Chapter 3

Affected Environment and Environmental Consequences

Introduction

Chapter 3 of this Final EIS describes the existing physical, biological, and social resources of the environment that may be affected by the alternatives presented in Chapter 2. It also presents the effects that the alternatives would have on those resources. This look at the affected environment and environmental effects was combined into one chapter to give a clearer picture of resources on the Wayne National Forest and how they would be affected by the different alternatives. The analysis of environmental effects provides the basis for the comparison of alternatives that appears at the end of Chapter 2.

Organization

The remainder of Chapter 3 is organized by resource, focusing on those resources related to the issues described in Chapter 1:

Issue 1 – Watershed Health

- Watersheds
- Soils
- Air Quality

Issue 2 – Plant and Animal Habitat

- Oak-hickory ecosystem
- Pine forest
- Early successional habitat
- Interior forest upland
- Interior forest riparian
- Grasslands
- Federally listed and Regional Forester sensitive species
- Species of public interest (including white-tailed deer and ginseng)

- Non-native invasive species
- Timber harvest
- Prescribed fire

Issue 3 – Recreation

- Recreation opportunities
- Recreational off-highway vehicle use
- Scenic quality

Issue 4 – Land Ownership

- Land ownership

Issue 5 – Minerals

- Oil and gas
- Coal

Resources Not Directly Related to a Revision Issue

- Social and economic effects of National Forest land ownership
- Environmental justice
- Heritage resources
- Economic effects (employment and income)
- Suitable Forestlands (timber production/allowable sale quantity)

Each resource section is presented in the following format:

Affected Environment

This section describes the current conditions of the resources relative to the issues. It may also include accounts of the history, development, past disturbances, naturally occurring events, and interactions that have helped shape current conditions.

Analysis Area

This section briefly describes the geographic area used for analysis. Analysis areas may vary depending on the resource, issue, or anticipated activities. Within a specific resource or issue, analysis areas for direct, indirect, and cumulative effects may also differ.

Environmental Consequences

Effects Common to All Alternatives

Describes the general type of effects that may occur to the resource from implementing the alternatives.

Direct and Indirect Effects

Describes the direct and indirect effects that each alternative could have on resources or issues. Direct effects occur at the same time and place as the action. Indirect effects occur later in time or are spatially removed from the action. Although a forest plan can guide management for 10 to 15 years, effects may be discussed for both the short (one to 10 years) and long term (greater than 10 years). Direct and indirect effects often overlap and are frequently discussed together.

Cumulative Effects

Describes cumulative effects by alternative for each resource or issue. Cumulative effects are incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes the other actions. Cumulative impacts can result from individually minor but collectively significant actions that take place over time.

Mitigation Measures

Mitigation measures, as defined by 40 CFR 1508.20 include:

- Avoiding the impact altogether by declining to take an action or part of an action.
- Minimizing impacts by limiting the degree or magnitude of an action or its implementation.
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of an action.
- Compensating for the impact by replacing or providing substitute resources or environments.

At a programmatic level, Forest-wide and management area standards and guidelines should provide the appropriate mitigation measures for all alternatives. While not listed specifically in the Forest Plan, all public laws, regulations, Forest Service manuals, administrative guidance and other public policy apply to Forest Service actions. At the site-specific project level, analysis may indicate the need for additional mitigation measures to resolve site-specific issues. Monitoring efforts will determine the effectiveness of mitigation measures. (See Chapter 4 of the Revised Forest Plan for the monitoring strategies.)

Relationship between Programmatic and Site-Specific Analysis

The Revised Forest Plan and Final EIS are programmatic documents. The Final EIS discusses environmental effects on a broad scale. Over the lifetime of the Revised Forest Plan, the selected alternative and the accompanying Forest-wide standards and guidelines will set Forest management direction by establishing and affirming rules and policies for use of natural resources.

Because this document contains a Forest-wide level of analysis, it does not predict what will happen when Forest-wide standards and guidelines are implemented on individual, site-specific projects. Nor does it convey the long-term environmental consequences of any site-specific project. Such effects will depend on the extent of each project and environmental conditions at the site (which vary across the Forest). Site-specific mitigation measures and their effectiveness will also play a role.

In preparing this document we focused on consequences most likely to occur. By combining this broad assessment with site-specific information, a reader should be able to make a reasonable prediction about the kinds of environmental effects that would result from a specific project.

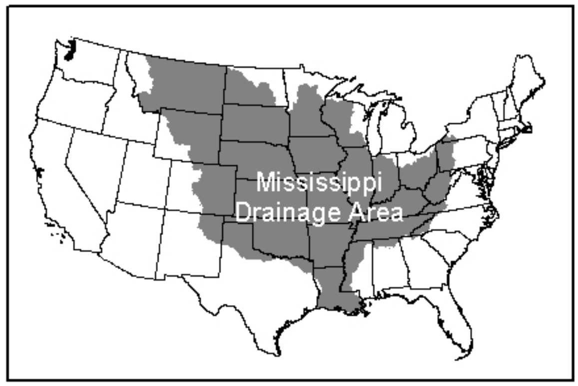
We do not describe every environmental process or condition on the WNF in this document. That would be impractical given the complexity of natural systems. The purpose of the Final EIS is to provide a survey of the broader environmental and social factors that are relevant to the programmatic planning process.

Watershed and Riparian Areas

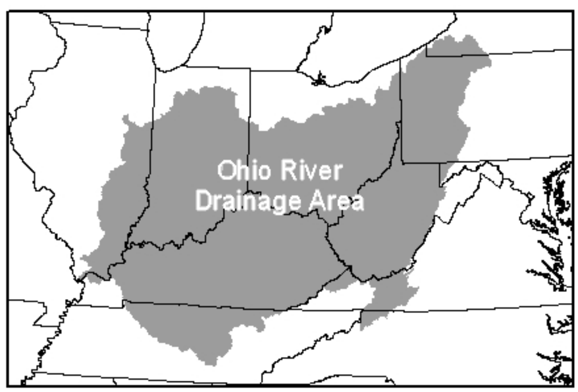
Affected Environment

Introduction: Watersheds

A watershed is a region or area draining to a particular watercourse or body of water. Watersheds can be small or large, and most are interconnected, eventually draining to the ultimate waterbodies-bays, gulfs, or oceans. Approximately one-third of the United States, including the Wayne National Forest, lies in the Mississippi River watershed.



The Ohio River is a tributary to the Mississippi River with a drainage area covering over 200,000 square miles. The WNF is located in southeastern Ohio, within the Ohio River drainage basin. Over 80 percent of stream miles in Ohio are composed of primary headwater streams. Headwater streams are the small swales, creeks, and streams that are the origin of most rivers. Primary headwater streams can be ephemeral, intermittent, or perennial, and generally have a watershed area of less than one square mile (Ohio EPA, 2003).



The climate of southeastern Ohio is continental with hot, humid summers and cold, cloudy winters. Approximately 40 inches of precipitation are received annually. Stream flows usually peak in spring following snowmelt while low flow periods occur during late summer and autumn.

Virtually all of the forest that covered southeast Ohio up until the late 1700s was cut for timber and firewood, mined for coal, iron ore, limestone, and clay, during the settlement and development of the late 18th and 19th centuries. In particular, the impacts of historic mining practices have left indelible marks upon the land. Since 1800, 3.4 billion tons of coal have been mined in Ohio (Crowell, 1997). According to the

U.S. Office of Surface Mining (OSM), there are over 575,000 acres of abandoned mine lands in the eastern United States. Figure 3 - 1 displays the extent of mining on a semi-regional basis. As can be seen from the dark shaded areas, the Ohio River drainage basin lies within the heart of the Appalachian Coal Fields.

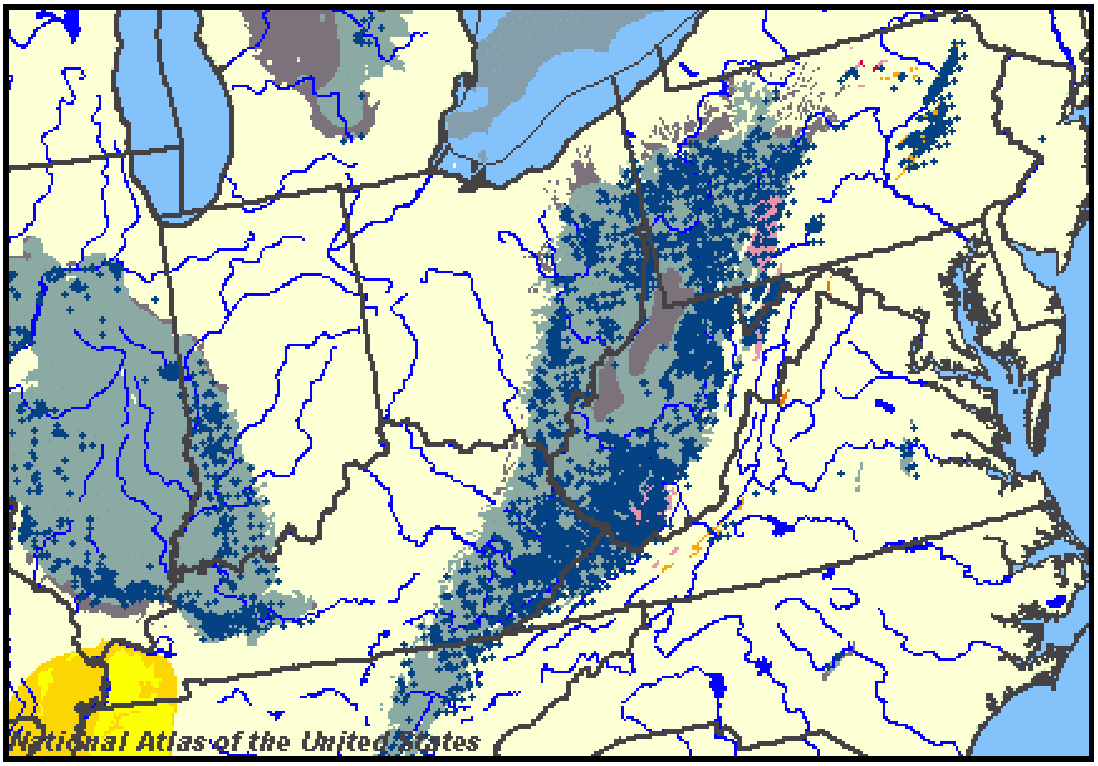


Figure 3 - 1. Appalachian Coal Fields.

During much of the 19th and 20th centuries, a significant amount of riparian area was destroyed by mining activities. The area of disturbed lands can range in size from a few acres to several square miles. However, the ecological and environmental impacts of abandoned mined lands can reach far beyond the limit of mining as a result of:

- Streams choked by excessive sediment loads
- Many miles of streams polluted by acid mine drainage (AMD)
- Freshwater streams captured by collapsed underground mine complexes
- Spoil or gob piles
- A landscape turned upside down by strip-mining.

Since 1970, Ohio's annual coal production has declined nearly 51 percent. However, mining's impacts on watersheds have left many streams impaired and nearly devoid of aquatic life (Crowell, 1997).

Restoration of abandoned mine lands has been ongoing. Management emphasis has shifted from treatment of eroding uplands to the restoration of abandoned mine lands and elimination of acid mine drainage. The 1988 Forest Plan's direction for management of streams, riparian areas, and floodplains emphasized protection of water quality and counteracting the effects of strip mining. Underground mining, the primary source of acid mine drainage, was not addressed in the 1988 Forest Plan because there was then no technology to effectively address acid mine drainage.

The WNF has an active program to reclaim abandoned mine lands and restore watersheds degraded by mining. The Forest works with other Federal, State, and local agencies to address these problems. Systematic efforts are required to restore these lands to productive uses.

The Forest Service, in conjunction with partners, has developed a five- to seven-year program for restoring abandoned mine lands. Since 1997, the following restoration activities have been accomplished:

- Reclamation of 25 acres of gob piles
- Closure and reclamation of 21 subsidence areas
- Closure or bat gating of seven open mine portals
- Enhancement of three acres of wetland
- Construction and/or installation of various systems to treat acid mine drainage.

Watershed Health: Restoration of Watersheds Impacted by Coal Mining and Protection of Streams and Riparian Areas

Current Condition

The WNF proclamation boundary falls within 31 fifth-level watersheds. Only 15 of these watersheds are comprised of at least one percent NFS land (Table 3 - 1; Figure 3 - 2). There is a significant amount of private ownership in all of these watersheds. Federal ownership is greatest in the Monday Creek watershed where there is almost 45 percent NFS land (Table 3 - 1).

Table 3 - 1. Percentage of National Forest System lands in 5th level watersheds.

Watershed	Watershed Number (Figure 3 - 2)	Hydrologic Unit Code	Watershed Size (acres)	Percent NFS lands
Monday Creek	1	0503020406	74,209	44.7
Pine Creek	2	0509010302	117,859	36.5
Symmes Creek (below Black Fork to below Buffalo Creek)	3	0509010109	64,168	35.1
Little Muskingum River (above Clear Fork to Ohio River)	4	0503020110	106,032	26.5
Ohio River (below Sunfish Cr. to above Muskingum R	5	0503020102	87,344	22.3
Sunday Creek	6	0503020407	88,773	21.9
Symmes Creek (below Buffalo Creek to Ohio River)	7	0509010110	96,987	17.9
Little Muskingum River (headwaters to above Clear	8	0503020109	95,313	15.5
Ohio River (below Big Sandy R. [W.V] to above Pine	9	0509010301	83,471	13.1
Hocking River (below Enterprise to above Monday Cr	10	0503020405	80,819	10.4
Symmes Creek (headwaters to below Black Fork)	11	0509010108	76,244	10.1
Raccoon Creek (headwaters to above Hewett Fork)	12	0509010102	86,715	6.7
Hocking River (below Monday Creek to Athens/RM33.1	13	0503020408	65,523	5.2
East Fork of Duck Creek	14	0503020111	87,190	1.7
Raccoon Creek (above Hewett Fork to below Elk Fork)	15	0509010103	99,234	1.4

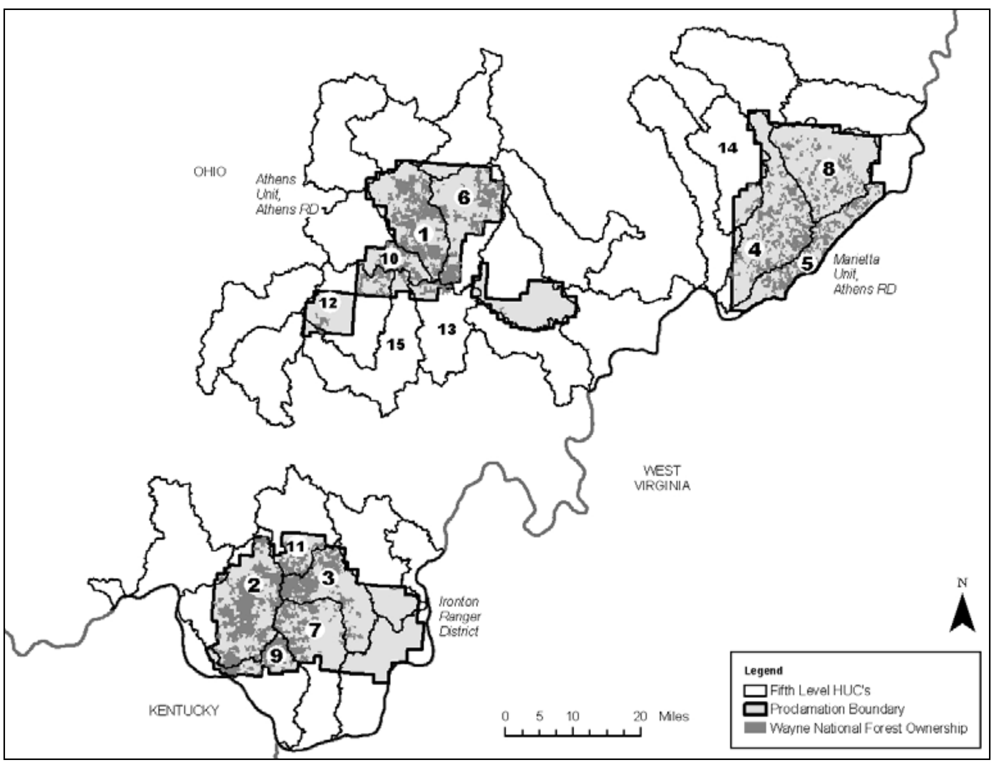


Figure 3 - 2. Fifth-level watersheds on the WNF. (See Table 3 - 1 for watershed names.)

In 2002, the Forest Service completed a watershed analysis for the WNF using the East-wide Watershed Assessment Protocol (EWAP) (Ewing and Stachler, 2002). This analysis was a rapid characterization of landscape information based on fifth-level watersheds, which provided an assessment of watershed health, or integrity.

EWAP characterizations are based on parameters that describe the physical and ecological conditions within a watershed as well as the parameters susceptible to change as a result of Forest Service management activities. Condition parameters quantify watershed disturbances (stressors), while vulnerability parameters denote values at risk that could be changed (positive or negative) as a result of Forest Service management. Watersheds with poor condition and high vulnerability are considered to have less integrity relative to those with better condition and lower vulnerability.

The relationship between condition and vulnerability for each of the fifth-level watersheds is displayed in the accompanying watershed integrity plot (Figure 3 - 3). The implied assumption is that as the condition and vulnerability scores increase, the watershed condition gets better and its vulnerability lessens.

