of plant communities, generally repeating over a landscape, such as forested and non-forested areas.

**multiple-use management** - The management of all the various renewable surface resources of National Forest System lands for a variety of purposes such as recreation, range, timber production, habitat, and watershed protection.

**mycorrhizae** - a fungus that colonizes the roots of a host plant. Different sorts of fungal structures are found in mycorrhizal trees and in roots of most herbaceous plants. These fungi belong to a group called ectomycorrhizae and endomycorrhizae respectively, forming mycorrhizal networks, which can be detected in the soil organic layers.

## N

**National Forest System Road** - A road wholly or partly within, or adjacent to, and serving National Forest System land and necessary for the protection, administration and use of the National Forest System and the use and development of its resources.

**National Historic Landmark** - Cultural properties designated by the Secretary of the Interior as being nationally significant. These cultural properties may be buildings, historic districts, structures, sites and objects that possess exceptional value in commemorating or illustrating the history of the United States.

**National Historic Preservation Act (NHPA)** – A federal Act, passed in 1966, which established a program for the preservation of additional historic properties throughout the nation and for other purposes, including the establishment of the National Register of Historic Places, the National Historic Landmarks designation, regulation for supervision of antiquities, designation of the State Historic Preservation Offices, guidelines for federal agency responsibilities, technical advice, and the establishment of the Advisory Council on Historic Preservation.

**National Register of Historic Places (NRHP)** – A list of heritage resources that have local, state, or national significance maintained by the Secretary of the Interior.

**native species** - Any species native to a given land or water area by natural occurrence.

**Natural-Appearing Landscape Character** - Landscape character that has resulted from human activities, yet appear natural, such as historic conversion of native forests in to farmlands, pastures, and hedgerows that have reverted back to forests through reforestation activities or natural regeneration

**natural range of variability** - In planning, the full range of ecosystem processes and disturbance regimes that occur within the current climatic period.

**NEPA process** – A series of procedural steps derived from the National Environmental Policy Act of 1970. The NEPA process is intended to help public officials make decisions that are based on public input and understanding of environmental consequences, and take actions that protect, restore, and enhance the environment.

**niche** - As it relates to recreation marketing; the role best suited for the Forest Service in its provision of recreational facilities, activities and settings to the public it serves.

**no action alternative** - A required alternative in an EIS or EA, it describes the most likely condition expected to exist in the future if management practices cease or continue without change. This alternative provides a basis (point of reference) for describing the environmental effects of the proposed action and other alternatives.

**“No effect”** – The appropriate conclusion when a determination is made that the proposed action will not affect a listed species or designated critical habitat.

**no surface occupancy stipulation** - A mineral leasing stipulation that prohibits occupancy or disturbance on all or part of the land surface to protect special values or uses.

**non-chargeable volume** - The harvested timber volume that is not included in the allowable sale quantity calculations. Such volume includes timber removed from lands unsuitable for timber harvest, fuelwood, and volume from non-commercial or cull trees.

**non-commercial thinning** - The thinning of commercial-size trees without a subsequent sale of the associated wood products. See thinning, pre-commercial thinning.

**non-native species** - An introduced species that evolved elsewhere, and that has been transported and disseminated purposefully or accidentally.

**non-point source pollution** - Pollution of the air or water from diffuse sources and which cannot be traced to a single point of origin. For example, air pollutants result from power plants, vehicle emissions and other widespread activities. Water pollutants result from agriculture, forestry, urban, mining, and construction projects, and are generally carried off the land by storm water runoff into waterways.

**non-renewable resource** - A resource whose total quantity does not increase measurably over time, so that each use of the resource diminishes the supply.

**non-timber forest product** – (See special forest products.)

**not administratively available stipulation** - A minerals stipulation on an area that prohibits lands from being available for leasing.

**notice of intent** - A notice in the Federal Register that an environmental impact statement will be prepared.

## O

**oak decline** - a complex condition caused by many factors, including predisposing conditions, inciting factors, and contributing secondary insects and diseases. The predisposing conditions are often relatively old trees, shallow soils, and previous droughts. The inciting conditions for the current event include severe drought and repeated defoliation by insects. The secondary agents commonly include red oak borer, carpenterworm, two-lined chestnut borer, armillaria root disease and hypoxylon canker.

**objective** - In planning, a concise, time-specific statement of measurable planned results that respond to pre-established goals. An objective forms the basis for further planning to define the precise steps to be taken and the resources to be used in achieving identified goals.

**obliteration** - In engineering, actions taken on a roadway or motorized trail over which travel has been and will continue to be denied. The entrance is obscured, and the wheel tracks or pathway is no longer continuous and suitable for travel. Maintenance needs have been eliminated, and it has been removed from the transportation or trail system inventory. Obliteration does not necessarily imply returning the road prism back to its original contours.

**off-highway vehicle** -Any motorized vehicle designed for or capable of cross-country travel on or immediately over land, water, snow, ice, marsh, swampland, or other natural terrain. It includes but is not limited to four-wheel drive and other high-clearance vehicles, low-pressure-tired vehicles (ATV), motorcycles and related two-wheeled vehicles (OHM), and any other means of transportation deriving power from any source other than muscle or wind; except that such term shall exclude any registered motorboat; any military, fire, or law enforcement vehicle; any farm-type tractor and other self-propelled agricultural equipment used exclusively for agricultural purposes; any self-propelled equipment for harvesting and transporting forest products, or for earth moving or construction while being used for these purposes on the work site (and self-propelled lawnmowers, snow-blowers, garden or lawn tractors, or golf carts while being used for their designed purpose). See all-terrain vehicle.

**old-growth forest** - Old-growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulation of large wood material, number of canopy layers, species composition, and ecosystem function. Different forest communities reach old-growth conditions at different ages, under different disturbance regimes, and via different management strategies. (Specific descriptions of old-growth on the Wayne National Forest can be found in Appendix D-Range of Natural Variability in the EIS.)

**organic soil** - Soil that is at least partly derived from living matter, such as decayed plant material.

**outstanding mineral rights** - The rights to extract subsurface minerals that are retained by the owner of those minerals, when ownership of the surface of the land (by subsequent party) is transferred to the federal government.

**overmature timber** - A tree or stand that has attained full development, particularly in height, and has begun to lessen in commercial value because of declining vigor, health, or soundness.

**overstocked stand** - A stand in which the density of trees is greater than the desired pre-established standard, which is usually tied to species and site index.

**overstory** - 1) The trees in a two- or multi-layered forest stand that provides the upper crown cover. 2) A more or less continuous cover of branches and foliage formed collectively by the upper portion of the vegetation structure.

## P

**parent material** - The mineral or organic matter from which the upper layers of soil are formed.

**partial retention** - A visual quality objective in which evidence of human activities is acceptable but must remain subordinate to the characteristic landscape.

**Passport in Time (PIT)**– A nationwide Forest Service program that provides opportunities for “hands-on” public involvement in heritage resources management, such as archaeological excavations, historical research, and oral history collection.

**patch** - An area of vegetation that is homogeneous in structure and composition. (See stand.)

**perennial stream** - Any watercourse that normally flows most of the year (greater than 90 percent of an average year) in a well-defined channel, although droughts and other precipitation patterns may influence the actual duration of flow. It contains fish or aquatic insects that have larvae with multiyear life cycles, and water-dependent vegetation is typically associated with it. (Contrast with ephemeral stream and intermittent stream.)

**periodic annual increment** - The average growth of a tree or stand observed over a specific period of years (a typical measurement period being ten years).

**permeability** - The capacity of a soil to transmit water or air.

**personal use** - The use of a forest product, such as firewood, for home use as opposed to commercial use or sale.

**persons at one time** - A recreation capacity measurement indicating the number of persons that can comfortably occupy, or use, a facility or area at one time.

**planning area** - In this document, the area of National Forest System land covered by a Forest Land and Resource Management Plan.

**planning period** - The 150-year time frame for which goods, services, and effects were projected in the development of the Forest Plan.

**plastic** - 1) A characteristic or index property of soils used as in expressing soil behavior, frequently in relation to soil stability. 2) A condition existing between semiliquid and semisolid states.

**plastic limits** - 1) The moisture content at which a soil changes from a semisolid to plastic state in which soils may be molded or deformed under pressure. 2) A soil physical property utilized as an engineering index value in describing or evaluating soil behavior.

**poletimber-size** - Trees that are at least 5.0 inches dbh, but smaller than the minimum size for sawtimber. Also known as small roundwood.

**precommercial thinning** - The removal from a stand of some of the trees that are too small to be sold for timber products, to promote growth of the remaining, more desirable trees. (See thinning.)

**preparatory cut** - The removal of trees near the end of a rotation to open the canopy so the crowns of seed bearing trees can enlarge to improve seed production and encourage natural regeneration.

**prescribed burning** - The controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions that allows the fire to be confined to a predetermined area, and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.