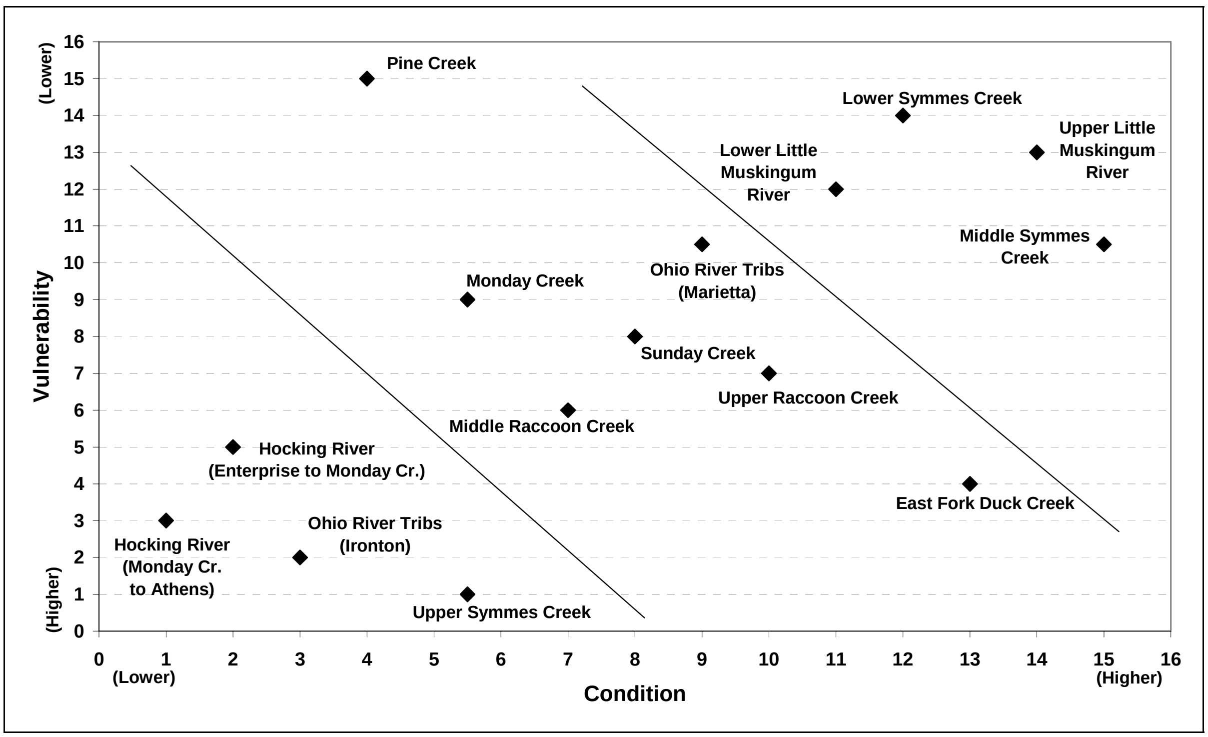


Figure 3 - 3. Watershed integrity plot of the 5th level watersheds that are comprised of at least one percent NFS lands.

Key summary points about WNF watersheds include the following:

- Private land comprises the majority of the 15 fifth-level watersheds that were analyzed using EWAP. National Forest System land comprises less than 45 percent of any of these watersheds. Because all watersheds have a significant component of non-Federal lands, collaboration is necessary to improve watershed health.
- Point sources, such as abandoned mine lands, play a major role in watershed health in these 15 watersheds. Southeastern Ohio lies in the coal mining region, and acid mine drainage from abandoned coal mines adversely effects large portions of some watersheds.
- Riparian areas adjacent to impaired streams can also be negatively impacted and/or destroyed by the effects of mining.

Water Quality Impaired Streams

The Total Maximum Daily Load (TMDL) program was established under Section 303(d) of the Clean Water Act and focuses on identifying and restoring polluted rivers, streams, lakes and other surface waterbodies. A TMDL is a written, quantitative assessment of water quality problems in a waterbody and contributing sources of pollution. The TMDL specifies the amount a pollutant needs to be reduced to meet water quality standards. It also allocates pollutant load reductions and provides the basis for taking actions needed to restore a waterbody.

The Ohio EPA has an evolving TMDL process that includes four broad, overlapping phases:

- Assess waterbody health (biological, chemical, and habitat)
- Develop a restoration target and viable scenario
- Implement the solution
- Validate to monitor progress.

The Ohio EPA has prioritized Ohio's watersheds for TMDL development (Table 3 - 2). According to the Ohio EPA, a TMDL is currently being developed for Monday Creek and Sunday Creek. Not all of the WNF 5th level watersheds are identified as TMDL priority watersheds. Please refer to the Ohio EPA's TMDL website for more information (http://www.epa.state.oh.us/dsw/tmdl/index.html).

Table 3 - 2. Schedule for TMDL development for 5th-level watersheds.

Watershed	Hydrologic Unit Code	Ohio EPA Next Field Monitoring	Ohio EPA Projected TMDL Development
Monday Creek	0503020406	2009	2004
Pine Creek	0509010302	2009	2011
Symmes Creek (below Black Fork to below Buffalo Creek)	0509010109	2009	
Little Muskingum River (above Clear Fork to Ohio River)	0503020110	2010	2012
Ohio River (below Sunfish Cr. to above Muskingum R	0503020102	2010	
Sunday Creek	0503020407	2009	2004
Symmes Creek (below Buffalo Creek to Ohio River)	0509010110	2009	2011
Little Muskingum River (headwaters to above Clear	0503020109	2010	2012
Ohio River (below Big Sandy R. [W.V] to above Pine	0509010301	2009	
Hocking River (below Enterprise to above Monday Cr	0503020405	2004	2006
Symmes Creek (headwaters to below Black Fork)	0509010108	2009	
Raccoon Creek (headwaters to above Hewett Fork)	0509010102	2009	2011
Hocking River (below Monday Creek to Athens/RM33.1	0503020408	2004	2006
East Fork of Duck Creek	0503020111	2010	
Raccoon Creek (above Hewett Fork to below Elk Fork)	0509010103	2009	2011

The Forest Service used the 1996 Ohio Water Resource Inventory (305b Report) and Forest Service water quality data to assess impairment of the more than 200 miles of perennial streams on the WNF. The information was summarized in the 1998 *National Forest System Inventory Eligibility Analysis; Forest Service Streams Not Meeting State Water Quality Standards* report. Based on the data, only 11 percent of the stream miles met Ohio water quality standards. Forty-eight percent were impaired and 41 percent had not been assessed by the Ohio EPA or the Forest Service. There is insufficient water quality data for intermittent and ephemeral stream miles.

Figure 3 - 4 displays water quality impairment within the WNF. Impairment is caused by two primary sources: agriculture and abandoned mine lands (Ohio EPA, 2004). Impairment on the Marietta Unit is due primarily to nutrients, siltation, and flow alteration from non-irrigated crop production, pasture lands, and onsite wastewater systems (septic tanks). Impairment on the Athens and Ironton units is primarily due to pH level, metals, and sedimentation from previous mining.

Acid mine drainage is considered to be the most significant non-point source pollutant in northern Appalachia (Kleinmann et al., 1995). Most mining on the WNF occurred on the Athens Unit (Figure 3 - 4 and Figure 3 - 5). The major watersheds impaired by acid mine drainage on the WNF include Monday Creek, Sunday Creek, Pine Creek and Symmes Creek.

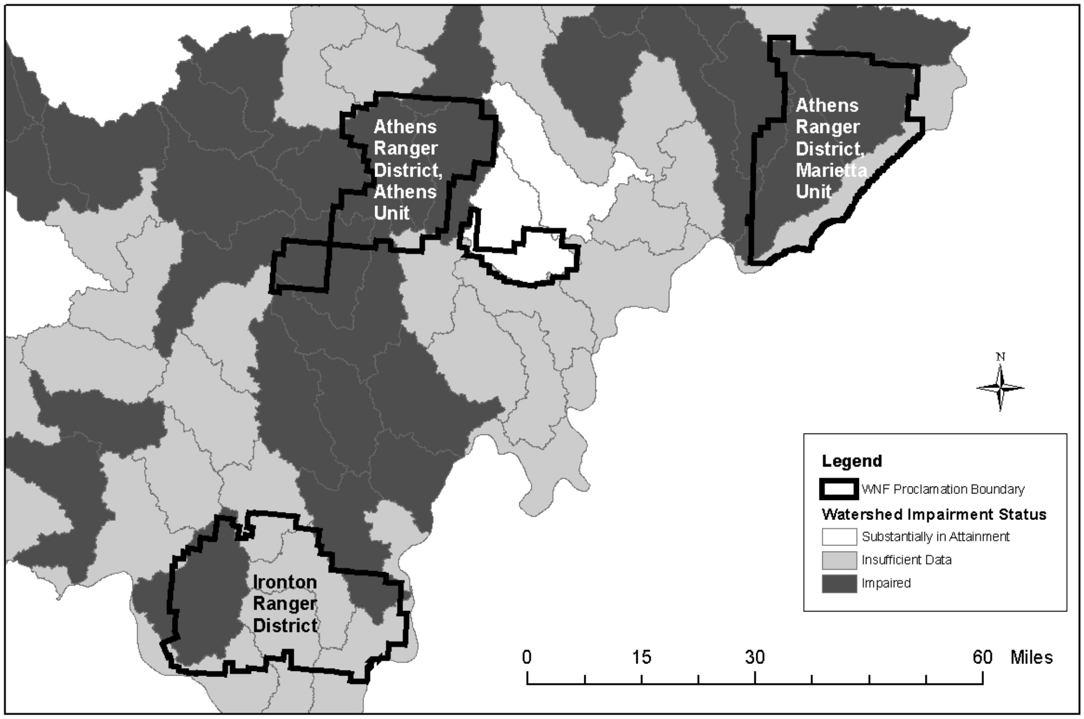


Figure 3 - 4. Impairment within WNF proclamation boundary and 5th level watersheds.

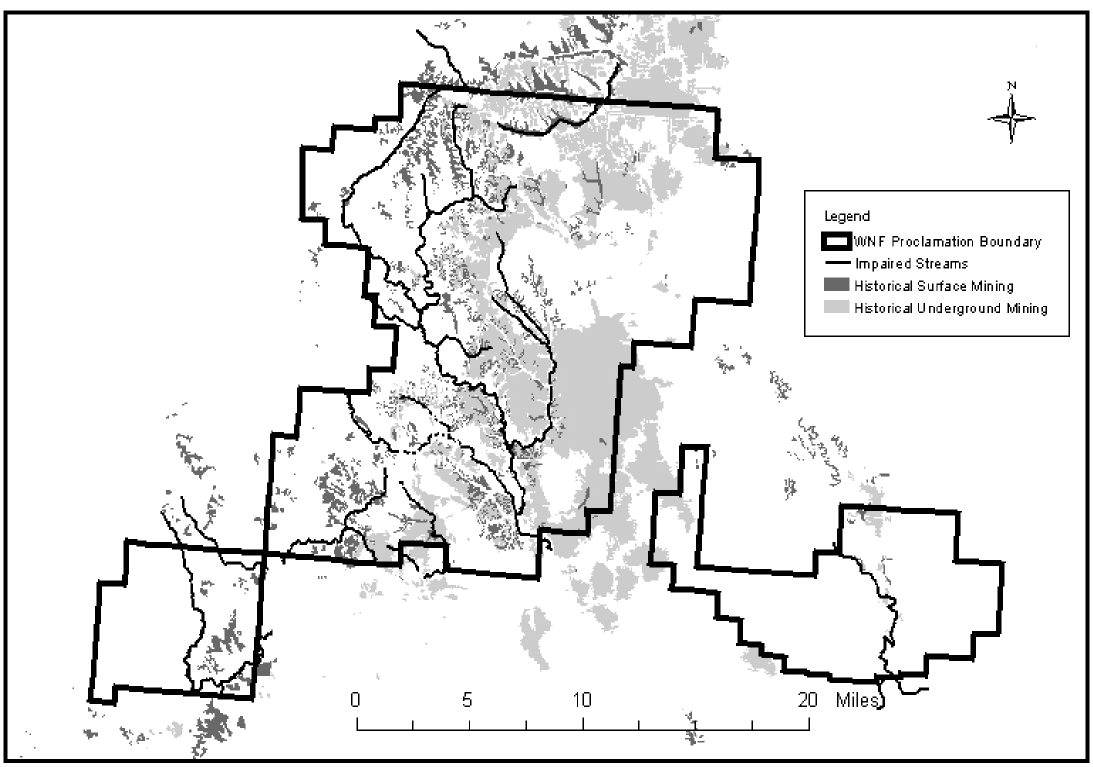


Figure 3 - 5. Impaired streams and historical mining areas on the Athens Unit.

In 1999, Forest Service (Region 9) and the United States Army Corps of Engineers (Huntington District) jointly developed a format and methodology to perform inventory abandoned and inactive mines on the Monongahela and Wayne National Forests. The inventory for the Athens and Ironton Units identified over 5,000 mining and health and safety related features. The majority of features identified are mining features that require treatment and/or reclamation (Table 3 - 3).

Table 3 - 3. Mining and health and safety related features on the WNF.

Portals	Gob Piles	Slumps	Subsidences	Seeps	Ponds	Highwalls	Structures	Rubbish Piles
1467	208	319	220	452	1999	99	206	614

Treatment of acid mine drainage is an evolving science. New technologies to remediate the effects of acid mine drainage (AMD) are continually being researched and developed. Current technology includes source control or the use of active or passive treatment methods.

Source control reduces the effects of AMD before it can reach a surface stream. On the Wayne, AMD source control is accomplished through closure of open subsidences, and the removal or capping of gob piles. Over time, the limestone cap over underground coal mines can collapse, and when this happens surface water can be introduced to the mine. Surface water can recharge and increase AMD that enters the surface at some other point. Closing subsidences reroutes surface water back into natural stream channels and helps to reduce AMD outflow into surface waters. Gob piles resulted from the waste coal products. Precipitation falls onto gob piles and filters through the material and AMD seeps out at the base. Removal or capping gob piles with an impervious material (e.g., clay) eliminates this AMD source.

Active treatments include chemical treatment systems that buffer acidity by applying alkaline chemicals such as calcium carbonate, sodium hydroxide, sodium bicarbonate or anhydrous ammonia. An example of an active treatment used on the Wayne is a doser system. Introduction of fine alkaline material raises the pH to acceptable levels and decreases the solubility of dissolved metals. Precipitates form and settle out from the solution. Active treatment systems require additional maintenance.

Passive treatments allow the naturally occurring chemical and biological reactions that aid in AMD treatment to occur in the controlled environment of the treatment system, and not in the receiving water body. Passive treatment conceptually offers many advantages over conventional active treatment systems. The use of chemical addition and energy consuming treatment processes are virtually eliminated with passive treatment systems. Also, the operation and maintenance requirements of passive systems are considerably less than active treatment systems.

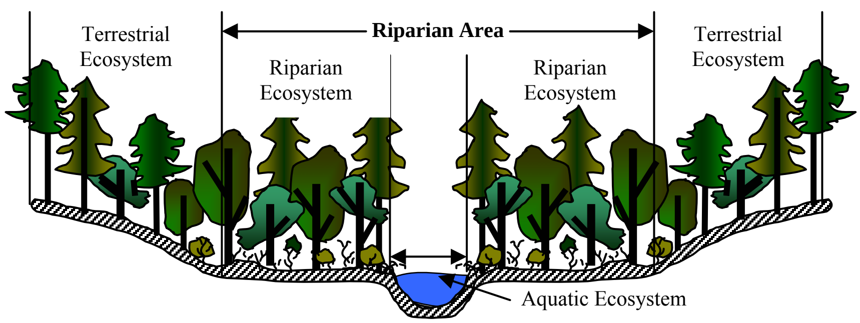
Passive treatments include construction of aerobic or anaerobic wetlands, open limestone channels, anoxic limestone drains, and the pyrolusite process.

Riparian Areas

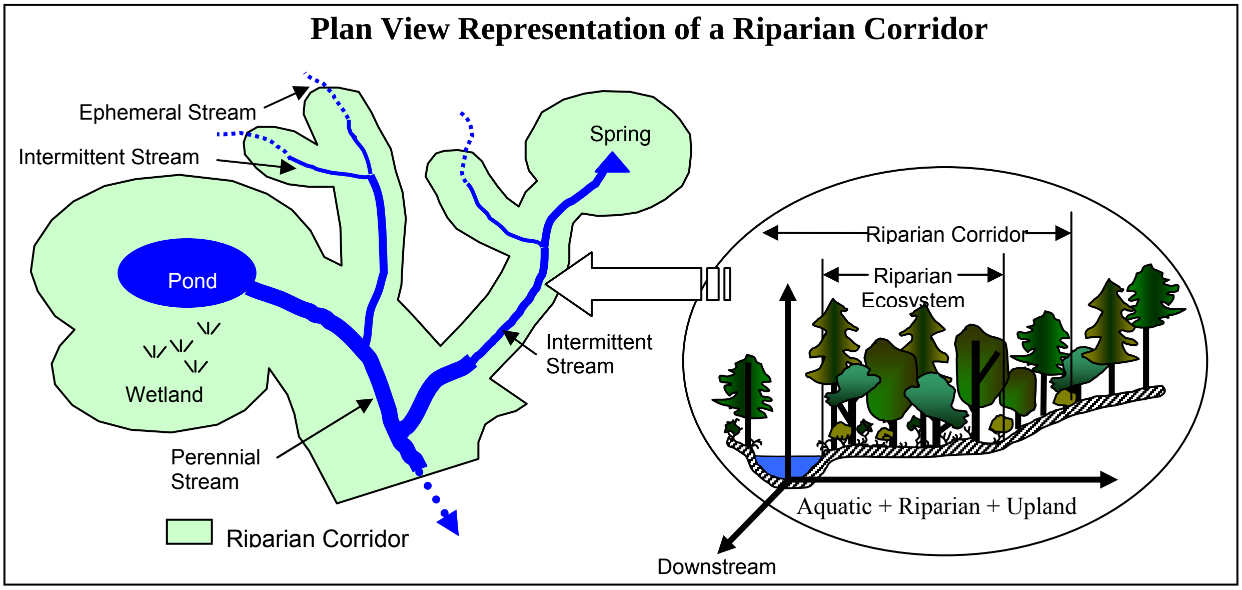
Introduction

Riparian areas are the links between the terrestrial and aquatic ecosystems, and are one of the most dynamic portions of the landscape. Under natural conditions, frequent disturbance events in the riparian area (e.g., floods) create complex mosaics of landforms and associated biological communities that are often more heterogeneous and diverse than those associated with upslope landscapes (Gregory et al., 1991).

Forest Service Definition of Riparian Area (FSM 2526.05)



Riparian corridors include the riparian area, wetlands, and land that extends away from the bank or shore of aquatic ecosystems with direct land-water interaction that may affect ecological structure, function, and composition. They extend in a linear fashion from the small headwater streams to the larger mainstem tributaries of the Ohio River.



Various activities have caused changes in the condition of riparian areas and riparian corridors over the past 200 years. Bottomlands which were enriched by periodic floods, and were flat in comparison to the hilly terrain of southeast Ohio, proved to be prime farmland for early settlers. Some of these bottomland areas along the streams were cleared as early as the late-1700s and early-1800s. Many bottomland fields were ditched and tile drained to facilitate agricultural production. About 90 percent of the natural wetlands existing in Ohio at the time of European settlement have been destroyed (National Research Council, 1992). Very few natural wetlands or bottomland forests are found on the Forest today.

Mining for coal, clay, and limestone has impacted riparian areas. Strip-mining had replaced deep mining as a more efficient method for mining coal and clay by the mid-1900s. During the strip-mining process, many streams were rerouted, channelized, impounded, or polluted with mine wastes. Whole valleys were filled with mine wastes, while others have been mined and returned to the topography present before mining was started. Acid mine drainage adversely affects major portions of the streams on the Athens Unit and, to a lesser degree, some streams on the Ironton Ranger District.

Riparian areas were altered when streams were impounded for water sources, flood control, and recreation. Creation of flood control structures increased after the 1937 Ohio River Flood. In many cases this caused an increase in the amount of riparian area when compared to the pre-existing condition. The creation of the Ohio River Lock and Dam system also affected National Forest System lands in the Marietta Unit. Water was backed up into embayments, and wave action created from tows and barges affected the shorelines.

Current Riparian Conditions on the Wayne National Forest

Based on occasionally and frequently flooded soils as defined by the USDA Soil Surveys, the Wayne has 53,299 acres of riparian area within the proclamation boundary. There are 9,836 acres of riparian area on NFS lands. (Table 3 - 4) (National Landcover Database, 1992).

Table 3 - 4. Riparian Acres within the WNF Proclamation Boundary.

Open Water	Non-forested	Forested	Wetlands	Agricultural
697	907	30,914	317	20,463

Environmental Consequences

Direct and Indirect Effects Common to all Alternatives

Effects on watershed and riparian resources should generally vary by the degree to which management activities are projected to occur under each alternative. Forest-wide objectives set the tone for managing specific resources, and management area direction further defines how resources will be managed. Even with these over-arching principles and with the application of standards and guidelines, unavoidable effects to water, soil, and riparian resources may occur as a result of project implementation. By and large, these effects should be short-term. However, operation and maintenance may entail a long-term commitment of resources.

Watershed Indicator 1: Restoration of Abandoned Mine Lands

Generally, reclamation of abandoned mine land sites on the Forest are accessed via existing roads and/or trails. However, in some cases, new road or temporary road construction is necessary. Any activity that disturbs the land surface, decreases cover, or alters vegetation can affect soils, water yield, water quantity and timing, runoff timing, and water quality. Essentially, sediment and erosion entering streams are the principal concern in protecting aquatic and riparian resources during the reclamation of abandoned mine land.

A significant percentage of mine land reclamation occurs in the riparian area. Abandoned mine land reclamation consists of, but is not limited to, construction of new stream channels, reconstruction of existing channels, capping of gob piles, reclaiming old strip-pits that impound acid water, development of various systems for treating poor water quality, and restoring flow paths in drainages where flow has been blocked by earthen berms. These activities can require a significant amount of soil disturbance during reclamation. The primary factors related to soil resource disturbance during reclamation are soil compaction, rutting, and soil displacement (top soil removal). Those factors are discussed in the soils section.

Watershed Indicator 2: Protection of Streams and Riparian Areas

During implementation of some management activities, some timber removal may occur. Timber removal from riparian areas and riparian corridors may decrease woody instream cover, contribute to destabilization of streambanks or lakeshores, reduce shading, increase water temperatures, and reduce inputs of fine litter which provides biological “energy” to adjacent bodies of water.

Although no specific issues regarding impacts to soils or watershed health were identified during public scoping for this Forest Plan revision, the following activities will be discussed in general terms because they can impact riparian areas and streams. The discussions will be more qualitative than quantitative and will focus more on roads since erosion and sedimentation are principal concerns during reclamation.

- Roads/Trails
- Vegetation Management
- Mineral Exploration
- Fire Management

Roads and Trails

Roads and trails directly and indirectly affect water by increasing sedimentation and concentrating runoff. Roads and trails expose and compact soils, alter surface and subsurface water flow, and can alter stream channels during construction. When left open, they will contribute to higher erosion and sedimentation rates than closed roads and trails. Sedimentation originating from both private and NFS land is the primary cause of reduced water quality in watersheds where no previous mining occurred.

Roads have long been recognized as the primary human-caused source of soil and water disturbances in forested environments (Patric, no date; Egan et al., 1996). As identified in the WNF’s 2002 Forest-scale Roads Analysis, most impacts occur during initial road construction and then gradually decrease as roadside vegetation is reestablished and disturbed soil surfaces stabilize. Effects, such as landslides may persist when a road permanently undercuts unstable soils or landforms or when roads are disturbed by road maintenance. Poorly maintained roads can result in greater impacts as surface water is diverted, culverts plug, and other road design characteristics are compromised. Lack of maintenance commonly has detrimental effects on water and soil resources.

Temporary road construction has most of the same effects as permanent road construction but generally for a shorter term and for a more limited physical extent. Long-term effects can occur if temporary roads receive extended use and they are not decommissioned.

Vegetation Management

Vegetation management activities that affect soil and water include timber harvesting, site preparation, timber stand improvement projects, and skid trail construction. Loss of the protective soil cover (litter) from ground disturbance can increase erosion and sedimentation while decreasing soil productivity. Reduced transpiration and raindrop interception also increases water yield.

Mineral Exploration

Mineral exploration and development can affect soil and water by increasing erosion and sedimentation, soil compaction, and water yield. In many cases soil productivity is reduced and turbidity and/or sedimentation may increase. The potential seepage or spillage of toxic substances from mining facilities or disposal areas may also pose a threat to water quality.

Fire Management

Prescribed burning directly affects soil and water by removing a portion of the vegetative cover, exposing the soil to erosion. Control lines also expose mineral soil. These factors can reduce soil productivity and increase stream sedimentation. The significance of this varies widely depending on the soils, topography, and the intensity of burn.

Standards and Guidelines

All alternatives incorporate management direction that would provide for maintaining and, where practical, restoration of watershed health. This direction consists of desired conditions, objectives, standards, and guidelines that would apply to and limit the effects of any alternative selected for implementation in the Forest Plan.

Although standards and guidelines do not completely eliminate water quality and riparian impacts, they would reduce impacts to acceptable levels. Standards and guidelines provide a level of protection that the States and the U.S. Environmental Protection Agency have judged sufficient to meet the goals of the Clean Water Act (Ice et al., 1997).

The key to sustaining soil productivity, hydrologic function, riparian integrity, and water quality in the long-term is protection of the forest floor and associated soil properties and qualities through implementation of Forest Plan standards and guidelines. With successful revegetation of bare soil areas, erosion and sedimentation rates should diminish rapidly to pre-disturbance or background levels within three years. The greatest decrease in these respective rates should be achieved in the first two growing seasons. Soil erosion risk is at its maximum immediately after soil disturbing activities are completed (Burger, 1985).

Currently, all Forest Service permanent and temporary roads needed to access resource management sites are designed and constructed using soil and water guidelines that meet or exceed those required by the State of Ohio.

The long-term effects of abandoned mine land reclamation and restoration of associated riparian areas are positive in that acid mine drainage is reduced or eliminated, and both the aquatic and terrestrial resources are restored to a functioning ecosystem.

Cumulative Effects

The cumulative effects analysis for watershed and riparian resources focuses on management activities that may result in soil erosion and sedimentation of aquatic and riparian habitats. An analysis of how the alternatives would affect soil productivity is addressed separately in the Soils section. The cumulative effects analysis area for watersheds and riparian resources covers the 31 fifth-level watersheds that fall at least partially within the WNF proclamation boundary. These watersheds encompass 2,613,184 acres of land in southeastern Ohio. At this time, only 22 of the fifth-level watersheds contain NFS lands, but NFS ownership patterns could change in the future with continuation of the Forest's land acquisition program.

To estimate the cumulative effects of the alternatives on watershed and riparian resources, activities on adjacent non-Federal lands must be considered. Unlike many of the nation's larger National Forests where the land base is mostly contiguous, the WNF is significantly fragmented by private and State lands. National Forest System ownership determines the degree of influence Forest Service resource management could have in any particular watershed (Table 3 - 5).

Table 3 - 5. Comparison of NFS ownership among fifth-level watersheds and the relative degree of influence Forest management activities could have on fifth-level watershed integrity.

	Percent NFS ownership in fifth-level watersheds					
	0	0-10	10-20	20-30	30-40	40-50
Number of 5th level watersheds	9	11	5	3	2	1
Degree of Forest Service influence	N/A	Low	Low	Moderate	Moderate	High

An analysis of cumulative effects requires that proposed actions be analyzed together with past actions and potential future activities. As described earlier, extractive land use activities from the late-1700s through the 1900s resulted in the degradation of watershed integrity. However, efforts by the Forest Service and other natural resource agencies and conservation organizations have led to improvements in the damaged watersheds and riparian areas of southeastern Ohio. State and Federal agencies with regulatory authority aid in the protection of watershed and riparian health during the implementation of energy minerals development on private and public lands, as well as projects that may directly affect wetland and aquatic habitat integrity. In addition to a well-organized abandoned mine land restoration program in southeastern Ohio, Federal and State programs provide opportunities for private landowners to restore or improve wetland and riparian habitat. Furthermore, Federal and State agencies offer educational opportunities for private landowners to learn best management practices (BMPs) for logging, woodlands management, and riparian management. These programs are providing long-term beneficial effects to watershed health. For example, an evaluation of best management practices for logging on private lands indicated that BMPs were employed in at least 80 percent of all timber harvests and 95 percent of these BMPs were rated effective at minimizing sedimentation of streams (McClenehen et al., 1999).

Forest Service management activities such as road construction, skid trails and landings associated with timber harvest, and to a lesser degree, off-highway vehicle trails, fire line construction, and abandoned mine land reclamation have the potential to decrease soil stability and could result in sedimentation of aquatic and riparian habitats. Surface mining and oil and gas well development are management activities that could occur, but are dependant on proposals by private minerals owners or Federal minerals lease holders. In order to accomplish short-term and long-term land management activities, soil erosion and sediment transport may be an unavoidable consequence. However, Forest-wide standards and guidelines integrated into all alternatives minimize effects to soil stability and downslope and downstream areas. These Forest-wide standards and guidelines not only reduce the threat of short-term impacts, but minimize the likelihood for long-term adverse effects to soil and water resources.

The acreage of ground disturbing activities that could occur on NFS land during the first decade would vary little between the alternatives (Table 3 - 6). Based on small amount of ground disturbance expected from these Forest management activities with Forest-wide standards and guidelines designed to reduce impact, cumulative effects of Forest Service management activities on watershed integrity would likely be minimal. The alternatives vary little in the amount of potential soil erosion and sediment transport that could occur during the first decade, with less than one percent of the cumulative effects analysis area affected by ground-disturbing activities on NFS land. Furthermore, some activities that may be implemented could result in short-term disturbance but provide significant long-term benefits. For example, abandoned mine land restoration may disturb localized areas for a brief period, but could result in the restoration of habitable aquatic habitat for fish, mussels, and other aquatic invertebrates.

Table 3 - 6. Potential acreage affected by Forest Service ground disturbing activities within the cumulative effects analysis area.

	A	B	C	D	E	E Modified	F
Trail Construction	303.5	303.5	265	302	265	265	225
Recreation Facility Construction	60	60	60	60	60	60	60
Road Construction or Reconstruction	315	421	540	537	530	538	495
Skid Trails and Landings	198	441	747	739	718	740	634
AML Restoration	522	522	522	522	522	522	522
Energy Minerals Development	1,371	1,371	1,371	1,371	1,371	1,371	1,371
Utility Line Construction	50	50	50	50	50	50	50
Fireline Construction	15	15	14	14	14	14	14
Total Acres Affected	**2,834.5**	**3,183.5**	**3,569**	**3,595**	**3,530**	**3,560**	**3,371**
Percentage of Cumulative Effects Analysis Area	**0.11**	**0.12**	**0.14**	**0.14**	**0.14**	**0.14**	**0.13**

Soils

Affected Environment

The Wayne National Forest is located in southeastern Ohio, commonly referred to as Ohio's Hill Country. The Hill Country consists of a long series of narrow ridges and U-shaped valleys.

The slopes are seldom smooth with uniform gradient from crest to toe. Rather, they are benched or segmented, having alternate sections of steep and moderate slope gradients. Local relief (local relief refers to the difference in elevation between the top of a ridge and the bottom of its adjacent valley) varies as little as 50 feet in some areas to as much as 500 feet in others. Slope gradients range from 15 to 80 percent with dominant slope gradients ranging between 25 and 55 percent.

Benches result from erosion of strata with different resistance to erosion. Weak strata, such as shale or mudstone, weather more rapidly than resistant sandstone.

The surface texture of most soils is silt loam, loam, or sandy loam, but texture of subsoil ranges from sandy loam to clay. Because of the steep slopes and silty textured soil surface layers, erosion is probable if the duff layer is disturbed.

Current natural soil loss through erosion on undisturbed forested lands can be up to one-half ton per acre per year. This compares to a soil loss on cropland in the Forest area of seven tons per acre per year (Soil and Water Conservation Districts Resources Inventory, 1979). However, the scope of past land uses was much more broad in comparison to current impacts. Settlement of southeast Ohio by non-Native Americans from the late 18th through the 19th century dramatically changed land use in the area. The new settlers practiced logging, mining, and grazing. While these land uses continue on a small scale, they were more widespread and intensive in the past. These intense land-uses in that era were rarely accompanied by mitigation measures to prevent soil erosion. As a result, soil productivity and fertility both declined.

Soils on the Forest's uplands are relatively infertile, but research by Finney et al. (1962) indicates that soil fertility varies with slope aspect. They found soils on southwest-facing slopes generally to be more acidic and have thinner topsoil than those on northeast-facing slopes. These soil differences, however, are not of enough magnitude to have been reflected in local detailed soil survey maps. The surveys also describe soils influenced by flooding. Soils found near streams and in bottomlands are classified as occasionally or frequently flooded soils. The occasional category still exists in some surveys, but is no longer used in current survey standards.

Timber site quality has also been shown to be related to slope aspect as well as slope position. Research by Carmean (1967) has shown that site indices for black oak in southeastern Ohio tend to be highest on lower slopes with northeast aspects and lowest on upper slopes with southwest aspects. Mid slopes and southeast and northwest aspects have intermediate site indices.

Soil mass movement is possible on the steepest areas of the Forest. Virtually every valley contains some evidence of landslide soil movement. Concave slopes at the heads of valleys are most susceptible to mass movement, while convex slopes at ends of spur ridges are least susceptible. Valley head slopes are very sensitive to disturbance. Movement of soils is also commonly seen in areas affected by surface and underground mining. Areas that have been surface mined may be characterized by slumps and gob piles, while subsidences and portals are often associated with areas around underground mines.

Serious erosion is usually limited to road use during excessively wet periods where roads are poorly located or lack erosion control devices. This effect is most likely on unauthorized roads and trails. Intermingled farms and rural roads, rather than forested land, are the major sources of soil erosion. In addition, serious soil erosion is common on private forest land, often caused by poor road location and lack of erosion control during and after logging operations.

Environmental Consequences

Direct and Indirect Effects

The Forest Service is directed by various laws, executive orders, and policies to protect or enhance long-term soil productivity while providing for multiple forest uses. Soil productivity is the inherent capacity of the soil to support the growth of plants and can be measured in terms of biomass produced.

While the Forest Service does not measure impacts to the productivity of soils with biomass because it is difficult to quantify, the Agency will describe impacts to soil productivity by estimating the number of acres likely to be affected by soil disturbing management activities. Some the impacts will be short-term (<5 years) and some long-term (>5). The intent is to show how each alternative will affect long-term soil productivity. By identifying impacts to soil productivity and minimizing the area to be affected, the soil's ability to function as an important part of the Forest's ecosystems can be protected.

Soil productivity can be affected by several factors and conditions resulting from Forest management activities (See Table 3 - 7). Compaction, erosion, topsoil removal (displacement), land use changes (e.g., forestland to parking area), fire, and soil improvement (fertilization/liming) can all impact soil productivity. Natural geologic weathering processes (rock to soil), organic decomposition (breakdown of dead biomass), fire, nutrient cycling, and atmospheric events (e.g., drought, precipitation, freezing) also influence soil productivity.

Table 3 - 7. Effects to Soil Productivity from Forest Service actions.

• Direct Effects	• Indirect Effects
• Compaction	• Erosion/soil movement
• Land use change	• Vegetation removal/nutrient cycling
• Displacement (Topsoil removal)	• Fire use
• Soil improvement	•

Key indicators for effects to the soil resource include:

- Acres of timber harvest
- Miles of road construction
- Acres of prescribed burning
- Miles of trail construction

- Soil improvement
- Mineral development
- Acres of dispersed and developed recreation use and construction

The Forest and Rangeland Renewable Resources Planning Act (RPA, 1974) requires an assessment of the present and potential productivity of NFS land. Regulations are to specify guidelines for land management plans developed to achieve the goals of the program which "insure that timber will be harvested from National Forest System lands only where…soil, slope or other watershed conditions will not be irreversibly damaged." The National Forest Management Act (1976) amended RPA by adding sections that stressed the maintenance of productivity, protection and improvement of soil and water resources, and avoidance of permanent impairment of the productive capability of the land.