**prescribed fire plan** - A written statement defining the objectives to be attained as well as the conditions of temperature, humidity, wind direction and speed, fuel moisture and soil moisture under which a fire will be allowed to burn. A prescription is generally expressed as acceptable ranges of the prescription elements and the limit of the geographic area to be covered.

**prescribed fire** - A fire ignited by management actions to meet specific objectives. More specifically, it is the controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions that allows the fire to be confined to a predetermined area, and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.

**present net value** - The measure of the economic value of a project when costs and revenues occur in different time periods. Future revenues and costs are "discounted" to the present by an interest rate that reflects the changing value of a dollar over time. The assumption is that dollars today are more valuable than dollars in the future. PNV is used to compare project alternatives that have different cost and revenue flows. Also called present net worth; net present value.

**professional archaeologist** - An archaeologist who meets the Secretary of the Interior's Standards for Archaeology and Historic Preservation.

**Public Forest Service Road** - A National Forest System road that is open to public travel and has been approved for inclusion into the Public Forest System Road Program.

**public involvement** - In planning, the use of appropriate procedures to inform the public, obtain early and continuing public participation, and consider the views of interested parties in planning and decision making.

## Q

**q-factor** - A term used in uneven-aged silviculture to describe the relative distribution of tree diameter size classes in a stand. This is expressed in terms of the “q” ratio between numbers of trees in successive 2-inch diameter classes. For example, a “q” of 1.5 means there are 1.5 times as many 10-inch trees as there are 12-inch trees, and 1.5 times as many 12-inch trees as there are 14-inch trees, etc. The lower the “q-factor”, the more large trees there are in proportion to small trees.

## R

**range of variability** - Refers to the range of sustainable conditions in a healthy ecosystem, which is determined by time, processes, species, and the land itself. For instance, ecosystems that have a 10-year fire cycle have a narrower range of variation than ecosystems with 200 to 300-year fire cycles. Also called the historic range of variability or natural range of variation.

**ranger district** - The administrative sub-unit of a national forest, supervised by a District Ranger who reports directly to a Forest Supervisor.

**rare community** - A unique biological community that is expected or known to harbor a sensitive community or rare species.

**Record of Decision** - The official document in which a deciding official announces the alternative that will be implemented from a prepared environmental impact statement. The ROD is also used to present the rationale used to arrive at the decision.

**Recreation Opportunity Spectrum** - A framework for stratifying and defining classes of outdoor recreation environments or settings, activities, and experiences along an opportunity spectrum. The spectrum is defined typically by six classes of opportunities (see below for each class description).

**primitive** - 1) Minimum modification. 2) Area is characterized by fairly large, essentially unmodified natural environment. Interaction between users is very low and evidence of other users is minimal. The area is managed to be essentially free from evidence of human induced restrictions and controls. Motorized use in the area is not permitted

**semi-primitive non-motorized** - 1) Minimum modification. Motorized access not allowed. 2) Area is characterized by a predominantly natural or natural appearing environment of moderate to large size. Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but is subtle. Motorized use is generally prohibited.

**semi-primitive motorized** - 1) Minimum modification. Motorized access is allowed. 2) Area characterized by a predominantly natural or

natural-appearing environment of moderate to large size, with a moderately high probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers challenge and risk. Motorized use is permitted.

**roaded natural** - 1) Moderate modification. 2) Area is characterized by a predominantly natural or natural-appearing environment of moderate size. Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but is subtle. Motorized use is permitted, but may be restricted in some areas.

**rural** -1) Heavy modification. 2) Area is characterized by substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities are often provided for special activities. Facilities for intensified motorized use and parking are available.

**urban** - 1) High degree of modification. 2) Area is characterized by a substantially urbanized environment, although the background may have natural-appearing elements. Renewable resource modification and utilization practices are to enhance specific recreation activities. Vegetative cover is often exotic and manicured. Sights and sounds of humans, on-site, predominate. Large numbers of users can be expected, both on-site and in nearby areas. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site.

ROS is used in two different contexts – either as an inventory tool or a management objective. As an inventory tool, ROS is used to describe the existing array of recreation settings. This application describes the existing recreation opportunities or condition on the Forest and is referred to as the ROS inventory. The second way ROS is used is to describe a set of recreation management objectives or desired future recreation settings, which is referred to as ROS class objectives.

**recreation visitor day** - A unit of measure of recreation use equivalent to 12 hours of accumulated recreational activity by one or more persons during one or more visits to the National Forest. For example, 1 person for 12 hours, 2 persons for 6 hours, 3 persons for 4 hours are each one RVD.

**reforestation** - The restocking of a harvested or poorly stocked forest by either natural or artificial means.

**regeneration** - 1) The renewal of a forest, including the regeneration cut(s) and subsequent reforestation. 2) A young cohort of trees generally in the seedling stage. Obsolete term: reproduction. (See advanced regeneration, artificial regeneration, and reforestation.)

**regeneration method** - A cutting procedure by which a new age class is created; the major methods are clearcutting, seed tree, shelterwood, and selection.

**Regional Forester** - The official of the USDA Forest Service responsible for administering an entire region of the Forest Service.

**Regional Forester sensitive species** - Those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by (1) significant current or predicted downward trends in population numbers or density; or (2) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution. Sometimes referred to as a sensitive species.

**rehabilitation** - The process of repairing damage done to the ecosystem or a part of it, such that natural processes will again function in the repaired system. Contrast with restoration.

**release cutting** - The removal of competing vegetation to allow desired tree species to grow.

**removal cut** - The removal of the last seed bearing or shelter trees after a regeneration cohort has been established.

**reserved mineral rights** - The rights to extract subsurface minerals that are retained by a landowner, when ownership of the surface of the land is transferred to the federal government. Basic standards for conducting mineral operations are inserted into the deed held by the private owner of the minerals.

**residual trees** – The live trees remaining after a natural or artificial disturbance (e.g., a wind event or timber harvest).

**resilience** - The ability of an ecosystem to maintain diversity, integrity, and ecological processes following a disturbance.

**responsible official** - The USDA Forest Service employee who has been delegated the authority to carry out a specific planning action.

**restoration** - The process of modifying an ecosystem to achieve a desired, healthy, and functioning condition. Contrast with rehabilitation.

**revegetation** – The re-establishment and development of a plant cover by either natural or artificial means, such as re-seeding.

**rill erosion** - The removal of soil through the cutting of many small, but conspicuous, channels where runoff concentrates.

**riparian area** – A geographically delineable area of transition between the aquatic and terrestrial ecosystems. The riparian area is delineated by frequently or occasionally flooded soils, as defined by USDA county Soil surveys.

**riparian corridor** – A three-dimensional area of interaction between the aquatic and terrestrial ecosystem. The riparian corridor extends up and down streams and along shorelines, extends laterally up into the terrestrial ecosystem where the land-water interface occurs, and extends from below the water table to the canopy. It includes the riparian area and upland areas within the flood-prone, or 100 feet from the edge of the aquatic ecosystem or wetland, whichever is greater.

**riparian-dependent resources**-Resources that owe their existence to the riparian area.

**riparian ecosystems**-A transition area between the aquatic ecosystem and the adjacent terrestrial ecosystem; identified by soil characteristics or distinctive vegetation communities that require free or unbound water.

**ripping** - The use of a subsoiler or chisel plow pulled by a large tractor to break up, deep shatter, and partially mix compacted soils and improve porosity. Ripping is a mechanical site preparation activity.

**Roadless Area Review and Evaluation** - The national inventory of roadless and undeveloped areas within National Forests and Grasslands.

**roadless area** - National Forest System lands evaluated for potential wilderness that meet one or more of the following criteria (FSH 1909.12, Chapter 7):

- 1) They contain 5,000 acres or more
- 2) They contain less than 5,000 acres but:
  - a) Due to physiography or vegetation, they are manageable in their natural condition.
  - b) They are self-contained ecosystems such as an island.
  - c) They are contiguous to existing wilderness, primitive areas, administration-endorsed wilderness, or roadless areas in other federal ownership, regardless of their size.
- 3) They do not contain improved roads maintained for travel by standard passenger-type vehicles, except as permitted in areas east of the 100th meridian. Criteria for inventorying roadless areas east of the 100th meridian recognize that much, if not all of the land, shows some signs of human activity and modification even though they have shown high recuperative capabilities. Roadless areas east of the 100th meridian qualify for inventory as potential wilderness if:
  - a) The land is regaining a natural, untrammelled appearance.
  - b) Improvements existing in the area are being affected by the forces of nature rather than humans and are disappearing or muted.
  - c) The area has existing or attainable National Forest System ownership patterns, both surface and subsurface, that could ensure perpetuation of identified wilderness values.

- d) The location of the area is conducive to the perpetuation of wilderness values. Consider the relationship of the area to sources of noise, air, and water pollution, as well as unsightly conditions that would have an effect on the wilderness experience. The amount and pattern of Federal ownership is also an influencing factor.
- e) The area contains no more than a half-mile of improved road for each 1,000 acres, and the road is under Forest Service jurisdiction.
- f) No more than 15 percent of the area is in non-native, planted vegetation.
- g) Twenty percent or less of the area has been harvested within the past ten years.
- h) The area contains only a few dwellings on private lands and the location of these dwellings and their access needs insulate their effects on the natural conditions of federal lands.