Compaction

Soil compaction is related to soil texture, structure, moisture, ground cover, rock content, and the type of activity. Soils with high moisture content are most susceptible to compaction. Fine textured soils without rock fragments are also more at risk. Rutting, increased runoff, erosion, and reduced root/plant growth can occur on severely compacted soils. If topsoil is removed, compaction is more likely, since the subsoil layers of many soils on the Forest have higher clay content and contain fewer rocks. However, if topsoil has already been removed, then soil productivity is already reduced on the area. Compaction is considered a short-term (less than 100 years) effect on soil productivity, since research has shown even severely compacted soils may recover in 10 to 60 years where mitigation measures of tilling and reestablishing vegetation have been used. Depth of compaction does not usually exceed 6 inches with the kinds of equipment currently used on the Forest. The actions associated with 2006 Forest Plan alternatives that can produce soil compaction include skid trail (unbladed access routes) use, dispersed recreation use, timber harvesting, grazing, and trail use.

Land Use Change

The ability to produce biomass, is a sign of soil productivity. If soil with biomass is converted to a parking lot, building site, paved road or some other use that prevents biomass production, then it has lost some or all of its productivity for some time, probably an extended period (greater than 100 years). Land use change is thus a long-term impact to soil productivity.

Displacement (Topsoil Removal)

Topsoil removal is considered a long-term impact on soil productivity because it means loss of the soil's most fertile section. The feeder roots of plants and many of the nutrients needed for soil organisms to grow are found in the organic layer and the soil surface beneath it. Many of the Forest's soils are formed in sandstones and shales that are naturally low in plant nutrients. Many are also acidic (low in soil pH). The upper layers of soil, where most of the organic material and microorganisms are found, are therefore very important in maintaining soil productivity. Soils require many years to recover their original productivity after their upper layers are removed. Soil formation typically occurs at a rate of one inch per 300 to 1,000 years and depends on many environmental factors.

Areas to which removed topsoil is relocated will be enriched by the new soil material and organic matter. The productivity of these topsoil disposal areas will be improved by increased soil depth, rooting depth, moisture holding capacity, and organic matter. However, this improved soil productivity does not offset the long-term loss of productivity in areas from which top soil is removed. It is noted here as an indirect effect of excavation and to document that not all effects from excavation are negative. Topsoil disposal areas will not be used to show any positive effects of excavation, since the extent of these areas is not easily estimated or displayed. Actions which can produce topsoil removal associated with Forest Plan alternatives include:

- Temporary road and skid road construction
- Log landing construction
- Developed recreation use
- New trail construction
- Oil and gas development
- Bulldozer constructed fireline
- Special use development and wildlife opening establishment.

Soil Improvement

The Forest's intent is to improve soil quality on about 10 acres per year. Special emphasis will be given to riparian areas to help reduce sediment delivery to stream channels, floodplains, and wetlands. Some watersheds may be targeted for this work to tie in with large-scale watershed partnerships, special concerns with species habitats and public water sources. The effects of soil improvement will be considered a long-term positive effect on soil productivity and an improvement of existing soil quality. Soil improvement actions associated with Forest Plan alternatives would include: slope stabilization, erosion control structures, and abandoned mine reclamation.

Prescribed Fire Use

Prescribed burning impacts soils in two ways:

- The fire itself burns up portions of the soil's organic layer, an important part of soil productivity.
- The combustion of these organic soil compounds under high temperature may leave a waxy residue, resulting in water repellent soils, reducing soil permeability, increasing runoff, and erosion potential.

Hotter fires with large fuel loads will burn up more of the organic matter than cooler fires. A few soils on the Forest with thin organic layers can lose their entire organic layer when a fire burns hot. Typically, these would be shallow, rocky soils, at or near ridge tops on steep slopes. In most cases, the effects of fire on the soils on the Forest are short-term. Soil organic layers are replenished by leaf fall. Existing vegetation takes advantage of a temporary increase in onsite available nutrients produced by the burning of organic matter (biomass), which adds new organic material to the site.

The construction of bladed firelines to control the burned area boundary is associated with prescribed burning. This form of topsoil removal has a long-term impact on soil productivity. Not all firelines are bladed, however. Non-bladed firelines are considered short-term impacts to soils.

Erosion/Soil Movement

Erosion (i.e., soil movement) is an indirect effect of removing a soil's duff layer to create bare mineral soil. An undisturbed soil with layers intact and growing biomass is not very susceptible to erosion. When soils are disturbed to expose bare mineral soil (soil surface and subsoil), then soils on slopes become susceptible to raindrop impact, displacement, and overland water flow. These forces can cause soil to move downslope, sometimes into stream channels, where it then becomes sediment and is incorporated into the bed load of the stream channel. Exposed slopes with low clay soils and soils without many rock fragments are most susceptible to soil movement.

Erosion in this case is considered soil movement rather than soil loss. Many factors influence movement of soil to new locations. Depositional areas may benefit from the addition of eroded soil. Due to Forest topography, erosion often results in deposition of soil on slope benches. Gully erosion is an extreme form of soil movement with a long-term impact on soil productivity. Gully erosion removes large amounts of soil that will not be replaced in the short-term (<100 years). Other forms of erosion are not as substantial and may last only until a vegetative cover is reestablished. Gully erosion is difficult to predict and depends on several factors. Soil movement erosion will be considered a short-term effect and will be estimated mainly to measure sediment delivery to stream channels.

Vegetation Removal/Nutrient Cycling

Reduced canopy (shade) can affect soil temperature, moisture, and nutrient cycling. This situation normally occurs with a timber harvest. The bole of the tree is removed from the site and the forest canopy opens up to allow more sunlight and moisture to reach the soil surface. Other parts of the tree will remain onsite to recycle into the soil system over time. Loss of trees will reduce evapotranspiration and increase soil moisture.

Loss of canopy will increase soil moisture and temperature in the topsoil. These conditions will increase soil organic matter decomposition and increase available nutrients on the treated area. Much of this increase in plant available nutrients will be taken up by the regeneration of hardwood trees and by the root systems of the remaining vegetation on the treated area.

Some nutrients may leach from the site and reach local streams. This leaching effect is short-term, and removal of the tree main stem alone will not reduce long-term soil productivity. These short-term losses are made up by leaf fall, atmospheric additions, and weathering of parent material. Any increased leaching of nutrients from the soil would be very short term (<5 years). Long-term productivity has been reduced with whole tree harvesting on short rotations, which is not prescribed for this Forest.

Table 3 - 8. Acres of treatments that could affect soil productivity.

Effects to Soil Productivity	Acres by Alternative						
	A	B	C	D	E	E Modified	F
Short-Term (10 year period)	552	552	552	552	552	552	552
Long-Term (10 year period)	2262.5	2610.5	2997	3023	2958	2988	2789
Soil Improvement Term (10 year period)	100	100	100	100	100	100	100
Long Term Cumulative effects (10+ Year Period)	2162.5	2510.5	2897	2923	2858	2888	2699
Percent of WNF with Long Term Cumulative Effects	1.2	1.3	1.5	1.5	1.5	1.5	1.4

Cumulative Effects

Cumulative effects are described by effects to soil productivity from management activities on the Forest, acid precipitation, and historic land use resulting from the 18th, 19th and 20th century settlement and development in southeast Ohio.

The cumulative effects to soil productivity from the actions taken during the first decade by each alternative are displayed in Table 3 - 8. Short-term effects to productivity (<5 years) are associated with removal of ground cover and compaction. Long-term negative (>5 years) effects to soil productivity reflect impacts from soil displacement and land use change due to road construction, dozer firelines, mineral activities, new trail construction, recreation development, special uses, and log landings. As shown, the alternatives would vary slightly in their impact to long-term soil productivity on the Forest. In the first decade of the plan, the table shows little variation between the alternatives. Long-term cumulative effects take into account the existing conditions on the Forest and add the impacts for the first decade. Soil productivity is being maintained on more than 98.5 percent of the Forest. Cumulative effects to the soils considered all resource management actions anticipated by the alternatives for the first ten years.

Modern Settlement and Development

Beginning in the late 18th and through the early 20th century, the lands of southeast Ohio were transformed dramatically by increased population and the supplanting of Native American culture. As settlement expanded and industrialization began, the natural resources of southeast Ohio were highly prized. Logging and extraction of minerals created the most changes in the landscape with agriculture and other modern developments playing a role. These varied activities all led to severe soil erosion during and well after the activities ceased. The resulting reduction in soil productivity and fertility permanently changed the landscape of southeast Ohio.

Acid Precipitation (Acid Deposition)

Acid rain falls on Southeastern Ohio. In many areas, acidic precipitation has a measurable impact on soil quality. The impact to soils in the southeastern Ohio, however, is considerably less than in areas with shallow soils and a low CEC (cation exchange capacity). The forested areas of southeast Ohio have what are considered deep soils (>20 in.). This soil depth, coupled with a high CEC, buffers the ph levels of acid rain. Soils where minimal impact may occur are on shallow (<20 in.) to very shallow soils (<10 in). The impact is minimal because these soils are often very coarse and the precipitation is quickly absorbed into ground water. (Martin NRCS Personal Communication, 2004)

While acid rain may reduce the buffering effect of the soil over a long period, soil acidity is more likely generated by in-situ microbial plant and animal processes (Kennedy, 1986). The amount and effects of acid deposition do not vary by alternative.

Air Quality

Affected Environment

The Clean Air Act requires that the United States Environmental Protection Agency (EPA) set National Ambient Air Quality Standards to protect public health and the environment. Hazardous air pollutants are those that cause or may cause cancer or other serious health effects or adverse environmental and ecological effects. EPA standards establish acceptable concentrations of six pollutants in the outdoor air. These pollutants are carbon monoxide, ground-level ozone, lead, nitrogen dioxide, particulate matter, and sulfur dioxide.

EPA designates areas that exceed these standards as non-attainment areas. For each such area, states are required to develop a detailed plan that lays out how attainment would be achieved. The Wayne National Forest manages land in 12 counties in southeastern Ohio, all but Washington County is considered in attainment for these pollutants. This means that the level of these pollutants in the air over the Forest is below the ambient air quality standards set by EPA. Washington County is a non-attainment area for the eight-hour ozone and fine particle pollution standard as of Sept.14, 2005.

Although air management issues can be very complex, three pollutants – sulfates, nitrates, and mercury cause the overwhelming majority of the impacts to ecosystems, the major source of these pollutants are the coal fired power plants throughout the Ohio River Valley. The Wayne National Forest lies within a region characterized by some of the highest levels of air pollution in the nation (Sams, 2002). As a result, this region also has some of the highest levels of acid rain and mercury deposition, which could contribute to a loss of ecosystem health. Sulfur dioxide and nitrogen oxides are precursors to important components of ozone and regional haze, resulting in inhibited visibility during hot sunny weather with stagnant atmospheric conditions. Sulfur dioxide and nitrogen oxide affect foliage and reduce the growth of species sensitive to these pollutants. The Wayne lies near some of the largest sulfur dioxide (SO_2) emitters in the nation. The resulting acidic sulfate deposition is the heaviest in the nation, and the Forest experiences high levels of acid deposition stemming from these and other nearby sources, it also important to note that much the $_{SO2}$ produced in Ohio is transported by winds to other states.

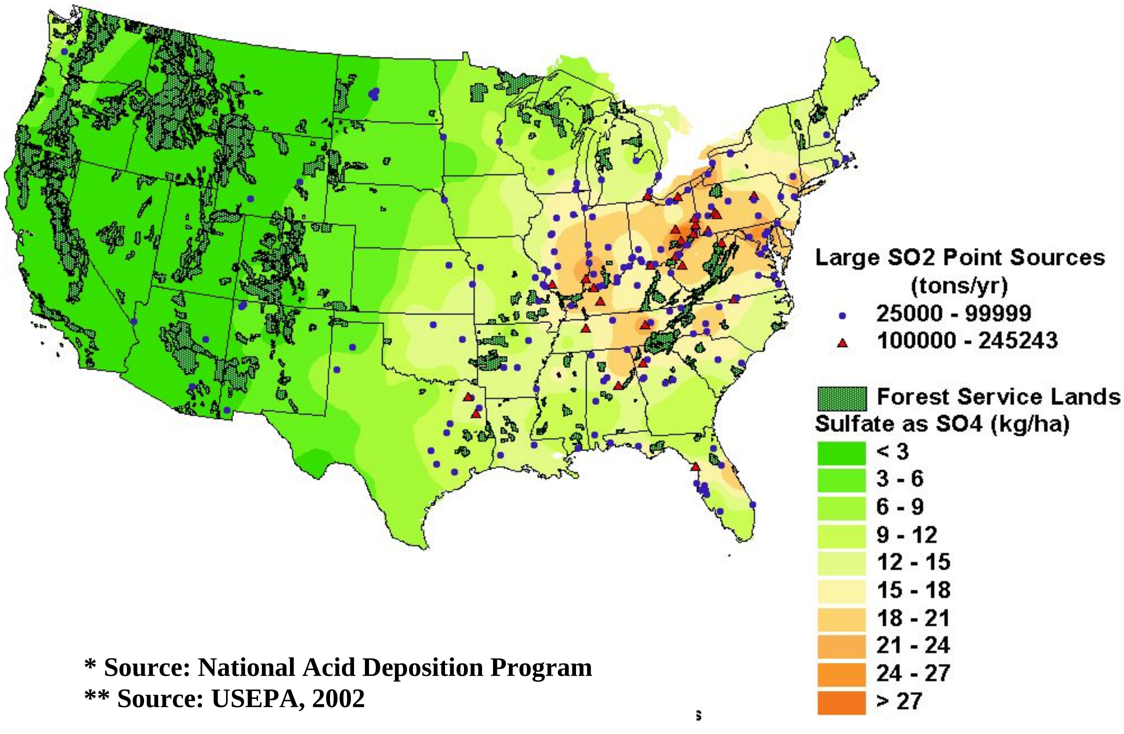


Figure 3 - 6. Sulfate Deposition During 1999* and Largest Sulfur Dioxide Point Sources.

Mercury depositions can occur anywhere due to long-range atmospheric transport. Mercury deposition can lead to the formation of methyl mercury in the aquatic environment. Methyl mercury is a potent neurotoxin, biomagnified in fish through the aquatic food chain. The State of Ohio issues fish consumption advisories for lakes and streams where mercury levels are unhealthy.

Particulate matter is a mixture of solid particles and liquid droplets in the air including dust, soot, and other microscopic particles. Particulate matter is a major component of smoke and can come from internal combustion engines, power plants, burning, or windblown dust. Scientists have linked exposure to particulate matter to serious human health problems. In addition, particulate matter can impair visibility.

Environmental Consequences

The major impact to air quality from management on the Wayne National Forest would be from wildfires and prescribed burns. Both wildfires and prescribed burns generate smoke that includes particulate matter that can temporarily degrade visibility and ambient air quality. Other management practices on the Forest are not expected to affect air quality to any noticeable degree.

Table 3 - 9. Total Acres of prescribed burning by alternative.

Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt. F
68,567	68,567	63,967	63,279	62,417	62,467	62,630

When prescribed burning is considered for use in restoring the role of fire in the ecosystem and to reduce fuels, the effects of smoke from wildland fire and prescribed burning must be taken into account. Fires emit large amounts of particulate matter (particulate matter size classes: PM 10 and PM 2.5 (microns)) and carbon monoxide as well as nitrous oxides (NOx) and organic compounds. Smoke created from burning is generally temporary. It dissipates and is not considered a significant factor in local air quality. The WNF implements most prescribed burning in the spring and fall when smoke would dissipate quickly. Burning during spring and fall would not affect the attainment status for pollutants, as the non-attainment days normally occur during the summer or periods of stagnant air. To minimize air quality impacts, all prescribed burns have an approved burn plan. These plans include measures to minimize and manage smoke. Prescribed burns also comply with State regulations for open burning. Other information related to prescribed fire and effects of smoke is in Chapter 3 Issue Indicator 11: Amount of NFS lands allocated to prescribed burning and mechanical fuels reduction.

Cumulative Effects

Timber harvest and motorized recreation affect air quality due to dust and the impacts of increased emissions. These impacts are expected to be negligible compared to background levels of air pollution from power plants and automobiles. Prescribed burning is accomplished in a controlled manner, and acreages are similar across all alternatives. Prescribed burn plans indicate the best conditions to conduct the burns, and include mitigations for air quality concerns.

Emissions from wildfire are expected to be constant across all alternatives and are outside the control of the Forest.

There is currently no evidence to suggest that air quality in Ohio and near the Wayne National Forest should constrain Forest management options or actions. In general, management actions improve forest health, which should allow the Forest to better withstand the stress caused by air pollution.

Plant and Animal Habitat

Background

Ecological Setting

The Wayne National Forest lies within the Southern Unglaciated Allegheny Plateau Ecological Section (Section 221E), which covers parts of Kentucky, Ohio, Pennsylvania, and West Virginia (Figure 3 - 7). The Southern Unglaciated Allegheny Plateau can be further subdivided into smaller ecological units, called subsections – three of which contain the WNF: the Ohio Valley Lowlands, the East Hocking Plateau and the West Hocking Plateau (Table 3 - 10). Thirty-one 5th level watersheds contain portions of the WNF (see Watershed and Riparian Areas in this Final EIS).

> The National Hierarchical Framework of Ecological Units is a classification and mapping system for dividing the Earth into progressively smaller areas of increasingly similar ecology. Ecological units are mapped based on patterns of climate, soils, hydrology, geology, landform and topography, potential natural communities and natural disturbances.
>
> **Wayne National Forest Ecological Hierarchy**
>
> 200 - Humid Temperate Domain
> 220 - Hot Continental Division
> 221 - Eastern Broadleaf Forest (Oceanic) Province
> 221E - Southern Unglaciated Allegheny Plateau Section
> 221Ec - Ohio Valley Lowlands Subsection/LTA
> 221Ed - East Hocking Plateau Subsection/LTA
> 221Ef - West Hocking Plateau Subsection/LTA
>
> *Source: USDA Forest Service 1995*

The WNF is located within a landscape that is fairly homogeneous compared to other Region 9 National Forests that are strongly influenced by glaciation or topographic relief. Landform, aspect, and slope are the primary factors that influence terrestrial forest communities on the WNF (USDA Forest Service, 1999). Landform and geology influence the physical aquatic systems, and subsequently the aquatic communities.