**rockshelter** - An area, usually within a cliffline, where erosion or rock fall has created a shallow void. Sometimes referred to as a rockhouse.

**rotation** – In silviculture, the number of years required for establishment and growth of trees to a specified condition of maturity, at which point they are harvested. The term rotation applies to even-aged management and does not apply to two-age or uneven-age systems. (See cutting cycle.)

**roundwood** - Logs, bolts, or other round sections cut from trees for industrial manufacture or consumer use. (See sawtimber; poletimber-size.)

**run-off** - The portion of precipitation that flows over the land surface or in open channels.

## S

**sacred site** - Any specific, discrete, narrowly delineated location on federal land that is identified by an Indian tribe or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion.

**salvage harvest** - The harvest of dead trees or trees being damaged or killed by injurious agents other than competition, to recover economic value that would otherwise be lost.

**sapling** - A tree, at least 1.0 inch dbh, and less than 5.0 inches dbh.

**sawtimber** - Trees that contain at least one 12-foot, or two 8-foot logs that can be made into lumber, that are typically at least 11 inches dbh for hardwood species, and 9 inches dbh for softwood species. Also referred to as large roundwood or saw timber.

**scarification** - A mechanical site preparation method using a machine that clears herbaceous and small woody vegetation and mixes soil to a depth of up to 4 inches.

**scenery** - General appearance of a place or landscape, and a natural resource of the Forests and composed of existing natural features including vegetation, water, landforms, and geology.

**scenery management system** - 1) A system of inventory, analysis, and management of scenery within an ecosystem context. 2) Tool incorporated into Forest Plans to determine the relative value and importance of scenery on National Forest System lands. The process involves classifying landscapes, and setting goals and objectives for maintaining, enhancing, restoring, and monitoring scenic integrity. SMS replaced the Visual Management System (VMS) as defined in Agriculture Handbook #462.

**scenery management** - The art and science of arranging, planning, and designing landscape attributes relative to the appearance of places and expanses in outdoor settings.

**scenic attractiveness** - The scenic importance of a landscape based on human perceptions of the intrinsic beauty of landform, rockform, waterform, and vegetation pattern. Reflects varying visual perception attributes of variety, unity, vividness, intactness, coherence, mystery, uniqueness, harmony, balance, and pattern. It is classified as: Class A-Distinctive, Class B-Typical or Common, or Class C-Undistinguished. (Same as Variety Class under the visual Management System.)

**scenic class** - A group of seven classes used in forest planning to rank the relative importance or value of landscape areas with similar characteristics of scenic attractiveness and landscape visibility. A level 1 area has the highest value and Level 7 has the lowest value.

**scenic integrity** -The state of naturalness, or conversely, the state of disturbance created by human activities or alteration. It is a measure of the degree to which a landscape is usually perceived to be “complete”. The degrees of deviation are used to describe the existing scenic integrity, proposed scenic integrity levels, and scenic integrity objectives.

**scenic integrity levels** - They are the proposed management objectives that are presented in the alternative development of the Environmental Impact Statement. Usually they are described at the management prescription level. Scenic Integrity Levels (SILs) are defined by minimal acceptable levels or performance standards in each alternative. SILs are Very High, High, Moderate, Low, and Very Low. The SILs define the degrees of acceptable deviation in form, line, color, and texture that may occur at any given time. (Full description in Agricultural Handbook 701).

**scenic integrity objective** - Scenic Integrity Objectives (SIOs) guide the amount, degree, intensity, and distribution of management activities needed to achieve desired scenic conditions. They are the management objectives that are adopted through the approval of the Forest Land and Resource Management Plan. Scenic integrity levels (SILs) becomes the objectives (SIOs) when the preferred alternative is selected. (Refer to the Forest's landscape character descriptions for a definition of the valued landscape character for each Management Area.)

**Very High Scenic Integrity:** *Unaltered*- The valued landscape character is intact with only subtle, if any, deviations. The existing landscape character and sense of place is expressed at the highest possible level. (Equivalent to Preservation in VMS)

**High Scenic Integrity:** *Appears unaltered*- The valued landscape character appears intact. Deviations may be present, but are not evident because they repeat the form, line, color, texture, and pattern common to the landscape character so completely and at the appropriate scale. (Equivalent to Retention in VMS)

**Moderate Scenic Integrity:** *Appears slightly altered*- The valued landscape character appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape being viewed. (Equivalent to Partial Retention in VMS)

**Low Scenic Integrity:** *Appears altered*- Deviations from the valued landscape character may begin to dominate the landscape being viewed, but they should borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes, or architectural styles that may occur elsewhere. (Equivalent to Modification in VMS)

**Very Low Scenic Integrity:** *Appears heavily altered-* The valued landscape character appears heavily altered. Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect, pattern and scale of natural openings, vegetative type changes or architectural styles within or outside the landscape being viewed. However deviations should be shaped and blended with the natural terrain (landforms) so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition. This is not a desirable management objective for scenery. (Equivalent to Maximum Modification in VMS)

**Unacceptably Low:** The valued landscape character being viewed appears extremely altered. Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern or scale from the landscape character. Landscapes at this level of integrity need rehabilitation. This level should only be used to inventory existing integrity or for monitoring. It must not be used as a management objective. (Equivalent to Unacceptable Modification in VMS) (Full description available in Agricultural Handbook 701).

**scenic resource-**The composite of basic terrain, geological features, water features, vegetative patterns, and land-use effects that typify a land unit and influence the visual appeal the unit may have for visitors.

**scoping -** In planning, the ongoing process used to determine public opinion, receive comments and suggestions, and determine issues during an environmental analysis. Scoping involves public meetings, telephone conversations, letters or other communication methods.

**Secretary of the Interior’s Standards for Archaeology and Historic Preservation –** A series of standards developed by the Department of the Interior’s National Park Service addressing various areas of historic preservation. They include standards for preservation, reconstruction, rehabilitation, and restoration of historic properties as well as the basic qualifications needed by professionals to conduct work in historic preservation.

**sediment -** Material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by water, wind, ice or mass-wasting and has come to rest on the earth’s surface.

**seedling -** A tree from the time of emergence from the seed, until it reaches sapling size (1 inch dbh). For silvicultural inventories, only established seedlings are counted. A hardwood seedling is considered established at one foot tall, and a softwood seedling at six inches tall.

**seed tree** - A residual tree left after harvest as a seed source for the next cohort.

**seed tree regeneration method** - An even-aged regeneration method where all merchantable trees in a stand are removed in a single cut, except for a small number of widely dispersed trees retained for seed production.

**seep** - A wet area where a seasonal high water table intersects with the ground surface.

**shelterwood** - 1) An even-aged regeneration method involving the cutting of most trees, leaving those needed to produce sufficient shade to produce an new age class in a moderated microenvironment, 2) residual trees left to provide shade for a new cohort.

**shelterwood regeneration method** - An even-aged regeneration method involving the cutting of most trees, leaving those needed to produce sufficient shade to produce an new age class in a moderated microenvironment.

**shelterwood tree** – A residual tree left after harvest to provide shade for a new cohort.

**shelterwood with reserves regeneration method** - A two-aged regeneration method in which some or all of the shelter trees are retained, well beyond the normal period of retention, to attain goals other than regeneration. (Also referred to as the two-aged shelterwood method.)

**short-term effects** - In planning, those effects that usually occur within ten years.

**significant heritage resource** – Any such resource that meets the criteria for listing on the National Register of Historic Places.

**significant issue** - In planning, an area of unresolved conflict concerning management of the National Forest.

**silvicultural system** - A management process whereby forests are tended, harvested, and replaced, resulting in a forest of distinctive form.

**silviculture** - The theory, practice, art and science of controlling the establishment, composition, growth, and quality of forest stands and trees, in order to meet management objectives.

**single tree selection** - An uneven-aged regeneration method in which individual trees, or small groups of trees less than one-quarter acre in size, from certain size and age classes are removed across a stand to achieve desired stand structural characteristics. Also referred to as individual tree selection.

**site preparation** - A reforestation activity, normally following a timber harvest, that is designed to control vegetation that could interfere with the establishment of the desired species, or designed to expose mineral soil sufficiently for the establishment of the desired species. Site preparation treatments could include mechanical, manual, chemical, prescribed fire, or a combination of such treatments.

**skid road** - A temporary blade-constructed pathway having a road-like function and appearance, used to drag felled trees or logs to a landing. Several skid trails normally branch off of a skid road.

**skid trail** - A temporary nonstructural pathway used to drag felled trees or logs to a skid road or landing, resulting in some ground disturbance. One or more skid trails normally connect to a skid road.

**skidding** - The movement of logs by dragging from stump to a log landing.

**skyline logging** - A cable logging system used to remove timber from steep slopes where logs are brought up-slope on a suspended cable, or skyline.

**slash** - The residue left on the ground after timber cutting or resulting from a storm, fire, or other natural event. Slash includes unused logs, uprooted stumps, broken or uprooted boles, branches, bark and other material.

**slope distance** - Distance that is measured along the surface of the ground.

**slope stability** - The susceptibility of a slope to erosion and landslides.

**Slow-the-Spread** - A strategy developed to slow the expansion of insects and/or diseases from the generally infested area.

**slump** - A mass movement process characterized by a landslide involving a shearing and rotary movement of a generally independent mass of rock and earth along a curved slip surface.

**snag** - A standing dead tree or a live tree with less than 10% crown.

**soil compaction** - A reduction of soil volume, which results in alteration of soil chemical, physical and biological properties and qualities.

**soil depth** - The distance from the top of the soil to the underlying bedrock. The depth is expressed as one of the following categories: shallow, 0-20 inches; , moderately deep, 20-40 inches; deep, 40-60 inches; or very deep, more than 60 inches.

**soil fertility** - The quality of a soil that enables it to provide nutrients in adequate amounts and in proper balance for the growth of specified plants.

**soil productivity** - The potential capability of a soil to supply the physical, chemical, and biological needs of plants over the long-term, as influenced by climate, parent materials, topographic on the landscape (including aspect), and land use history.

**soil quality** – 1) A soil’s inherent or “natural” capacities to perform its functions to sustain productivity. 2) The capacity of a soil to function within ecosystem boundaries to sustain biological productivity, maintain environmental quality and promote plant and animal health.

**soil survey** - The systematic examination, description, classification, and mapping of soils in an area.

**soil texture** - The relative proportions of sand, silt and clay in a soil.

**sound wood** - Wood that is in solid condition, free from structural damage, decay, or rot.

**special forest products** - Includes edibles (e. g. mushrooms); medicinals (e.g. ginseng and St. John’s Wort); floral products (e. g. moss, grape vines and ferns); and specialty wood products (e.g. carvings and containers) removed from NFS lands for personal or commercial use.

**special use authorization** - A permit, term permit, temporary permit, lease, easement, or other written instrument that grants rights of privileges of occupancy and use subject to specified terms and conditions on National Forest System land.

**Spectrum** - A computer-modeling tool to address ecosystem management issues. It models alternative resource management scenarios applied to landscapes through time in support of strategic and tactical planning. This includes scheduling vegetation manipulation activities to achieve ecosystem management objectives; modeling resource effects and interactions within management scenarios; and exploring tradeoffs between alternative management scenarios in support of decisionmaking.

**spring** - A water source located where water begins to flow from the ground due to the intersection of the water table with the ground surface. Springs generally flow throughout the year.

**stage construction** - For analysis purposes, stage construction is used to address specific road segments of concern (i.e., stream crossings) during construction of a road project. The intent being is to require construction of a particular road segment of concern (potentially of high risk for environmental damages) as fully designed prior to proceeding further, so as to protect sensitive resources (e.g., water quality, aquatic habitats, and slope stability). This is in contrast to the more traditional definition commonly used to mean, “Construct to a lower standard initially, but returning at a later time to rise to a higher standard of construction.” For example, a road would be initially constructed without gravel surfacing, with application of gravel surfacing planned for the following year.

**stand** - 1) In silviculture, a contiguous group of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit. 2) In ecology, a contiguous group of similar plants.

**stand improvement** - An intermediate treatment, not involving timber harvest, made to improve the composition, structure, condition, health, and growth of stands. Formerly known as timber stand improvement or wildlife stand improvement.

**standard** - Requirement found in a Forest Plan, which govern actions taken to meet objectives. Standards often preclude or impose limitations on management activities or resource uses, generally for environmental protection or public safety. Standards are mandatory, and deviation from a standard requires a Forest Plan amendment.

**State Historic Preservation Officer** - The state official, designated by the governor in each state, to administer the national historic preservation program at the State level. Administrative activities include receiving and administering matching grants from the National Park Service to support their own work and pass through to others, identifying historic properties and nominating them to the National Register, maintaining inventories, developing preservation plans, and consulting with federal agencies when and undertaking many affect an historic property.

**stocking** - 1) In silviculture, an indication of growing-space occupancy of live trees relative to a pre-established standard. Common indices of stocking are based on percent occupancy, basal area, relative density, stand density index, and crown competition factor. 2) In wildlife and fisheries management, the intentional and deliberate placement of a species in a specific location.

**stratigraphy** - The branch of geology that deals with the formation, composition, sequence, and correlation of the stratified rocks forming the earth’s crust.

**stream order** - A categorization of a stream according to its size. Stream order increases incrementally, with the order increasing with stream size, when one stream flows into a stream of equal or greater size. For example, first order streams are unbranched and usually found at the head of drainage basins. Second order streams are formed when two first order streams come together.

**strike and dip** - A geological phrase used to describe the attitude of an inclined stratum or structural surface. Strike is the direction or trend taken by a structural surface, e.g. N30°W. Dip is the angle that a structural surface makes with the horizontal, measured perpendicular to the strike of the structure and in the vertical plane.

**structure** - In ecology, the horizontal and vertical arrangement of ecological components. A study of an area's structure might reveal a mosaic of vegetation. In geology, one of the larger features of a rock mass, like bedding, flow banding, jointing, cleavage, and brecciation; also the sum total of such features.

**succession** - The natural replacement, in time, of one plant community with another. Conditions of the prior plant community (or successional stage) create conditions that are favorable for the establishment of the next stage.

**successional stage** - A stage of development of a plant community as it moves from bare ground to climax. For example, the grass-forbs stage of succession precedes the woody shrub stage. This phrase is often used with modifiers (such as early and late successional stage) to imply the age of a forest.

**Sudden Oak Death** - a recently recognized disease that is killing oaks and other plant species. First noticed in the western U. S. in 1995, the pathogen responsible for the disease is a fungus-like organism called *Phytophthora ramorum*.

**suitable for timber production** – Forest land where timber is produced on a scheduled basis. (See unsuitable for timber production; timberland.)

**suitability** - The appropriateness of the application of certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices. For example, in this document, each prescription area has been identified as suitable or not suitable for timber production and management reflects the designation.

**suppression (gypsy moth)** - Reduction of gypsy moth populations in heavily infested areas.

**surface use plan of operations** - In minerals management, a plan for surface use, disturbance, and reclamation on a leasehold.

**sustainability** - The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.

**sustained yield** - The yield that a renewable resource can produce continuously at a given intensity of management.

## T

**take** – An Endangered Species Act term that means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a listed species or attempt to engage in any such conduct.

**thinning** - An intermediate treatment or harvest made to reduce tree density, primarily to improve growth, enhance forest health, or recover potential mortality. See non-commercial thinning, precommercial thinning.

**threatened species** - A plant or animal species likely to become endangered throughout all or a specific portion of their range within the foreseeable future, as designated by the Secretary of the Interior or the Secretary of Commerce under the Endangered Species Act of 1973.

**timber** - Trees or wooded land regarded as a source of wood; a renewable natural resource.

**timber harvest** - The sum of activities making up a logging operation, including the felling, skidding, decking, loading, and hauling of timber products from the sale area.

**timber management** - A broad term that includes all of the silvicultural and technical aspects of forestry related to timber production.

**timber production** - The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. Timber production does not include the production of fuelwood. Also referred to as wood fiber production.

**timber products** - Logs, bolts, or other round sections available for industrial or consumer use (roundwood), or secondary products produced from roundwood, such as lumber. (See roundwood.)

**timber sale** - A process that is initiated by a management decision to implement a silvicultural prescription for a timber harvest. The process includes the sale area layout, designation of the timber that is to be harvested, timber appraisal, advertisement, bidding, award of sale, implementation of the timber harvest, and the closing of the sale.

**timber sale program quantity** - The volume of timber planned for sale during the first decade of the planning horizon. It includes the allowable sale quantity (chargeable volume), and any additional material (non-chargeable volume), planned for sale. The timber sale program quantity is usually expressed as an annual average.

**timber stand improvement (TSI)** - Obsolete term. (See stand improvement.)

**timberland** - Land declared suitable for producing timber crops, not withdrawn from timber production by statute or administrative regulation, and capable of growing at least 20 cubic feet of industrial wood per acre-year. Also referred to as commercial forest land.

**timing limitation** - In mineral management, a prohibition of surface use during specified time periods to protect identified resource values. Also referred to as a seasonal restriction.

**tractor logging** - A logging method that uses crawler tractor (bulldozer) or rubber-tired tractor (usually a center-articulated skidder) to carry or skid logs from the stump to a collection point.

**traditional cultural property** – A property that is associated with cultural practices or beliefs or a living community that (1) are rooted in that community’s history, and (2) are important in maintaining the continuing cultural identity of the community.

**travel route or travelway** - An established road or trail designed primarily as a means of access to an area.

**tree** - A woody perennial plant, typically large or capable of becoming large, with a well-defined stem or stems carrying a more or less definite crown. The USDA Forest Service identifies certain species as capable of becoming trees.