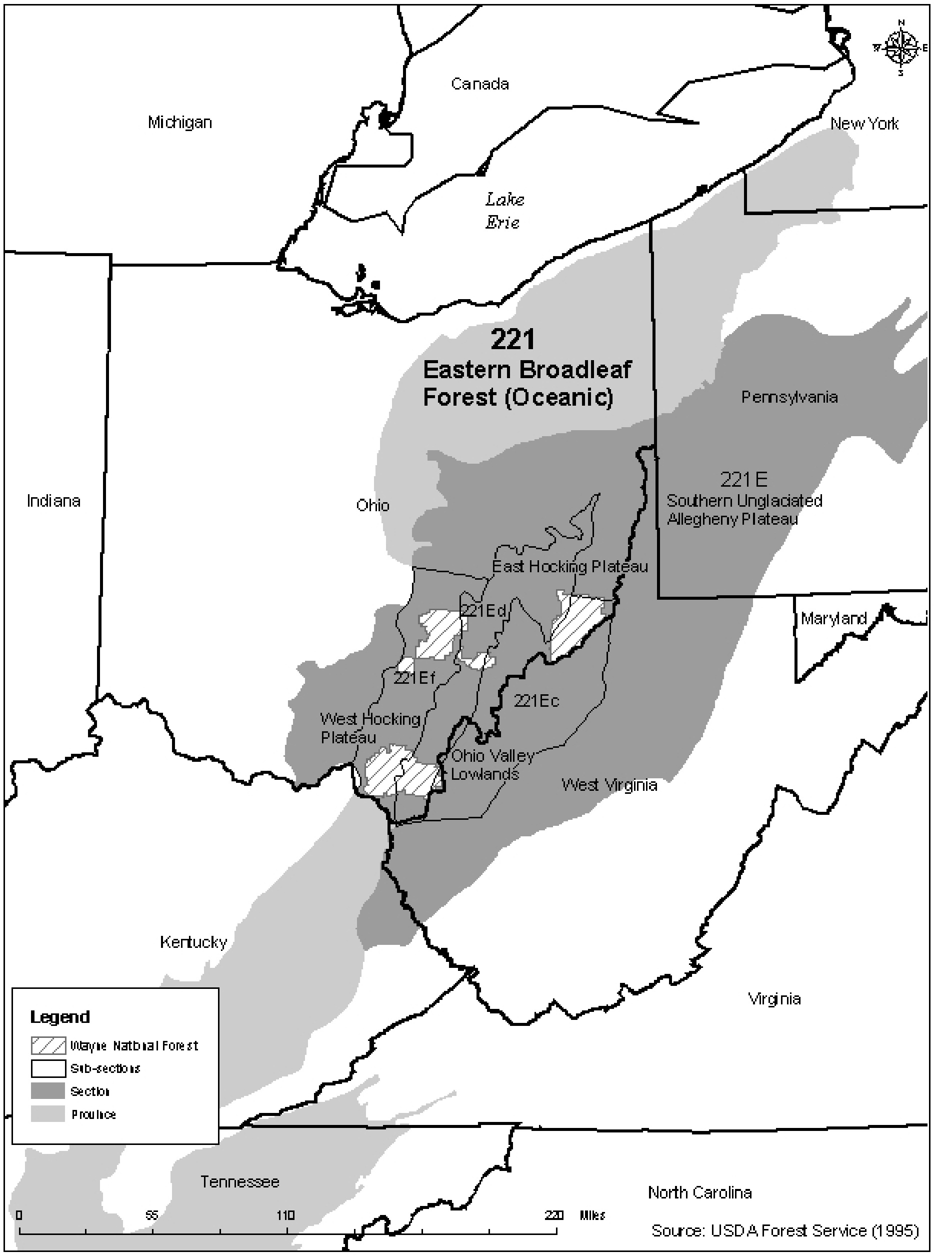


Figure 3 - 7. The Wayne National Forest in relationship to the Southern Unglaciated Allegheny Plateau Ecological Section 221E and three ecological subsections.

Table 3 - 10. Ecological patterns of the three ecological subsections that contain the WNF.

	Ohio Valley Lowlands Subsection (221Ec)	East Hocking Plateau Subsection (221Ed)	West Hocking Plateau Subsection (221Ef)
General Description	Rugged, wooded, and, commonly, too steep to be farmed. High gradient streams without acidity problems are characteristic and have developed on the underlying Permian shale, sandstone, and coal; on shale, the streams are often ephemeral and without large riffle-inhabiting fish populations.	Rounded hills and ridges that are generally less rugged than 221Ec, but are still steep. Gas wells, coal mining, and reclaimed land are locally extensive and associated stream degradation is common. Forests occupy steeper areas; dairy, livestock, and general farms also occur.	The ridges are forested while its floodplains and broad, clay-filled, flat-bottomed, preglacial valleys are used for general farms. Characterized by extensive bituminous coal mining (especially in the north) and associated stream degradation. Originally, the hill slopes had mixed oak forests, while the broad, Teays-age valleys supported mixed mesophytic forests.
Physiography	Unglaciated, except in the extreme west and northeast. Highly dissected plateau with rounded hills, ridges, landslips. Steep slopes of high relief along the Ohio River. Stream flow can be low in the summer.	Unglaciated. Dissected plateau, rounded hills and ridges, narrow valleys, steep slopes of high relief. Landslips. Some streams impacted by acid mine drainage.	Unglaciated, except in the extreme northwest. Dissected plateau with broad, flat-bottomed, hanging, pre-glacial valleys. Stream degradation associated with coal mining.
Natural Vegetation	Mostly mixed oak forest; with mixed mesophytic forest, oak-sugar maple forest; beech forest in broad valleys in Meigs and Athens counties.	Mixed mesophytic forest and mixed oak forest; beech forest in wide valleys of certain counties.	Extensive mixed oak forest on hill slopes. Teays-age valleys support mixed mesophytic forests. Beech forests in the wide valleys of the Hocking River system.

Source: U. S. Environmental Protection Agency (no date)

Plant and Animal Diversity

The National Forest Management Act (NFMA) requires the Forest Service to provide for diversity of plant and animal communities based on the suitability and capability of the specific land area so that overall multiple-use objectives can be met. There are over 300 aquatic and terrestrial vertebrate species, in addition to countless invertebrates and over 2,000 plant species known to inhabit the WNF sometime during their life cycle. Species viability evaluations conducted as part of the 2006 Forest Plan revision demonstrated that habitat diversity is the key to the conservation of these plants and animals (see Appendix E of this Final EIS).

Through our species viability evaluations, we found that the WNF plays a primary role in providing habitat for certain species of viability concern. One example includes the sun-loving yellow crownbeard, where 20 out of Ohio’s 27 populations occur on NFS land. Another example is the Ohio lamprey which is found only in a handful of Ohio River tributaries within the Southern Unglaciated Allegheny Plateau. The Ohio lamprey appears to be declining throughout its range except for the Little Muskingum River where its population is considered stable. The WNF also plays an important role in the recovery of the Federally endangered American burying beetle; reintroduction sites occur adjacent to the Wayne and could occur on NFS land in the future.

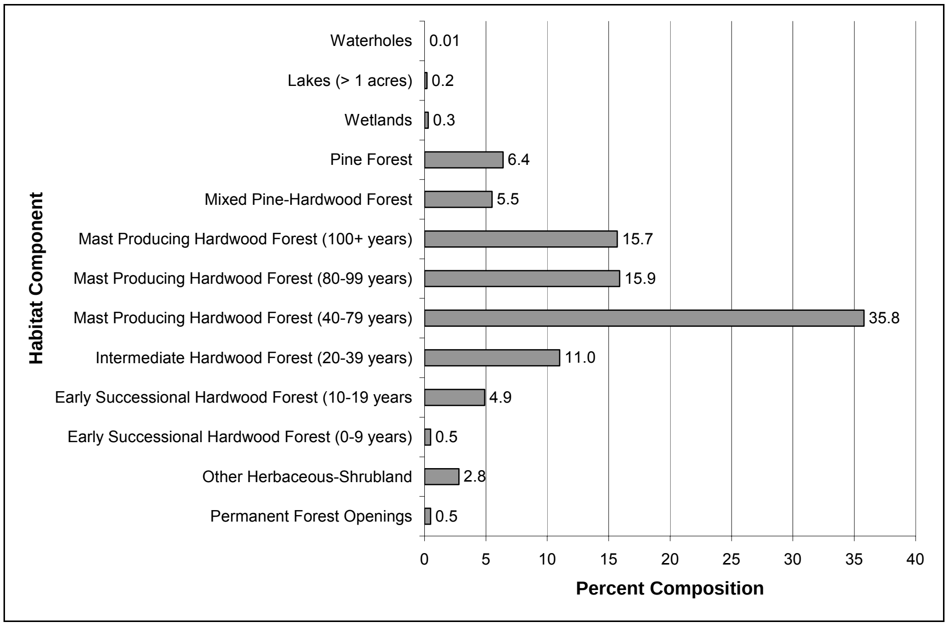
Some plant and animal species provide visitors to the WNF with a wide variety of recreational opportunities, such as hunting, fishing, and nature viewing. Major game species include the white-tailed deer, wild turkey, squirrel, and ruffed grouse. Other wildlife species hunted or trapped include the wood duck, beaver, bobwhite quail, rabbit, and mourning dove. Streams flowing through the Forest provide habitat for game fish such as smallmouth bass, channel and flathead catfish, and various sunfishes. The Little Muskingum River is one of the few remaining streams in Ohio and the Southern Unglaciated Allegheny Plateau containing a reproducing population of Ohio muskellunge. Impoundments and stripmine ponds provide habitat for largemouth bass, bluegill, and channel catfish. American ginseng, goldenseal and other plants are collected from portions of the Forest each year for medicinal purposes.

Terrestrial Habitat

The existing terrestrial habitat composition on NFS land is dominated by mature hardwood forest (Figure 3 - 8). At the time of the earliest land surveys, the area which is now the WNF was covered primarily by mixed oak forests (OBS, 1966). However, a minor component of mixed mesophytic and beech forest communities naturally occurred. Some pine was found locally on some ridges.

Mixed oak and oak-hickory communities still dominate the landscape of the Forest today. However, decreased fire occurrence over the last century has contributed to an increase in shade tolerant species in the forest understory and midstory and to a concern about maintenance of the oak component across the landscape in the future (Abrams, 1992; Abrams, 1998; Rodewald and Abrams, 2002). Oak communities support numerous plant and animal species, and their potential decline across the landscape raises concerns about how changes in forest composition will affect species over time.

Our species viability evaluations demonstrated that fire is important in the maintenance of healthy populations of fire-adapted herbaceous plants that are rare or experiencing declines, such as the juniper sedge (McCartney and Goodwin, 2003a) and yellow gentian (Larson, 2003). These plants are found in small oak barrens and prairie remnants that occur on certain ridges on the WNF.



Most of the WNF is covered with hardwood forest less than 80 years old.

Figure 3 - 8. Habitat composition on NFS land, 2003. Stream acreages are not accounted for in this chart. (Source: Analysis of the Management Situation).

Aquatic Habitat

The land ownership pattern of the WNF is scattered, but more often than not, NFS land occurs in upland areas on ridges and sideslopes. In terms of aquatic habitat, headwater streams (stream orders 1 to 3) are the dominant aquatic feature on the landscape where NFS land primarily occurs. These small streams do not necessarily support large numbers of game fish, but instead play an important ecological role for downstream waters and provide the greatest connection between the water and the land (Meyer et al., 2003).

The forested riparian corridor is a source of organic nutrients that supports the aquatic food chain, which in turn benefits a myriad of terrestrial animal species. It is also a source of large woody debris, which provides instream cover for aquatic animals, and performs channel forming functions. Thirty-seven percent of the species addressed during the species viability evaluation process were aquatic or riparian-dependant species.

Within the WNF proclamation boundary, which includes NFS land and all other ownerships, riparian corridors are generally forested (about 73%). Agricultural production is common in the riparian corridors because the land is relatively flat and fertile. About 25 percent of the lands in the riparian corridors produce hay, row crops, tobacco, or serve as pasture for livestock.

Wetlands occur in the riparian corridor. Historically, these included floodplain wetlands which were flooded seasonally, beaver-created wetlands, or shrub-scrub swamps. These different wetland types have a diversity of water regimes and plant communities. The life history of certain species that are rare or exhibiting population declines is tied to wetlands (e.g., Blanchard's cricket frog, featherbells).

Organization of the Analysis

We conducted coarse filter and fine filter analyses of biodiversity and these provided us with information about species of viability and conservation concern, as well as terrestrial and aquatic habitats, forest communities, and disturbance regimes that were important for maintaining viable populations of plants and animals in the planning area (see Appendix E). Our analyses showed that maintaining components of the oak-hickory forest and some native pine communities, and providing all successional stages of forest across the landscape are necessary in order to conserve plants and animals in the planning area. Using this information, we selected 11 habitat indicators to use in this analysis to display differences in how a diversity of plant and animal habitat is provided among the alternatives (Table 3 - 11). This approach is consistent with 36 CFR 219.14(f).

Timber harvesting and prescribed fire are two management tools considered necessary to provide habitat conditions for certain species. The amount of timber harvesting and prescribed fire projected to occur will vary by alternatives, and this analysis will display these differences.

The long-term maintenance of oak-hickory and native pine on the landscape is necessary to conserve biodiversity. Each supports plant and animal species native to the WNF, and therefore each has been termed a management indicator habitat. The degree to which oak and native pine are maintained on the landscape in the planning area over time will be based on the amount and type of timber harvesting and, to a degree, prescribed burning that is projected to occur in each alternative.

Early successional forest habitat is needed to conserve certain animal species in the planning area, however our analyses showed that this habitat has declined on NFS land since the 1988 Forest Plan was implemented (Ewing, 2003a). We have selected early successional forest as a management indicator habitat to show the degree to which habitat for a suite of species is provided among the alternatives.

Our analysis will also use eight animal species to supply supplemental information to show differences in how other forest habitats or habitat features would be provided under each alternative. These are termed management indicator species (MIS). These MIS were selected because their habitat requirements are generally the same as many other species, i.e., their large area requirements or their use of multiple habitats. The rationale for their selection is provided in Appendix E.

Each of the 11 habitat indicators will be individually addressed in the following section. They will be introduced with general information, followed by the current condition and then a comparison of differences among alternatives.

Table 3 - 11. Habitat indicators used to display differences among alternatives in plant and animal habitat.

Indicator Number	Habitat Indicator*	Summary
1	Amount and trends in **oak-hickory forest.**	An ecological forest type.
2	Amount and trends **in pine forest** and trends in habitat and populations for the **pine warbler**.	An ecological forest type and species associated with pine or mixed pine-hardwood communities.
3	Amount and trends in **early successional habitat** and trends in habitat and populations for the **yellow-breasted chat and ruffed grouse**.	A successional habitat component and species associated with early successional forest habitat.
4	Amount and trends in habitat and populations for the **cerulean warbler**, **worm-eating warbler,** and **pileated woodpecker**.	Species associated with mature, interior forest.
5	Amount and trends in habitat and populations for the **Louisiana waterthrush**.	Species associated with mature riparian forest and healthy headwater streams.
6	Amount and trends in habitat and populations for the **Henslow's sparrow**.	Species associated with grassland habitat.
7	Species of viability concern.	Federally listed threatened and endangered species, and Regional Forester Sensitive Species.
8	Species of public interest.	Species commonly harvested including white-tailed deer and ginseng.
9	Non-native invasive species	Plants, fungi and animals which can cause extensive and rapid habitat change.
10	Amount of NFS land allocated to management areas that allow timber harvest.	Displays amount of NFS land available for habitat management using timber harvesting as a tool.
11	Amount of NFS land allocated to management areas that allow prescribed fire.	Displays amount of NFS land available for habitat management using prescribed fire as a tool.

*Management indicator species or habitats are highlighted with bold text.

Analysis Area

The analysis area for considering direct and indirect effects to aquatic and terrestrial animals and plants includes the lands managed by the WNF. The cumulative effects analysis area used to evaluate Habitat Indicators 1-11 will vary. The Partners in Flight Ohio Hills Physiographic Region, an ecological area aligned with the Southern Unglaciated Allegheny Plateau Ecological Section, will be used as the cumulative effects analysis area for Habitat Indicators 2-6, while the WNF proclamation boundary is used as the cumulative effects analysis area for Habitat Indicators 1, 7 (Regional Forester sensitive species), and 8-11. The WNF proclamation boundary plus all lands within one mile from its edge will be used to evaluate cumulative effects on Federally listed species (Habitat Indicator 7).

Habitat Indicator 1: Amount and trends in oak-hickory forest on NFS land

A chestnut-oak forest dominated the landscape until the early 1900s, but this gave way to an oak-hickory forest after a widespread chestnut blight. The relative abundance of oaks and hickories is declining in southern Ohio, while maples, black cherry, and yellow poplar are increasing (Griffith et al., 1993). An increase of maples is occurring in the understory of oak stands of various ages, a change that many researchers attribute to the loss of disturbance processes (e.g., fire, harvesting).