**turbidity** - 1) The state, condition, or quality of opaqueness or reduced clarity of water, due to the presence of suspended matter as with sediment. 2) A measure of the ability of suspended matter to disturb or diminish the penetration of light.

**two-aged silvicultural system** - A planned sequence of treatments designed to maintain and regenerate a stand with two age classes. On the Wayne National Forest, generally 10-20 square feet of BA is retained to grow for another cutting cycle. Formerly known as irregular shelterwood or two-aged shelterwood. (See shelterwood with reserves.)

**type conversion** - The natural or artificial change of a stand’s existing forest type to another forest type.

## U

**Underground Railroad** – The historic effort to assist persons held in bondage in North America to escape from slavery.

**understocked stand** - A stand in which the density of trees is less than the desired pre-established standard, usually tied to species and site index.

**understory** - The trees and other vegetation growing under a more or less continuous cover of branches and foliage known as the overstory.

**undertaking** – Any project, activity, or program that can result in changes in the character or use of any historic properties located in the area of potential effects (36 CFR 800.2). The project, activity, or program must be under the direct or indirect jurisdiction of a federal agency or licensed or assisted by a federal agency.

**uneven-aged management** - See uneven-aged silvicultural system.

**uneven-aged silvicultural system** - A planned sequence of treatments designed to maintain and regenerate a stand with three or more age classes- singly, in small groups, or in strips. (Also known as uneven-aged management.)

**Universal Transverse Mercator system (UTM)** – An international plane coordinate system that uses numeric values to identify the location of a point on the surface of the earth, similar to latitude and longitude.

**unsuitable for timber production** – Forest land that is not managed for timber production. On the WNF, lands unsuitable for timber production may be further divided into two subcategories: lands where tree cutting, tree removal, or timber harvest may occur on an unscheduled basis to attain desired future conditions; or lands where timber harvest is not allowed. Determinations for suitability are based on the criteria in paragraphs (a) through (d) of 36 CFR 219.14. See suitable for timber production.

## V

**variety class** - A way to classify landscapes according to their visual features. This system is based on the premise that landscapes with the greatest variety or diversity has the greatest potential for scenic value.

**vegetation management** - Any activity that is designed primarily to alter or modify vegetation to meet desired conditions on land or water having vegetation cover.

**vertical diversity** - The diversity in a stand that results from the different layers or tiers of vegetation.

**viability** - The tendency of a species to remain at population levels sufficient to assure its continued existence on the landscape, expressed as a likelihood of achievement.

**viable population** - A population that has the estimated numbers and distribution of reproductive individuals to insure that its continued existence is well distributed in the planning area.

**viewshed** - The total visible area from a single observer's position or from multiple observer positions. Viewsheds are accumulated seen-areas as travel routes or corridors, use areas, or water bodies.

**vista** - A confined view, especially one seen through a long passage, as between rows of trees or down a valley. A vista often focuses upon a specific feature in the landscape. Vistas are generally created/designed by humans for the specific purpose of viewing a unique feature in the landscape

**Visual Management System**-The planning and design of visual aspects of multi-use land management. This system was replaced by the Scenery Management System.

**visual quality objective** - An obsolete term used in scenery management to identify a set of measurable goals for the management of forest visual resources.

**visual resource** - A part of the landscape important for its scenic quality. It may include a composite of terrain, geologic features, or vegetation.

## W

**water yield** - The runoff from a watershed, including groundwater outflow.

**watershed** - 1) In general, the entire region drained by a waterway into a lake or reservoir. 2) More specifically, the land above a given point that contributes water to the stream flow at that point.

**wetland** - Area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include, for example, swamps, marshes, bogs and similar areas.

**wild and scenic river** - A river, or river section, designated under the Wild and Scenic Rivers Act of 1964. A river can be classified under the following three categories:

**wild river** - Free of impoundments and generally inaccessible except by trail, and within watersheds or shorelines that are essentially primitive.

**scenic river** - Free of impoundments but accessible by roads, and within watersheds or shorelines that are still largely primitive and undeveloped..

**recreational river** – Readily accessible by roads, with some development along their shorelines and may have undergone some impoundment or diversion in the past.

**wilderness** - A Congressionally designated area that is essentially unaltered and undisturbed by humans. Management of this area preserves and protects its physical and biological characteristics.

**wildfire** - Now an obsolete term for a fire type, an unwanted wildland fire, or more specifically, a fire occurring on wildland that is not meeting management objectives and thus requires a suppression response. Wildfires can be ignited by humans or by natural events such as lightning. The term wildfire exists for use in promoting fire prevention.

**wildland fire** - Any non-structure fire, other than prescribed fire, that occurs in the wildland. The term encompasses fires previously identified as “wildfires,” which required a suppression response, and “prescribed natural fires,” which were used to meet resource objectives. Both of these terms are now considered obsolete and the appropriate response by fire personnel to “a wildland fire” cannot be discerned without additional information.

**wildland/urban interface** - The line, area, or zone where structures and other human development meet or intermingle with flammable natural fuels, such as leaf litter or logging slash.

**wildlife habitat diversity** - The number and variety of habitat types present in an area and their spatial distribution.

**wildlife-associated recreation** - Recreation closely associated with one or more plant or animal species. Wildlife-associated recreation is often divided into consumptive use or non-consumptive use of the resource (for example, hunting, fishing, collection of medicinal plants versus wildlife watching). See consumptive use and nonconsumptive use.

## X

**xeric** - Refers to very dry soil conditions. Under xeric conditions, soil moisture is predictably inadequate for plant growth during the growing season.

## Y

**yarding** - A term used in conjunction with cable logging operations, to describe the process of moving logs from stump to a landing.

---

## Acronyms

### A

**ABB:** American Burying Beetle

**ACSI:** Appalachian Clean Streams Initiative

**AIM:** abandoned and inactive mine land inventory

**APD:** Application for Permit to Drill

**AMS:** Analysis of the management situation

**AQI:** Air Quality Index

**ASQ:** allowable sale quantity

**ARPA:** Archeological Resources Protection Act

**ATV:** All terrain vehicles

### B

**BA:** basal area; Biological Assessment

**BE:** Biological Evaluation

**BEA:** Bureau of Economic Analysis

**BEIG:** Built Environment Image Guide

**BF:** board foot

**BLM:** United States Bureau of Land Management

**BMP:** Best Management Practices

**BO:** Biological Opinion

**BP:** before present

### C

**CA:** candidate areas

**CBM:** coal bed methane

**ccf:** hundred cubic feet

**CE:** categorical exclusion

**CEQ:** Council on Environmental Quality

**cf:** cubic feet

**CFR:** Code of Federal Regulations

**CISC:** Continuous Inventory of Stand Condition

**CNEPA:** Comprehensive National Energy Policy Act

**CSU:** Controlled Surface Use

**CUA:** Concentrated use area

**CWA:** Clean Water Act

## **D**

**dbh:** diameter at breast height

**DCF:** Diverse Continuous Forest

**DCFO:** Diverse Continuous Forest with Off-Highway-Vehicles

**DEIS:** Draft Environmental Impact Statement

**DFC:** desired future condition

**DR:** District Ranger or Developed Recreation

## **E**

**EA:** Environmental Assessment

**EIS:** Environmental Impact Statement

**EPA:** Environmental Protection Agency

**ESA:** Endangered Species Act

**EWAP:** East-wide Watershed Assessment Protocol

## **F**

**FAI:** forest area of influence

**FDR:** Forest Development Road

**FEIS:** Final Environmental Impact Statement

**FFIS:** Foundation Financial Information System

**FIA:** Forest Inventory and Analysis

**FLT:** Forest Leadership Team

**FMO:** Fire Management Officer

**FMP:** Fire Management Plan

**FMT:** Forest management team

**FOF:** Future Old Forest

**FOFM:** Future Old Forest with Mineral Activity

**FONSI:** Finding of No Significant Impact

**FRCC:** Fire Regime Condition Class

**FS:** Forest Service

**FSH:** Forest Service Handbook

**FSM:** Forest Service Manual or Forest and Shrubland Mosaic

**FSMO:** Forest and Shrubland Mosaic with Off-Highway-Vehicles

## **G**

**GFM:** Grassland and Forest Mosaic

**GIS:** Geographic Information System

## **H**

**HABS:** Historic American Buildings Survey

**HAER:** Historic American Engineering Record

**HF:** Historic Forest

**HFO:** Historic Forest with Off-Highway-Vehicles

**HUC:** Hydrologic Unit Code

## **I**

**I&DC:** Insect and Disease Control

**ICO's:** issues, concerns, and opportunities

**ID:** interdisciplinary

**IDT:** interdisciplinary team

**IMPLAN:** Impact Analysis for Planning

**INFRA:** Forest Service “Infrastructure” Application

**IPM:** integrated pest management

## **K**

## **L**

**LAC:** Limits of acceptable change

**LBA:** lease by application

**LEIMARS:** Law Enforcement Information and Reporting System

**LEO:** Law Enforcement Officer

**LMP:** Land Management Planning

**LN:** Lease Notice

**LRMP:** Land and Resource Management Plan

## **M**

**MA:** Management Area

**MAI:** mean annual increment

**M&E:** monitoring and evaluation

**MBF:** thousand board feet

**MCF:** thousand cubic feet

**MCFGPD:** thousand cubic feet of gas per day

**MCRP:** Monday Creek Restoration Project

**MIS:** Management Indicator Species

**MMBF:** million board feet

**MMCF:** million cubic feet

**MOU:** Memorandum of Understanding

**MSDS:** Material Safety Data Sheets

## **N**

**NAA:** Not Administratively Available

**NAAQS:** National Ambient Air Quality Standard

**NAGPRA:** Native American Grave Protection and Repatriation Act

**NEPA:** National Environmental Policy Act

**NF:** National Forest

**NFC:** Need for Change

**NFMA:** National Forest Management Act

**NFS:** National Forest System

**NFSI:** National Forest System Inventory

**NFSR:** National Forest System roads

**NHPA:** National Historic Preservation Act

**NNIS:** Non-native invasive species

**NOI:** Notice of Intent

**NRHP:** National Register of Historic Places

**NRIS:** Natural Resource Inventory System

**NSO:** No-Surface-Occupancy

**NTFP:** Non-timber forest products

**NTL:** Notice to Lessees

**NVUM:** National Visitor Use Monitoring

## **O**

**ODNR:** Ohio Department of Natural Resources

**OHM:** off-highway motor vehicle

**OHPO:** Ohio Historic preservation Office

**OHV:** off-highway vehicle

**ORV:** off-road vehicle; outstandingly remarkable values

**OSM:** Office of Surface Mining

## **P**

**PAI:** Periodic annual increment

**PAO:** Public Affairs Officer

**PAOT:** Persons-at-one-time

**PIF:** Partners-in-Flight

**PILT:** Payment in Lieu of Taxes

**PIT:** Passport in Time

**PNF:** prescribed natural fire

**PNV:** present net value

**PSI:** Pounds per square inch

## **R**

**RARE II:** Roadless Area Review and Evaluation

**RC:** River Corridors

**RD:** Ranger District

**RF:** Regional Forester

**RFDS:** Reasonable Foreseeable Development Scenario

**RFSS:** Regional Forester Sensitive Species

**RNA:** Research Natural Area

**RO:** Regional Office

**ROD:** Record of Decision

**ROS:** Recreation Opportunity Spectrum

**ROW:** Right-of-way

**RPA:** Resource Planning Act

**RV:** recreation vehicle

**RVD:** Recreation visitor day

## **S**

**SA:** Special Areas

**SCORP:** State Comprehensive Outdoor Recreation Plan

**SHPO:** State Historic Preservation Offices

**SIC:** Standard Industrial Code  
**SIL:** Scenic integrity levels  
**SIO:** Scenic Integrity Objective  
**SMS:** Scenery Management System  
**SMCRA:** Surface Mining Control and Reclamation Act  
**SO:** Supervisor's Office  
**SO<sub>2</sub>:** sulfur dioxide  
**SPM:** Semi-primitive Motorized  
**SPNM:** Semi-primitive Non-motorized  
**STARS:** Sale Tracking and Reporting System  
**SUPO:** Surface Use Plan of Operation  
**S & Gs:** standards and guidelines

## **T**

**tcfg:** trillion cubic feet of gas  
**TES:** Threatened, Endangered, and Sensitive Species  
**TL:** Timing Limitation Stipulation  
**TNC:** The Nature Conservancy  
**TRL:** Timbre Ridge Lake  
**TSI:** timber stand improvement

## **U**

**USACE:** United States Army Corp of Engineers  
**USDA:** United States Department of Agriculture  
**USDI:** United States Department of Interior  
**USFS:** United States Forest Service  
**USGS:** United States Geological Service  
**USFWS:** United States Fish and Wildlife Service  
**UTM:** Universal Transverse Mercator system

**V**

**VMS:** Visual Management System

**VQO:** visual quality objective

**W**

**W&SR:** Wild and Scenic River

**WNF:** Wayne National Forest

**WO:** Washington Office

## Scientific Names for Common Names Used

Common Name	Scientific Name
American basswood	<i>Tilia americana</i>
American beech	<i>Fagus grandifolia</i>
American bison	<i>Bison bison</i>
American burying beetle	<i>Nicrophorus americanus</i>
American chestnut	<i>Castanea dentate</i>
American elm	<i>Ulmus americana</i>
American ginseng	<i>Panax quinquefolius</i>
American goldfinch	<i>Carduelis tristis</i>
Amur honeysuckle	<i>Lonicera maackii</i>
Asian bittersweet	<i>Celastrus orbiculatus</i>
Asian longhorned beetle	<i>Anoplophora glabripennis</i>
Autumn olive	<i>Elaeagnus umbellata</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Banded darter	<i>Etheostoma zonale</i>
Banded sculpin	<i>Cottus carolinae</i>
Basil bee balm	<i>Monarda clinopodium</i>
Basswood	<i>Tilia americana</i>
Bay laurel	<i>Umbellularia californica</i>
Beaver	<i>Castor canadensis</i>
Belted kingfisher	<i>Ceryle alcyon</i>
Bicknell's Panic Grass	<i>Panicum bicknellii</i>
Bigleaf maple	<i>Acer macrophyllum</i>
Bitternut hickory	<i>Carya cordiformis</i>
Black bear	<i>Ursus americanus</i>
Black cherry	<i>Prunus serotina</i>
Black oak	<i>Quercus velutina</i>
Black snakeroot	<i>Sanicula marilandica</i>
Blackberry	<i>Rubus spp.</i>
Blanchard's cricket frog	<i>Acris crepitans blanchardi</i>
Bloodroot	<i>Sanguinaria canadensis</i>
Blotchside logperch	<i>Percina burtoni</i>
Blue grosbeak	<i>Passerina caerulea</i>

Common Name	Scientific Name
Blue phlox	<i>Phlox divaricata</i>
Blue Scorpionweed	<i>Phacelia ranunculacea</i>
Blueberry	<i>Vaccinium</i> spp.
Bluegill	<i>Lepomis macrochirus</i>
Bluejay	<i>Cyanocitta cristata</i>
Blue-winged warbler	<i>Vermivora pinus</i>
Bobcat	<i>Lynx rufus</i>
Brown thrasher	<i>Toxostoma rufum</i>
Bulblet fern	<i>Cystopteris bulbifera</i>
Butterfly pea	<i>Clitoria mariana</i>
Butternut	<i>Juglans cinerea</i>
California buckeye	<i>Aesculus californica</i>
Canada cinquefoil	<i>Potentilla canadensis</i>
Canada thistle	<i>Cirsium arvense</i>
Canadian clearweed	<i>Pilea pumila</i>
Canadian wild ginger	<i>Asarum canadense</i>
Carolina thistle	<i>Cirsium carolinianum</i>
Cerulean warbler	<i>Dendroica cerulea</i>
Channel catfish	<i>Ictalurus punctatus</i>
Chestnut oak	<i>Quercus prinus</i>
Chinese privet	<i>Ligustrum sinense</i>
Chokeberry	<i>Phoyinia</i> spp.
Cinnamon vine	<i>Dioscorea batatas</i>
Clearweed	<i>Pilea pumila</i>
Common buckthorn	<i>Rhamnus cathartica</i>
Common privet	<i>Ligustrum vulgare</i>
Common reed grass	<i>Phragmites australis</i>
Common yellowthroat	<i>Geothlypsis trichas</i>
Cottonwood	<i>Populus deltoides</i>
Creamy violet	<i>Viola striata</i>
Crown-vetch	<i>Coronilla varia</i>
Dodder	<i>Cuscuta species</i>
Dwarf iris	<i>Iris verna</i>
Eastern cottonwood	<i>Populus deltoides</i>
Eastern hellbender	<i>Cryptobranchus alleganiensis</i>