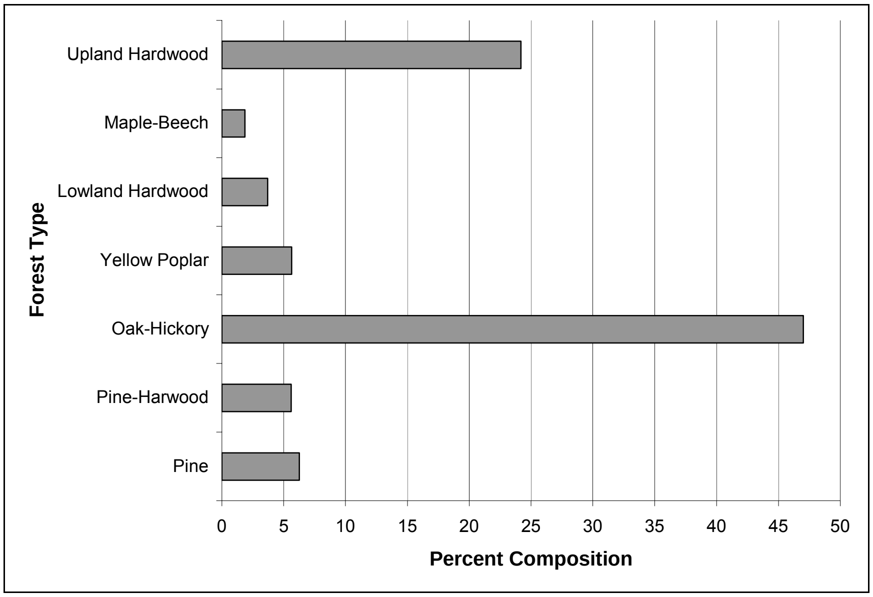
The oak-hickory forest found on the Wayne supports numerous plant and animal species. The oak-hickory forest produces an annual crop of acorns and other nuts that are a primary fall and winter food source for species like the blue jay, red-headed woodpecker, wood duck, raccoon, black bear, white-tailed deer, wild turkey, and northern bobwhite (Dickson, 2004). Acorns have a high lipid content, which serves as an energy source that becomes important for winter survival and successful reproduction. Acorn production fluctuates from year to year, which can affect natality, mortality, and movement of species like the black bear and white-footed mouse (Dickson, 2004). Studies in Appalachian oak-hickory forests suggest that fall hard mast crops may regulate ruffed grouse populations. Whitaker (2003) found ruffed grouse home ranges increased after poor mast crops, which has important consequences for predation rates and possible effects to ruffed grouse condition and reproductive success.

The furrowed bark and short-petioled leaves characteristic of oak trees also offer increased feeding opportunities to bird species that glean insects from crevices in their bark. Rodewald and Abrams (2002) study of oak-dominated and maple-dominated forest stands in Pennsylvania suggests that tree species composition influences avian community structure. They found that the majority of species and guilds that were consistently less abundant in maple than in oak stands over multiple seasons were bark-gleaning or resident species that regularly consume and cache acorns. Patterson and James (2004) found that birds foraging during the summer in closed-canopy oak-hickory forests used oaks in greater proportion than their abundance at the site, and that other tree species were used less than their abundance at the site.

The exfoliating bark of certain oak and hickory trees also provides the roosting structure needed by the Indiana bat. Fifty percent of the Indiana bat's Class I roost trees include oaks and hickories (Rommé et al., 1995).

Affected Environment

The oak-hickory forest still dominates landscape of the WNF (Figure 3 - 9). Forest stands composed primarily of oak and hickory account for 47 percent of the forest cover on NFS land. Oak is scattered, but also present in most forest stands that are categorized as upland hardwoods.



Oak-hickory is the predominant forest type on the WNF.

Figure 3 - 9. Percent composition of the different forest types on NFS land 2004.

(Source: WNF Vegetation Database)

Although oak-hickory is currently the predominant forest type on the Wayne, the relative amount of oak-hickory acreage is much less in stands younger than 70 years old, as compared to stands older than 70 years (Figure 3 - 10; Table 3 - 12). Conditions on the WNF are similar to the rest of the central hardwood region, an area that extends from New York to Georgia and from Virginia to Missouri, and encompasses the southern allegheny plateau ecological section. Forest stands that originated prior to the 1930s are predominantly oak-hickory, but the stands that originated after the institution of fire prevention are comprised to a much lesser degree of oak-hickory.

Oak regeneration problems are not confined to northern states at the margin of the range, which might otherwise be most affected by climatic change. Also, problems are occurring far outside the original range of American chestnut, as well as in areas such as the Southern Appalachian Mountains where the forest is not highly fragmented (Lorimer, 1992).

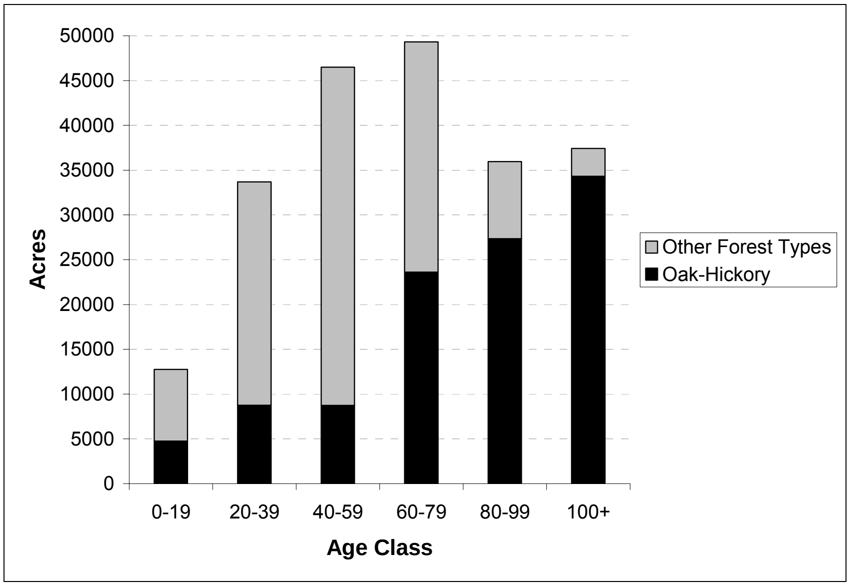


Figure 3 - 10. Acres of forest by type and age on NFS land, WNF.

(Source: WNF Vegetation Database)

The oak-hickory type is less prevalent in younger stands.

Table 3 - 12. Acres and percentage of oak-hickory forest type by age class.

Age (years)	All Forest Types (Acres)	Oak-Hickory (Acres)	Percent Oak-Hickory (by Age-Class)
0-9	1,044	110	11%
10-19	11,715	4,632	40%
20-29	12,374	4,343	34%
30-39	21,319	4,417	21%
40-49	21,309	3,024	14%
50-59	25,185	5,724	23%
60-69	26,060	10,493	40%
70-79	23,259	13,120	56%
80-89	19,194	13,722	71%
90-99	16,764	13,628	81%
100-109	15,786	14,131	90%
110-119	11,356	10,524	93%
120-129	6,926	6,625	96%
130-139	2,036	1,859	91%
140-149	1,086	988	91%
150+	240	197	82%

(Source: WNF Vegetation Database)

Factors Affecting Oak-Hickory Regeneration

Acorn Production and Predation

Because successful oak regeneration usually depends on the existence of seedlings in the understory before harvest, poor seed crops and high rates of consumption by animals can have significant impacts on the ability of oaks to compete with other species. Both unfavorable weather and insect damage can lead to poor acorn crops. Most of the eastern upland oak species have good seed crops at intervals of 3 to 5 years. Intervals between good seed years in white oak may be longer, and local factors might occasionally lead to regeneration failures from this cause.

Destruction of acorns by insects, rodents, and deer are an important factor in most areas; to lose 90 percent of an acorn crop is not uncommon. In a study in Pennsylvania, rodents removed virtually every unprotected acorn on the ground surface and 78 percent of the buried acorns. Insects destroyed 63 percent of the surface acorns protected from rodents (Lorimer, 1992).

Deer browsing is clearly a limiting factor for oak regeneration in some places, and the substantial growth of deer populations that occurred in many areas around the 1930s does coincide with the beginning of widespread oak problems. However, the occurrence of oak regeneration failures in places where deer are not especially numerous makes a number of researchers feel that deer are generally more of an aggravating factor than a primary limiting factor (Lorimer, 1992).

Shade Effects

The effect of a shaded forest floor and dense understory vegetation is one factor that explains the slow growth and high mortality of understory oak seedlings. Oak has a growth strategy in which energy from photosynthesis is directed to seedling root growth at the expense of shoot development. Seedlings can develop a substantial taproot and a seedling can persist for many years despite repeated shoot dieback if an adequate amount of sunlight is available. When an opening in the crown occurs, allowing more light into the understory, such seedlings are capable of rapid growth because of the extensive root system (Lorimer, 1992).

Shade-tolerant species such as maples often have an important advantage over oaks because they can make significant height growth under a closed canopy (in more shade than an oak can develop), and steadily increase in both size and number until a nearly continuous subcanopy or a multi-storied layer of vegetation develops. These added layers of foliage beneath a closed upper canopy intercept so much light that often less than one percent of full sunlight reaches the seedling layer. As a result, oak seedlings often die once acorn reserves are exhausted, and even among the survivors a vigorous root system doesn’t ordinarily develop. The ability to persist under dense shade appears to vary among oak species. White oak and chestnut oak, for example, are often considered to be moderately shade-tolerant. However, the shade tolerance of oaks is markedly less than that of many of its mesic competitors. The average 5-year mortality rate for large, overtopped saplings in a dry-mesic stand in southern New York was 45 percent for northern red oak and 26 percent for chestnut oak, but only 11 percent for red maple. On a dry-mesic site in central Massachusetts, overtopped red oak had a 19-year mortality rate of 90 percent compared to only 16 percent for red maple (Lorimer, 1983).

On mesic sites, advanced oak reproduction that is able to compete does not accumulate in mature stands because of the deep shade under the closed canopy. The advanced oak reproduction cannot develop into a size that would be competitive if it was released by overstory removal. Rather, it cycles in and out of the system with new seedling establishment after good acorn crops followed by mortality. Interrupting this cycle of establishment and mortality to enhance survival and growth of advance oak reproduction requires a silvicultural treatment that alters stand structure so that more light is available to the seedlings in the understory (Loftis, 2004).

Large numbers of advance oak regeneration will not necessarily assure acceptable oak regeneration even if released by complete clearcutting. One reason is that, even though the overstory is removed, the oaks may still have to compete with a dense understory of larger and usually more tolerant seedlings, saplings, and sprouts. These species usually have well-developed root systems and ample foliage, enabling them to respond faster to release than oak seedlings. If, at the time of release, the seedling does not have a large root system and adequate shoot height, shoot growth will be slow until the root system develops. Therefore, the mere presence of oak seedlings does not mean that they will become part of the future stand if released.

In summary, an oak seedling can become a dominant part of the new forest type if it has developed a strong root system, and when released to adequate sunlight, it is not encumbered by an established shade-intolerant, mesic tree seedling.

Oak Stump Sprouts

Sprouts that develop from harvested trees can contribute to the stocking of the regenerated stand of trees after harvests. Oak species vary in their capacity to sprout, but the diameter of the stump seems to have a larger factor on the number of sprouts that appear after a harvest. Table 3 - 13 shows the ability of different species to sprout, at different size classes. White oak and black oaks are not reliable sprouters after they reach a diameter approaching 16 inches and larger. So if a stand has a large number of trees larger than this for these species, then the future stand will be regenerated mostly by seedlings established before harvest, or “advanced regeneration” (Sander et al., 1976).

Table 3 - 13. Expected percentage of oak stumps that will sprout after cutting.

Diameter of Parent Tree in inches	Black Oak	Scarlet Oak	Northern Red Oak	White Oak	Chestnut Oak
2 – 5	85	100	100	80	100
6 – 11	65	85	60	50	90
12 – 16	20	50	45	15	75
17 +	5	20	30	0	50

(Source: Sander et al., 1976)

White and black oaks are not reliable sprouters after they reach a diameter of about 16 inches.

Although decay in stump sprouts has sometimes been a concern, when the sprouts originate at or below ground level, there is low probability of their becoming infected via the parent stump.

Effects of Fire

Fire has numerous functions which address some of the problems outlined above. Fire can improve oak regeneration if applied at the right time and place.

Fire removes excessive litter buildup from the forest floor, thereby preparing a favorable seedbed. Areas of thin litter are preferred by squirrels and blue jays for acorn burial. An important ecological finding is that blue jays collect and disperse only sound nuts, which implies that if these acorns escape predation they will result in well-established first-year seedlings. Seedlings from freshly germinated acorns are unable to emerge through a heavy litter cover. Germination and first-year survival are best when acorns are buried about 1.2 inches deep in the mineral soil. Although removal of thick litter may expedite germination by encouraging the caching of acorns by squirrels and blue jays, it is important that not all the humus layer be consumed. The humus layer keeps the surface of the soil porous, so that uncached acorns can more easily penetrate the soil. Humus also retains moisture and provides support for new seedlings (Van Lear and Watt, 1992).

Fire helps to control insect predators of acorns and new seedlings. Insect pests act as primary invaders, secondary invaders, parasites, or scavengers on, or in, acorns. Many of these insects spend all or part of their lives on the forest floor. Infestations, which can vary from year to year and even from tree to tree in some areas, are a major contributor to the oak regeneration problem. Annually about 50 percent of the acorn crop in Ohio is destroyed by the larvae of Curculio weevils, acorn moths, and gall wasps. However, recent studies indicate that prescribed burning may reduce populations of oak insect pests when conducted under proper conditions. A reduction in insect predation would allow more acorns to be scattered and buried by jays and squirrels, thus enhancing the probability of successful germination, and also encourage subsequent seedling establishment. Burning may also reduce rodent habitat, eliminating another source of acorn predation (Van Lear and Watt, 1992).

A regime of frequent burning over long periods creates a more open understory. In hardwood stands, long-term burning tends to eliminate small understory stems outright and gradually reduces the midstory and overstory canopy through mortality resulting from fire wounds. Increased light reaching the forest floor in these open stands will maintain the vigor of oak advance regeneration. Frequent fires xerify the surface of forest sites by consuming some of the forest floor as well as by exposing the site to greater solar radiation through canopy reduction (Van Lear and Watt, 1992).

The absence of fire since the turn of the 20th century has allowed species that are intolerant of fire to become established and grow to a size where they, because of thicker bark associated with age, can now resist fire. At greater than 2 inches dbh, yellow-poplar becomes almost as fire resistant as oak. Suppression of fire has allowed shrubby understory species to occupy drier sites where fire was once frequent and oak more dominant. Yellow-poplar produces an abundance of seed almost annually, and although the seed has low viability, many remain viable in the litter and duff layer for several years. Yellow-poplar seeds germinate readily following burning. However, in a regime of frequent fire, small yellow-poplar seedlings would be killed and the reservoir of stored seed in the duff would be gradually depleted. Thus, frequent fires would control to a large degree this major competitor of oaks on high-quality sites (Van Lear and Watt, 1992).

Figure 3 - 11 shows mortality of hickory, oak, red maple, and yellow-poplar advanced regeneration as fire intensity increases within spring prescribed burns conducted in shelterwood stands (Van Lear and Brose, 1998). Mortality rates experienced by yellow poplar and red maple are much higher for all intensities than oak or hickory.

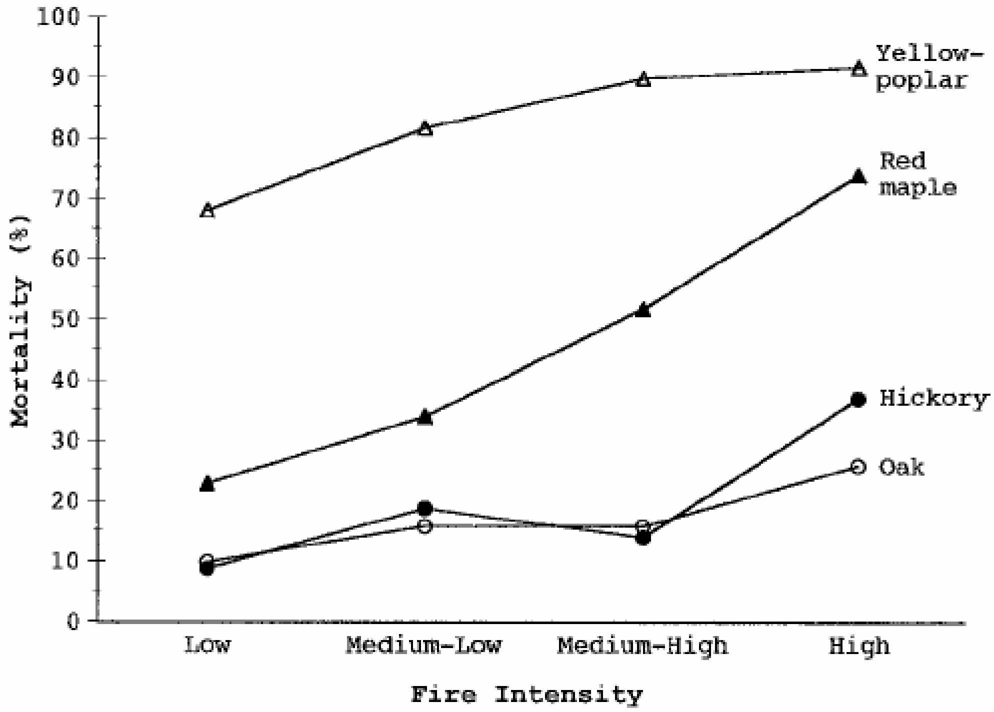


Figure 3 - 11. Morality rates of various hardwood species in shelterwood stands from prescribed fire. (Source: Van Lear and Brose, 1998)

Oaks and hickories are more tolerant of fire than maple and yellow-poplar.

When repeated burning occurs in stands with mixed advanced regeneration, oaks have an advantage over less fire-resistant vegetation which is killed by fewer fires of lower intensity. This loss usually exceeds species gain through invasion, since the frequency of the fires is as important to reduction of fire-susceptible species as the intensity of the fire.

Thus, a regime of frequent understory burns, perhaps including both growing-season and winter burns during a period of 5 to 20 years prior to harvest, should promote a favorable root/shoot ratio during oak seedling establishment (Van Lear and Watt, 1992). This fire frequency would be similar to the fire-returns that occurred in the mid–1800s to 1925 that was likely an important contributor to the mature oaks now present on much of the WNF. The harvest of the overstory would then release the established seedlings from the dense shade of the overstory, and the oak seedlings could then develop into the future oak stand.