Common Name	Scientific Name
Eastern hemlock	<i>Tsuga canadensis</i>
Eastern meadowlark	<i>Sturnella magna</i>
Eastern sand darter	<i>Etheostoma pellucidum</i>
Eastern towhee	<i>Pipilo erythrophthalmus</i>
Emerald ash borer	<i>Agrilus planipennis</i>
Eulalia	<i>Miscanthus sinensis</i>
Eurasian water-milfoil	<i>Myriophyllum spicatum</i>
Evening bat	<i>Nycticeius humeralis</i>
Fanshell	<i>Cyprogenia stegaria</i>
Featherbells	<i>Stenanthium gramineum</i>
Featherbells	<i>Stenanthium gramineum</i>
Field penny-cress	<i>Thlaspi arvense</i>
Field sparrow	<i>Spizella pusilla</i>
Flathead catfish	<i>Pylodictis olivaris</i>
Florist's fern	<i>Dryopteris spinulosa sensulato</i>
Flowering dogwood	<i>Cornus florida</i>
Four-toed salamander	<i>Hemidactylium scutatum</i>
Fowl mannagrass	<i>Glyceria striata</i>
Fragile fern	<i>Cystopteris fragilis sensu lato</i>
Freshwater drum	<i>Aplodinotus grunniens</i>
Garlic mustard	<i>Alliaria petiolata</i>
Garter snake	<i>Thamnophis sirtalis sirtalis</i>
Giant knotweed	<i>Polygonum sachalinense</i>
Gill-over-the-ground	<i>Glechoma hederacea</i>
Glossy buckthorn	<i>Rhamnus frangula</i>
Goldenrods	<i>Solidago spp</i>
Goldenseal	<i>Hydrastis canadensis</i>
Golden-winged warbler	<i>Vermivora chrysoptera</i>
Grasshopper sparrow	<i>Ammodramus savannarum</i>
Great blue heron	<i>Ardea herodias</i>
Green ash	<i>Fraxinus pennsylvanica</i>
Green salamander	<i>Aneides aeneus</i>
Green sunfish	<i>Lepomis cyanellus</i>
Green-faced clubtail	<i>Gomphus quadricolor</i>
Greenside darter	<i>Etheostoma blennioides</i>

Common Name	Scientific Name
Grizzled Skipper	<i>Pyrgus wyandot</i>
Ground hog	<i>Marmota monax</i>
Gypsy moth	<i>Lymantria dispar</i>
Heart-leaved groundsel	<i>Senecio aureus</i>
Henslow's sparrow	<i>Ammodramus henslowii</i>
Honewort	<i>Cryptotaenia canadensis</i>
Hooded warbler	<i>Wilsonia citrina</i>
Horned lark	<i>Eremophila alpestris</i>
Horsechestnut	<i>Aesculus hippocastanum</i>
Huckleberry	<i>Vaccinium ovatum</i>
Indian cucumber root	<i>Medeola virginiana</i>
Indian strawberry	<i>Duchesnea indica</i>
Indiana bat	<i>Myotis sodalist</i>
Indigo bunting	<i>Passerina cyanea</i>
Jack-in-the-pulpit	<i>Arisaema triphyllum</i>
Japanese barberry	<i>Berberis thunbergii</i>
Japanese honeysuckle	<i>Lonicera japonica</i>
Japanese knotweed	<i>Polygonum cuspidatum</i>
Japanese stilt-grass	<i>Microstegium vimineum</i>
Japanese wisteria	<i>Wisteria floribunda</i>
Juniper sedge	<i>Carex juniperorum</i>
Kirtland's warbler	<i>Dendroica kirtlandii</i>
Kudzu	<i>Pueraria lobata</i>
Lady fern	<i>Athyrium felix-femina</i>
Large white trillium	<i>Trillium grandiflorum</i>
Large whorled pogonia	<i>Isotria verticillata</i>
Largemouth bass	<i>Micropterus salmoides</i>
Lilliput	<i>Simpsonia ambigua</i>
Lined sedge	<i>Carex striatula</i>
Little brown bat	<i>Myotis lucifugus</i>
Little headed nutrush	<i>Scleria oligantha</i>
Little spectaclecase	<i>Toxolasma parvus</i>
Lizard's tail	<i>Saururus cernuus</i>
Logperch	<i>Percina caprodes</i>
Louisiana waterthrush	<i>Seiurus motacilla</i>

Common Name	Scientific Name
Madrone	<i>Arbutus menziesii</i>
Manzanita	<i>Arctostaphylos manzanita</i>
Marshes St. John's wort	<i>Triadenum tubulosum</i>
Mayapple	<i>Podophyllum peltatum</i>
Mile-a-minute	<i>Polygonum perfoliatum</i>
Mink	<i>Mustela vison</i>
Morrow (Fly) honeysuckle	<i>Lonicera morrowi</i>
Mottled sculpin	<i>Cottus bairdi</i>
Mountain maple	<i>Acer spicatum</i>
Mourning dove	<i>Zenaida macroura</i>
Mud salamander	<i>Pseudotriton montanus</i>
Multiflora rose	<i>Rosa multiflora</i>
Musclewood	<i>Carpinus caroliniana</i>
Muskrat	<i>Ondatra zibethicus</i>
Narrow-leaved cattail	<i>Typha angustifolia</i>
New York fern	<i>Thelypteris noveboracensis</i>
Northern beech fern	<i>Thelpteris phegopteris</i>
Northern bobwhite	<i>Colinus virginianus</i>
Northern harrier	<i>Circus cyaneus</i>
Northern monkshood	<i>Aconitum noveboracense</i>
Northern panic grass	<i>Dichanthelium. boreale</i>
Northern red oak	<i>Quercus rubra</i>
Northern watersnake	<i>Natrix sipedon sipedon</i>
Oak fern	<i>Gymnocarpium dryopteris</i>
Ohio lamprey	<i>Ichthyomyzon bdellium</i>
Olympia marble	<i>Euchloe olympia</i>
Opossum	<i>Didelphis virginiana</i>
Ovenbird	<i>Seiurus aurocapilla</i>
Pale straw sedge	<i>Carex albolutescens</i>
Partridgeberry	<i>Mitchella repens</i>
Peregrine falcon	<i>Falco peregrinus</i>
Periwinkle or myrtle	<i>Vinca minor</i>
Persimmon	<i>Diospyros virginiana</i>
Philadelphia panic grass	<i>Dichanthelium bicknellii</i>
Pigeon grape	<i>Vitis cinerea</i>

Common Name	Scientific Name
Pignut hickory	<i>Carya glabra</i>
Pileated woodpecker	<i>Dryocopus pileatus</i>
Pine warbler	<i>Dendroica pinus</i>
Pink mucket pearly mussel	<i>Lampsilis abrupta (=orbiculata)</i>
Pinxter flower	<i>Rhododendron nudiflorum</i>
Pitch pine	<i>Pinus rigida</i>
Post oak	<i>Quercus stellata</i>
Prairie warbler	<i>Dendroica discolor</i>
Princess tree	<i>Paulownia tomentosa</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Rabbit	<i>Sylvilagus floridanus</i>
Raccoon	<i>Procyon lotor</i>
Rapids clubtail	<i>Gomphus viridifrons</i>
Red elder	<i>Sambucus pubens</i>
red maple	<i>Acer rubrum</i>
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>
Reed canary grass	<i>Phalaris arundinacea</i>
River otter	<i>Lutra canadensis</i>
Roanoke darter	<i>Percina roanoka</i>
Rock skullcap	<i>Scutellaria saxatilis</i>
Round hickorynut	<i>Obovaria subrotunda</i>
Royal fern	<i>Osmunda regalis</i>
Ruby-throated hummingbird	<i>Archilochus colubris</i>
Ruffed grouse	<i>Bonasa umbellus</i>
Running buffalo clover	<i>Trifolium stoloniferum</i>
Russian olive	<i>Elaeagnus angustifolia</i>
Salamander mussel	<i>Villosa lienosa</i>
Sassafras	<i>Sassafras albidum</i>
Sauger	<i>Stizostedion canadense</i>
Savannah sparrow	<i>Passerculus sandwichensis</i>
Scarlet oak	<i>Quercus coccinea</i>
Serviceberry	<i>Amelanchier arborea</i>
Shagbark hickory	<i>Carya ovata</i>
Sharp-shinned hawk	<i>Accipiter striatus</i>
Sheepnose	<i>Plethobasus cyphus</i>

Common Name	Scientific Name
Shellbark hickory	<i>Carya laciniosa</i>
Shingle oak	<i>Quercus imbricaria</i>
Shortleaf pine	<i>Pinus echinata</i>
Silver maple	<i>Acer saccharinum</i>
Slippery elm	<i>Ulmus rubra</i>
Small Carpgrass	<i>Arthraxon hispidus</i>
Small whorled pogonia	<i>Isotria medeoloides</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Smooth beardtongue	<i>Penstemon laevigatus</i>
Smooth brome	<i>Bromus inermis</i>
Snubnose darter	<i>Etheostoma simoterum</i>
Solomon's seal	<i>Polygonatum biflorum</i>
Song sparrow	<i>Melospiza melodia</i>
Sour gum	<i>Nyssa sylvatica</i>
Sourwood	<i>Oxydendrum arboreum</i>
Southern arrowwood	<i>Viburnum dentatum</i>
Southern blue monkshood	<i>Aconitum uncinatum</i>
Sparse-lobed grape fern	<i>Botrychium biternatum</i>
Spotted bass	<i>Micropterus punctulatus</i>
Stonecrop	<i>Sedum ternatum</i>
Striped gentian	<i>Gentiana villosa</i>
Striped maple	<i>Acer pensylvanica</i>
Sugar maple	<i>Acer saccharum</i>
sugar maple	<i>A. saccharum</i>
Sycamore	<i>Plantanus occidentalis</i>
Tall nut rush	<i>Scleria triglomerata</i>
Tangerine darter	<i>Percina aurantiaca</i>
Tatarian honeysuckle	<i>Lonicera tatarica</i>
Timber Rattlesnake	<i>Crotalus horridus</i>
Tree of heaven	<i>Ailanthus altissima</i>
Trumpet creeper	<i>Campsis radicans</i>
Umbrella magnolia	<i>Magnolia tripetala</i>
Upright carrion flower	<i>Smilax ecirrata</i>
Virginia knotweed	<i>Polygonum virginianum</i>
Virginia pine	<i>Pinus virginiana</i>

Common Name	Scientific Name
Virginia Spiraea	<i>Spiraea virginiana</i>
Wabash river cruiser	<i>Macromia wabashensis</i>
Walleye	<i>Stizostedion vitreum</i>
Warmouth	<i>Lepomis gulosus</i>
Water milfoil	<i>Myriophyllum heterophyllum</i>
Western lake chubsucker	<i>Erimyzon sucetta</i>
White ash	<i>Fraxinus americana</i>
White clover	<i>Trifolium repens</i>
White oak	<i>Quercus alba</i>
White snakeroot	<i>Eupatorium rugosum</i>
White sweet-clover	<i>Melilotus alba</i>
White-footed mouse	<i>Peromyscus leucopus</i>
White-tailed deer	<i>Odocoileus virginianus</i>
Whorled yam	<i>Dioscorea quaternata</i>
Wild ginger	<i>Asarum canadensis</i>
Wild grape	<i>Vitis spp.</i>
Wild turkey	<i>Meleagris gallopavo</i>
Wineberry	<i>Rubus phoenicolasius</i>
Winged burning bush	<i>Euonymus alatus</i>
Wingstem	<i>Verbesina spp</i>
Wintercreeper	<i>Euonymus fortunei</i>
Witch hazel	<i>Hamamelis virginiana</i>
Wood duck	<i>Aix sponsa</i>
Wood nettle	<i>Laportea canadensis</i>
Wood thrush	<i>Hylocichla mustelina</i>
Worm-eating warbler	<i>Helmitheros vermivorus</i>
Yellow birch	<i>Betula alleghaniensis</i>
Yellow buckeye	<i>Aesculus octandra</i>
Yellow crownbeard	<i>Verbesina occidentalis</i>
Yellow gentian	<i>Gentiana alba</i>
Yellow poplar	<i>Liriodendron tulipifera</i>
Yellow sweet-clover	<i>Melilotus officinalis</i>
Yellow-breasted chat	<i>Icteria vireus</i>
Yellow-fringed Orchid	<i>Platanthera ciliaris</i>
Yellowish gentian	<i>Gentiana alba</i>

Common Name	Scientific Name
<b>Zebra mussel</b>	<b><i>Dreissena polymorpha</i></b>

## Appendix K

# US Highway 33 - Nelsonville Bypass

---

## Introduction

The Ohio Department of Transportation (ODOT) is proposing to build a four-lane controlled access highway between Haydenville in Hocking County and New Floodwood in Athens County. This project is known as the Nelsonville Bypass project and is an upgrade of a nine-mile section of existing U.S. Highway 33 which currently goes through the city of Nelsonville. A significant portion of this Nelsonville Bypass will traverse and impact the Wayne National Forest (WNF). A map of the bypass location is shown in Figure K-1.

The USDA Forest Service (FS) and the Federal Highway Administration (FHWA) have executed a memorandum of understanding (MOU) 8/20/98 regarding the appropriation and transfer of Wayne National Forest lands for highway purposes. Per this agreement, the FS is designated as a cooperating agency and FHWA is designated as the lead agency. ODOT will serve as the highway agent and be responsible for constructing the highway. Per the MOU, the FS will serve as the agent of FHWA in monitoring and enforcement of the environmental conditions set forth in the proposed bypass' environment analysis documents, Record of Decision (ROD), and letter of consent (LOC).

---

## Effects Analysis

A comprehensive effects analysis has been completed for the proposed Nelsonville Bypass project by ODOT and the Federal Highways Administration, in consultation with the Forest Service, U.S. Fish and Wildlife Service, and other federal, state, and local agencies and public officials. The general public was also given opportunities to provide comments on the proposed project and their comments were considered.

The following environmental analysis documents have been completed for this project:

- Biological Assessment for Federally-Listed Species (BA) - 27 August 2003
- Biological Opinion for Federally-Listed Species (BO) - 15 April 2005
- Final Environmental Impact Statement (FEIS) - 5 August 2005

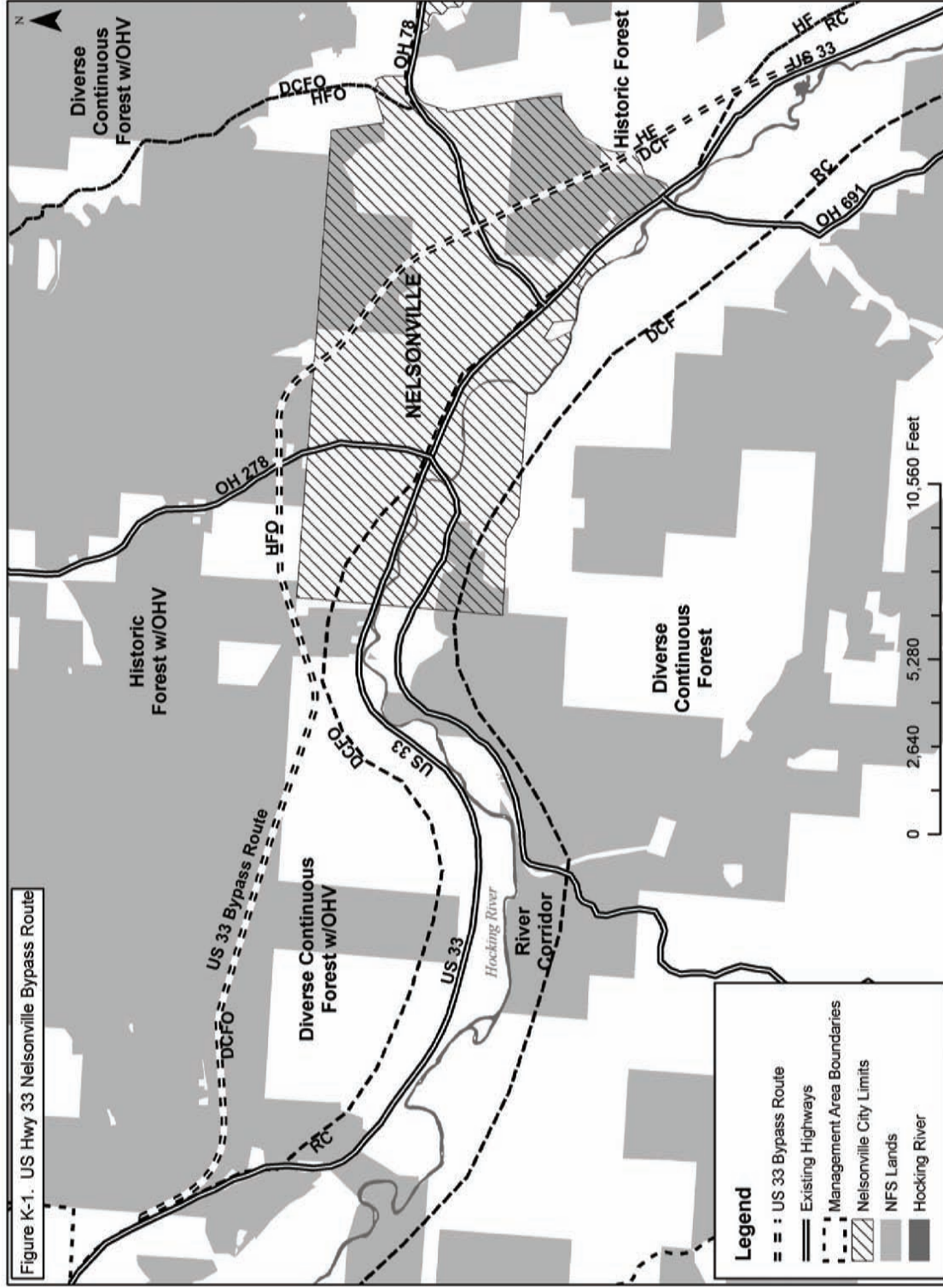
- Biological Evaluation (BE) - 26 August 2005
- Record of Decision (ROD) - 19 August 2005
- Letter of Consent (LOC) – Fall 2005

All project terms, conditions, stipulations, and mitigations are addressed in the above documents

---

## Incorporation By Reference

A detailed discussion of the effects, terms, conditions, stipulations, and mitigations of the proposed Nelsonville Bypass project will not be included in the Forest Plan revision FEIS, the 2006 Forest Plan, or any of the plan revision associated environmental documents. The effects of the Bypass are covered in the bypass' environmental analysis documents which are incorporated by reference in the Final EIS. All documents related to the Nelsonville Bypass project are recorded and can be reviewed at the Wayne National Forest's headquarters in Nelsonville, Ohio.



This page intentionally left blank.