The timing of the burns would be dependent on the observed vigor of the oak advance regeneration and its competitors. A series of burns over an indefinite preharvest period will likely be required to favor oak regeneration. The first burn may be detrimental to oak advance regeneration in that small rootstocks may be killed. However, over the long-run, oak will be less adversely affected than competitors and will, therefore, receive a competitive advantage that will enable them to favorably respond to subsequent release (Van Lear and Watt, 1992).

Herbicides may be required to remove midstory trees that have grown too large to be killed by low-intensity fires. Herbicides provide initial selectivity of midstory stems to be eliminated prior to burning. A combination of herbicide treatment and frequent fire may be required to secure oak regeneration and allow it to maintain its vigor in mixed hardwood forests that have not been burned for decades (Van Lear and Watt, 1992). Spot treatments of herbicides are generally applied directly to the stump immediately after the tree is harvested or directly to seedlings.

Direct and Indirect Effects of the Alternatives

Short-term Effects

Certain vegetation management techniques are better able to regenerate and maintain oak-hickory than others, and analyses were conducted for each alternative to estimate how much of the WNF may be comprised of forest stands dominated over time by oak-hickory.

The charts in Figure 3 - 12 show the number of acres that would be treated by silvicultural activities in the first decade with the objective of maintaining a significant oak component in the future. The charts also show the silvicultural activities that would likely be required to maintain the oak ecosystem in the management areas.

In addition, the charts in Figure 3 - 12 show the silvicultural treatment levels that would be accomplished by alternative. These numbers depict the sum of the treatments over a 10-year period. Treatments in any one year may be higher or lower than the average.

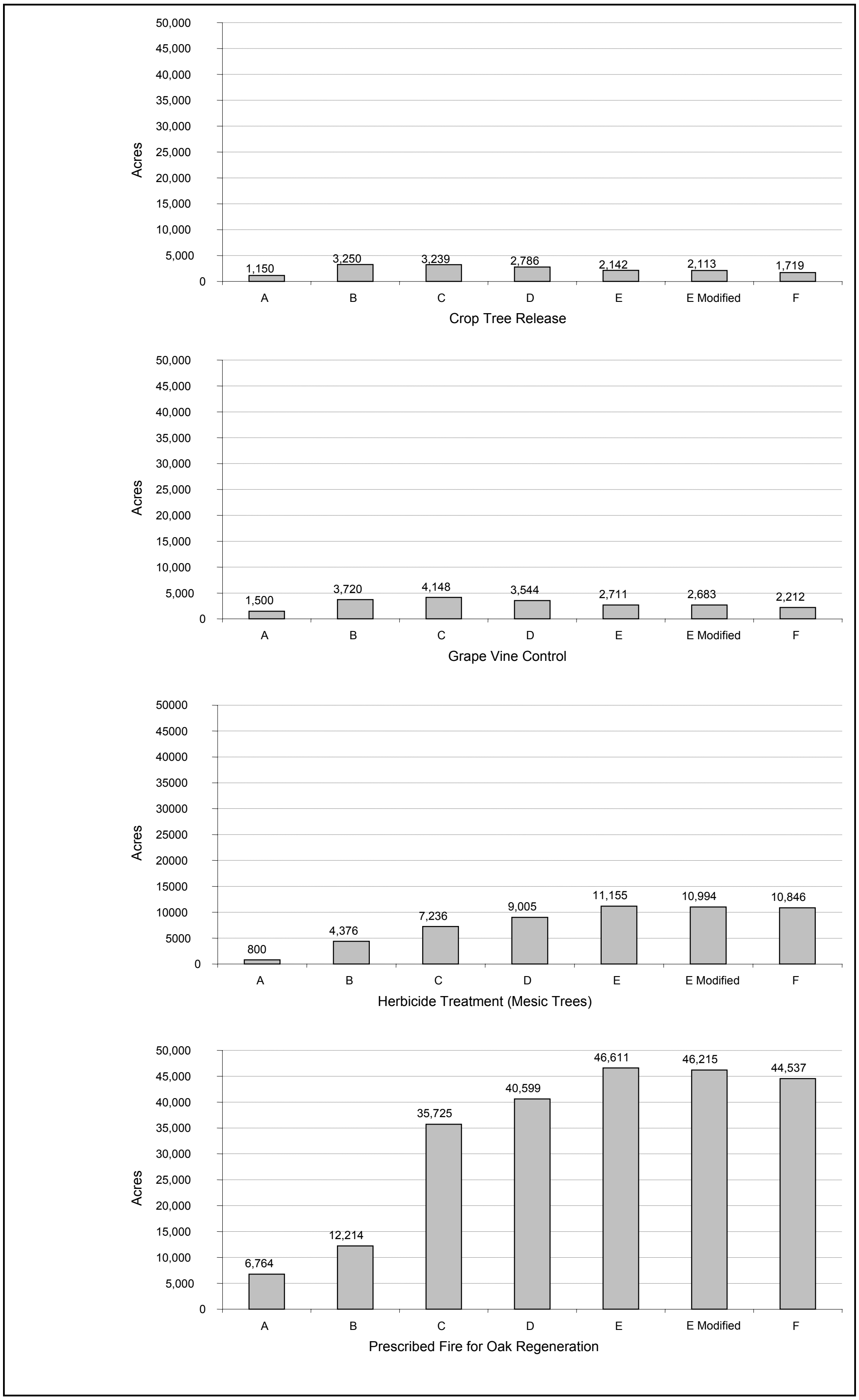


Figure 3 - 12. Acres of silvicultural activities projected for Decade #1.

Acres Where the Future Oak Component Will Likely Be Significant as a Result of Management Actions

Oak is likely to be maintained in stands regenerated with two-aged harvests, clearcut harvests, and historic forest management prescriptions that are also treated with a combination of silvicultural treatments such as prescribed fire, herbicides, crop tree release, and/or grapevine control.

Figure 3 - 13 depicts the number of acres by alternative where it is likely that the oak ecosystem would be maintained during the first decade, assuming that silvicultural treatments are implemented as needed. If these silvicultural treatments are not implemented as needed, then the regeneration would likely be composed of many more mesic and pioneer species such as maples and yellow poplar.

The regeneration method in Alternative A is predominantly single-tree selection, therefore very little oak regeneration would be expected. Alternative B would regenerate a fair amount of acreage to oak since it employs predominantly even-aged management, assuming that the other silvicultural work is performed. The oak regeneration increases from Alternatives C through E because both even-aged and Historic Forest management increases from C through E; the most significant increase is in the acres of Historic Forest implemented. Alternatives E Modified and F show a slight decrease in the number of acres regenerated to oak when compared to Alternative E, but the acreage is still higher than the other alternatives because more acres of forest would be treated under the Historic Forest prescription despite the fact that the acreage of projected even-aged management drops.

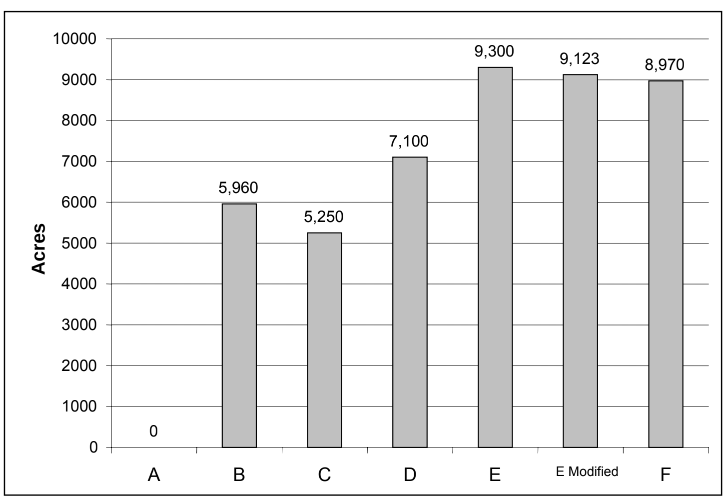


Figure 3 - 13. Acres likely to regenerate to oaks in the 1st decade in each management area by alternative.

Acres Where the Future Oak Component Will Not Likely Be Significant as a Result of Management Actions

Of those acres that may be harvested during the first decade, Figure 3 - 14 depicts the proportion of acres by alternative that would not be treated with silvicultural techniques that promote a preponderance of oak in the future. These are acres that would be treated with single-tree selection and group selection harvests (uneven-aged management).

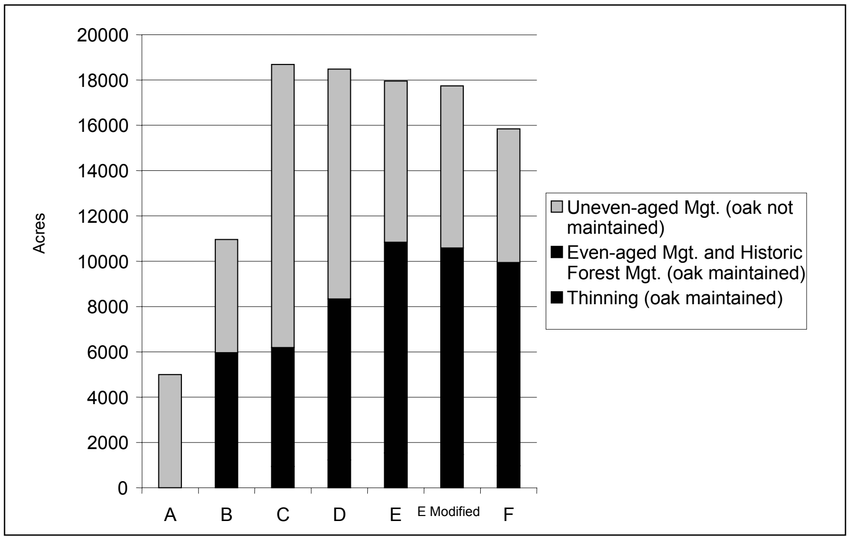


Figure 3 - 14. Acres treated in the first decade that will and will not maintain oak forest.

Alternative A allows for the smallest amount of timber harvesting during the first decade (2 percent of NFS lands), and all of the harvesting would employ uneven-aged methods. In other words, Alternative A would not aid in the maintenance of the oak component on the WNF during the first decade. Timber harvest levels increase in Alternatives B through F when compared to the no action alternative, but still accounts for only 5 to 8 percent of NFS lands. Of those acres harvested under Alternatives C and D, a greater proportion of the acres treated would not regenerate to stands with a preponderance of oak. Conversely, a greater proportion of stands treated under Alternatives B, E, E Modified, and F would regenerate to oak dominated stands.

Effects of Other Actions on Maintenance and Restoration of Oak Ecosystem

Some other projects will result in changes to the vegetation, and some areas that are currently forested becoming non-forest – at least temporarily. The overall impact that these projects will have on the restoration and maintenance of the oak ecosystem is very minimal, so that the effect will not make any discernable change in the amount of the oak ecosystem in the future. Listed below are examples of projects that fit this description.

- Oil and gas well development and maintenance
- Special use authorizations for items such as roads and utility corridors
- Permanent forest opening, wetland, and small pond creation and maintenance
- Recreation facility construction and maintenance, such as trails, picnic areas, day-use areas and campgrounds
- Wildland fire suppression
- Watershed improvement projects such as reclaiming abandoned mines and correcting erosion from past land management practices
- Road construction and reconstruction
- Non-native plant eradication

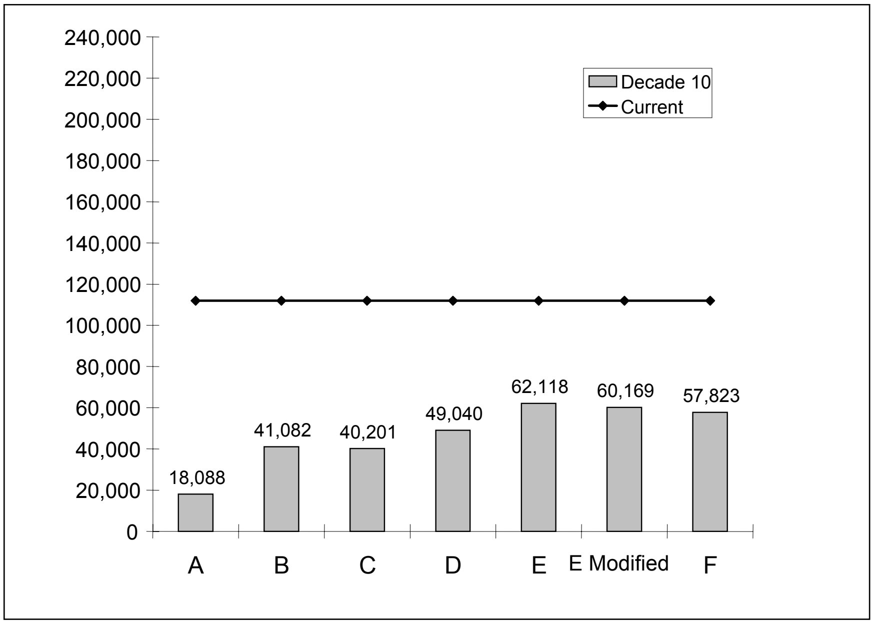
The amount of land that these projects would alter is very small in relation to the total acreage of the WNF. Therefore, these projects would not have a major affect on efforts to restore and maintain an oak ecosystem on the Forest. Some projects could have a beneficial effect on the oak ecosystem such as the wildfires if they are not too hot and/or in the wrong season, or the control of non-native plants which may allow the oaks to regenerate more effectively depending on the type of non-native and where it is growing.

Long-term Effects

Based on regeneration methods prescribed in the various management areas and on the Spectrum model outputs, there will likely be a declining trend in forest stands dominated by oak-hickory in 100 years on NFS lands with the implementation of any of the alternatives (Figure 3 - 15). There could be an 84 percent declining trend in forest stands dominated by oak-hickory after 100 years with implementation of Alternative A where only minimal uneven-aged harvest methods would be employed. Alternative E would likely maintain the most oak-hickory on NFS land after 100 years, but there could still be a 45 percent declining trend from present amounts.

As mentioned above, researchers are concerned that a decline in oak-hickory could affect animals which rely upon these species for food or shelter. This decline could be exacerbated with the cyclical oak mast trend seen in the Appalachian region. In all alternatives, oak and hickory trees would remain scattered across the WNF as individuals, or found in small groups on ridges and southwest facing slopes. In Alternatives C through F, extensive oak and hickory communities would also be concentrated on the landscape where the HF and HFO management areas are located.

While only speculative, it is possible that in the future there could be more competition for the oak mast resource, possible declines in populations of species that rely upon this resource for food or shelter, or altered species distributions in the planning area to coincide with oak-hickory concentrations.



Oak-hickory forest will decline from current levels under all alternatives. Alternative E would maintain the most oak-hickory forest.

Figure 3 - 15. Trend in the acres of forest stands dominated by oak-hickory by alternative after 100 years of implementation.

Cumulative Effects for Habitat Indicator 1

Oak is likely to continue its decline on NFS lands in the future, however efforts to regenerate and maintain oak communities in each of the alternatives may have beneficial cumulative effects when compared to trends in oak abundance on other lands in the cumulative effects analysis area.

In addition to NFS land, a large amount of non-industrial corporate or State ownership is present within the WNF proclamation boundary. However, most of the land is owned by private individuals. National Forest System land comprises about 28% of the WNF proclamation boundary.

State forests and wildlife management areas are generally managed by the Ohio Department of Natural Resources for game and non-game wildlife species. To manage habitat for these species, some timber is occasionally harvested within state forests or wildlife areas. Some silvicultural work may be done (e.g., prescribed burning) that will benefit oak regeneration. Most of state forests and wildlife management areas are either on the perimeter or a few miles from the WNF. Dean State Forest, Trimble

Wildlife Area and Cooper Hollow are within the WNF proclamation boundary, while Zaleski State Forest is immediately adjacent to the Wayne. Following is a listing of the areas, their size, and general location.

- Dean State Forest (near Ironton District) – 2,745 Acres
- Cooper Hollow Wildlife Area (near Ironton District) – 5,421 Acres
- Crown City Wildlife Area (near Ironton District) – 10,171 Acres
- Sunday Creek Wildlife Area (near Athens District) – 11,000 Acres
- Zaleski State Forest (near Athens District) – 28,000 Acres
- Ales Run Wildlife Area (near Marietta Unit, Athens District) – 2,905 Acres
- Trimble Wildlife Area (near Athens District) – 2,096 Acres
- Waterloo Wildlife Area – (near Athens District) – 1,522 Acres

Several state parks are also near the WNF. The vegetation within these public areas is generally managed only in and around the recreation facilities for public safety and scenery. Therefore, most of the forest land within the state parks will likely grow older and not regenerate to predominantly oak forests. Following is a listing of the state parks near the WNF, their size, and general location:

- Strouds Run State Park (near Athens District) – 2,606 Acres
- Burr Oak State Park (near Athens District) – 2,593 Acres
- Lake Hope State Park (near Athens District) – 2,983 Acres
- Jackson Lake State Park (near Ironton District) – 2,349 Acres

About 130,000 acres of corporate timber land is present in southeast Ohio. These lands that were owned by the MeadWestvaco Corporation were sold to Escanaba Timber LLC in May 2005. Not all of these 130,000 acres are adjacent to, or near, the WNF, but much of it is. These lands, plus other private and public lands, supply the paper mill in Chillicothe, Ohio, recently acquired by the NewPage Corporation. Escanaba Timber has entered into a long-term supply agreement with NewPage to ensure that the forestland owned by Escanaba Timber will remain a key source of wood supply to the mill – both hardwood pulpwood and softwood pulpwood.

On lands managed for hardwoods, MeadWestvaco had been testing ways to increase the oak component on the lands it will be harvesting, but the company did not have operational procedures in place when this Final EIS was written. The company had also been increasing the pine component with a target of approximately 23 percent of the corporate land in pine, plus encouraging private land to be stocked in pine. MeadWestvaco was also researching ways to increase the oak component of their hardwood regeneration, but has not instituted a standard procedure; therefore, the oak component of the future stands being regenerated now will likely be less than the current oak proportions.

Other private lands in and around the WNF are managed for a wide-variety of purposes. The Forest Service Inventory and Analysis Research Unit and Northeastern Area State and Private Forestry surveyed forest landowners across the country in the early 1990s. The data were summarized in a variety of ways, including by state. The following discussion is based on the results of the Ohio survey.

As can be seen in Table 3 - 14 and Figure 3 - 16, private landowners in and around the WNF have harvested timber in the past and are likely to harvest timber in the foreseeable future. In the past, landowners have rarely implemented any special measures to improve the amount of oak regeneration when they harvest.

Table 3 - 14. The number of owners, and ownership acreage by types, who have or have not harvest trees in the past.

Form of Ownership	Number of owners who have harvested	Acres harvested by those owners	Owners who have not harvested	Acres not harvested
Individual or Joint	165,000	3,923,000	149,200	2,062,000
Partnership	2,300	165,000	1,900	77,000
Corporation	2,700	607,000	3,100	173,000,
Club/Association	200	40,000	1,900	38,000
Other	600	49,000	2,300	57,000

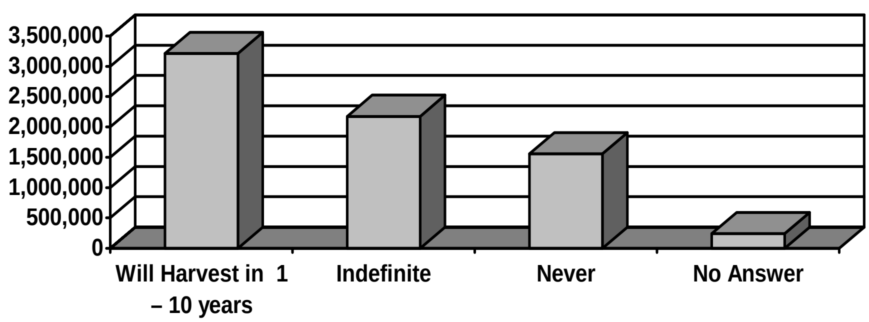


Figure 3 - 16. The acreage in Ohio that will, may, or will not be harvested in the future. (Birch 1994)

As observed by longtime residents and Forest Service employees, landowners almost never use prescribed fire or apply herbicides to the more mesic or shade intolerant tree species to encourage successful oak regeneration success. Therefore, despite the fact that the survey summarized above demonstrates that some harvesting can be expected on private, non-corporate, lands, the regeneration will likely have a large amount of species other than oaks making-up the dominant and co-dominant trees into the future. Landowners who do not harvest their lands in the foreseeable future will not remove the existing oak stands, but overtime, these stands will convert to species that are more shade tolerant such as maples and beeches.

Habitat Indicator 2: Amount and trends of pine forest and population trend for the pine warbler.

The mixed oak forest encompassed the majority of the landscape of the WNF at the time of the earliest land surveys. Forests of white oak-black oak and chestnut oak-chestnut covered the ridges, but flowering dogwood, sassafras, Virginia pine, pitch pine, and/or shortleaf pine occurred locally (OBS, 1966). Today, pine is scattered across the landscape of the Wayne, either in plantations or in stands comprised of hardwood and pine species.

As farms were abandoned in southeastern Ohio in the 1930s, the Civilian Conservation Corps began planting various species of pine to stabilize eroding soils. Pine is relatively quick growing, which helps to stabilize the soils and build up the duff layer through their periodic needle loss. The use of pine species continued as the Forest Service acquired eroding lands, including on abandoned mine lands.

Some animals and plants use pine plantations (e.g., the sharp-shinned hawk), but some people refer to these plantations as biological deserts because the canopy of closely spaced trees keeps sunlight from reaching the ground. This, combined with the dense mat of pine needles, limits the growth of understory vegetation.

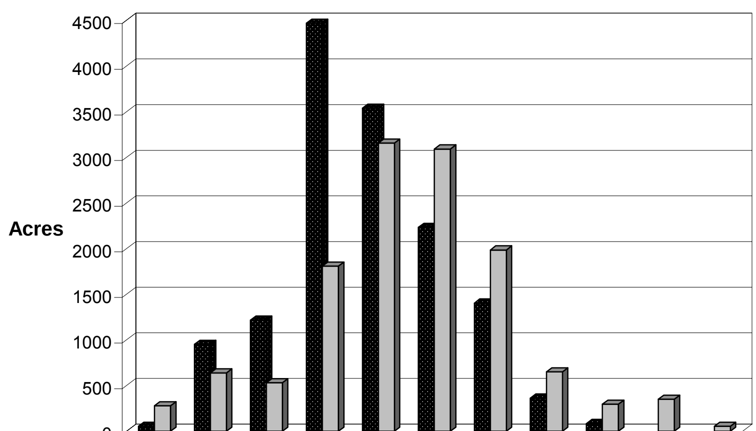
The pine warbler was selected as a management indicator species since it is closely associated with pine and pine-hardwood forests, generally occurring only where some pine component is present. It therefore is an appropriate indicator of the effects of management in maintaining a component of pine in the landscape. The pine warbler is identified as a Stewardship Species for the Eastern Avifaunal Biome in the Partners in Flight North American Landbird Conservation Plan (NALCP), with a continental objective of maintaining its population at current levels (Rich et al., 2004a).

Affected Environment

Pine is a minor component of the overall forest landscape on the WNF. Stands dominated by pine species account for only six percent of the forested acres on the Wayne, and stands that consist of a hardwood-pine mix cover about five percent of forested NFS land (Figure 3 - 17).

Pine species occurring on the WNF include red pine, white pine, shortleaf pine, Virginia pine, and pitch pine. The Wayne is within the native range of shortleaf pine (Lawson, 1990), pitch pine (Little and Garrett, 1990) and Virginia pine (Carter and Snow, 1990). The eastern part of the Marietta Unit is on the edge of the native range of the white pine (Wendel and Smith, 1990). Red pine is not native to Ohio (Rudolf, 1990). Hemlock naturally occurs in scattered groups or individuals in some Special Areas or in site-specific locations.

The pine warbler has enjoyed an increasing population trend in the Ohio Hills Physiographic Regions of about 5 percent since 1966 (Figure 3 - 18). The pine warbler has been observed on all units of the WNF, but appears to be more abundant on the Ironton Ranger District than any other unit. It was documented from 30 percent of the survey routes during the first year of the WNF Breeding Bird Survey in 2003, and was observed in areas comprised of pine, hardwoods, and mixed hardwood-pine (Ewing, 2003c).



	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+
Pine Acres	55	953	1217	4470	3539	2233	1405	364	85		
Pine-Hardwood Acres	279	640	532	1811	3157	3093	1986	650	297	352	56

Age in Years

Most pine and pine-hardwood stands on the Wayne are between 30 and 70 years old.

Figure 3 - 17. Age distribution of pine-dominated stands and pine-hardwood stands. (Source: WNF Vegetation Database)

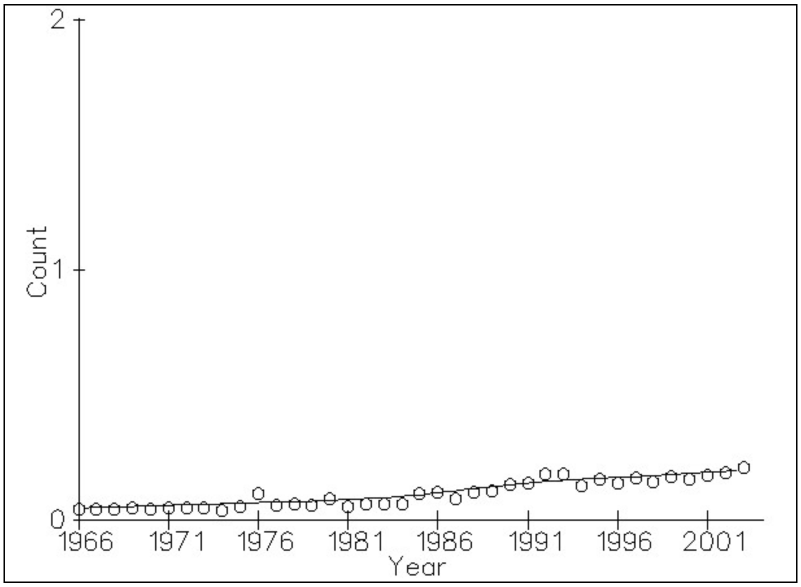


Figure 3 - 18. Pine warbler population trend for the Ohio Hills Physiographic Region 1966-2003 (Source: Sauer et al., 2004).

Direct and Indirect Effects of the Alternatives

For this analysis of effects, assumptions were made that the abundance of pine trees in existing mixed pine-hardwood stands would continue to decline over time. Pine would likely disappear from stands that are not manipulated with any form of vegetation management. The majority of pine-dominated stands are expected to convert to mixed pine-hardwood stands, and then to hardwood stands over a period of several decades. However, a combination of even-aged timber harvesting, possibly in conjunction with prescribed fire, could maintain some of these as mixed pine-hardwood stands for species like the pine warbler.

For purposes of displaying effects, only those stands where white pine, shortleaf pine, Virginia pine and/or pitch pine comprises more than 50 percent of the stems are included in this analysis of future mixed pine-hardwood stands. Queries to the WNF vegetation database show that there are a total of 14,373 acres of pine-dominated stands. Using the knowledge that even-aged timber harvesting has the potential to maintain a forest stand as a mixed pine-hardwood stand, acreages of existing pine-dominated stands were identified for each management area that prescribed even-aged management in the alternatives. This is to show the potential acreage of mixed pine-hardwood habitat that could be maintained in each alternative for the pine warbler. The potential acreages in each alternative vary because of the spatial allocation of these management areas.

This analysis suggests that there will likely be a declining trend in pine and mixed pine-hardwood communities over time (in 100 years) with implementation of any alternative (Figure 3 - 19). Pine warbler population trends would likely mirror this declining pine habitat trend on NFS land.

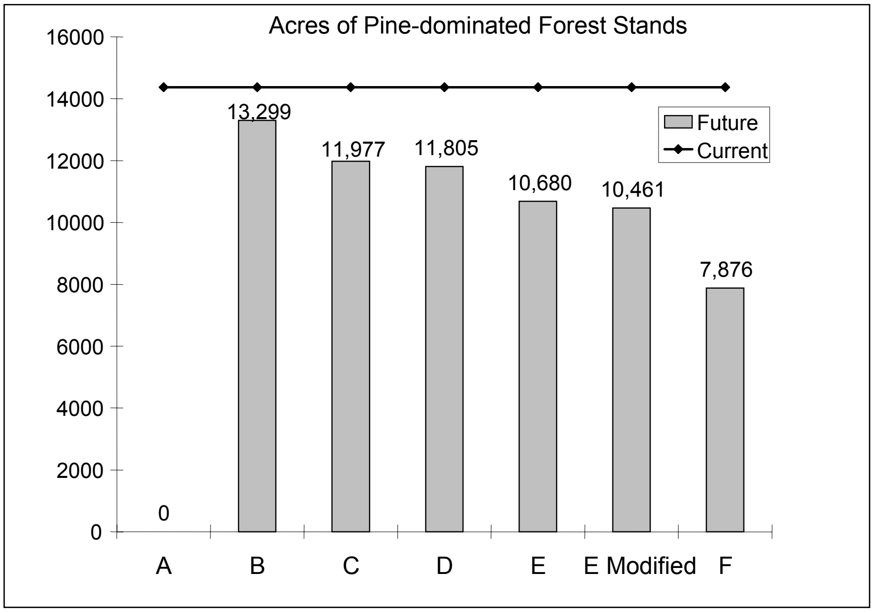


Figure 3 - 19. **Comparison of acreage of pine-dominated stands occurring in management areas which allow for use of even-aged management methods that would maintain mixed pine-hardwood communities in the landscape**.

Figure 3 - 19.

Pine and pine-hardwood forest is expected to decline from current levels under all alternatives.

In Alternative A, even-aged management is not incorporated as a plant and animal habitat management tool. Therefore, pine-dominated stands would decline in pine abundance and revert to hardwoods. White pine, which makes up the majority of these pine-dominated stands, is a longer-lived species, and therefore the decline of pine and conversion to hardwoods would be expected to take place over several decades. Pine warbler populations would likely decline the greatest with Alternative A in comparison to the other alternatives. Alternatives B through F are likely to maintain mixed pine-hardwood on the landscape, but less than exists currently. Pine warbler population trends may decline in Alternatives B through F, but may be maintained at low levels on the Forest over time.

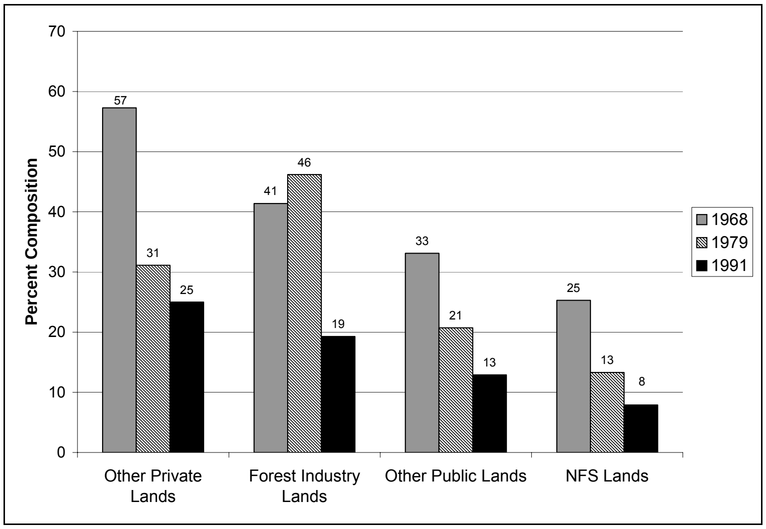
Habitat Indicator 3: Amount and trends in early successional forest and population trends for the yellow-breasted chat and ruffed grouse.

Early successional forest is an ephemeral habitat created by disturbances in the forested landscape. These disturbances may be natural or human induced and vary in size. Once the forest canopy is opened up, light is allowed to reach the ground. The result is the growth of herbaceous plants and shrubs during the first few years (generally in the first decade), followed by the establishment of tree seedlings and saplings (later in the first decade and during the second decade of growth). This early successional forest habitat is characterized by high stem densities of shrubs, seedlings, and saplings.

Approximately 35 percent of the terrestrial vertebrate species that are known to occur on the Wayne use early successional forest habitat during their life cycle. The herbaceous plants and shrubs provide dense cover that is useful for hiding from predators and produce a variety of soft mast (e.g., blackberries) that is nutritionally important.

Repeated disturbances are required to maintain early successional forest habitat. Natural disturbances created by tornadoes, ice storms, floods, windthrow, insect and disease outbreaks, and natural death, vary in size from small gaps to large-scale clearings. Timber harvesting is a tool that can create early successional forest habitat in the landscape, and the size and habitat quality of the resulting disturbance can vary, as it does with natural disturbances.

A declining trend in early successional forest habitat and the subsequent decline in population trends for some species that rely upon it, is not only a concern on the WNF, but has emerged as an issue across the eastern United States (Trani et al., 2001). Forest Inventory and Assessment data show that early successional forest habitat has been declining on all lands in Ohio since the late-1960s (Figure 3 - 20) (USDA Forest Service, 2000). This decline is in part due to maturation of forests, but also to a decline in farm abandonment.



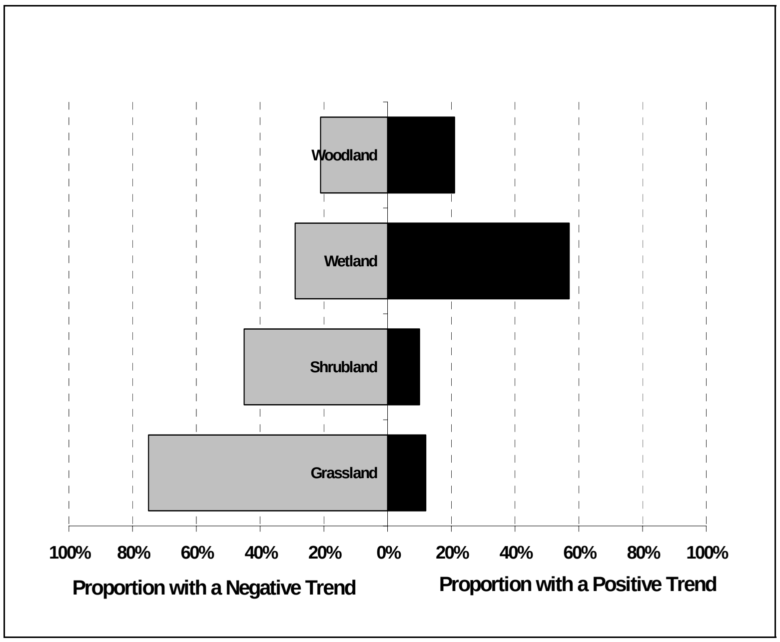
Early successional forest habitat has declined on all ownerships in Ohio since the 1960s.

Figure 3 - 20. Percent composition of early successional forest habitat in Ohio on lands managed by four ownerships, 1968-1991 (USDA Forest Service, 2000).

The species viability evaluations identified the concern that the conservation of early successional forest-dependant species on NFS land could be at risk in the future if current management was to continue. Early successional habitat has been declining on NFS land. In 1968, 25 percent of NFS land was comprised of early successional forest habitat, whereas only 5.4 percent is covered by early successional forest today. Timber harvest (even-aged management) was last used as a tool to create early successional forest habitat on NFS land in 1994. Reforestation efforts on abandoned and reclaimed mine lands and the lands acquisition program accounts for much of the existing early successional habitat on NFS land. These individual tracts range in size from less than one acre to as much as 400 acres, but average about 16 acres in size. The tracts of early successional forest are randomly scattered across the WNF.

North American Breeding Bird Survey data show that a greater proportion of early successional forest bird species have exhibited a population decline rather than an increase in the Ohio Hills Physiographic Region since 1966, a region aligned with the Southern Unglaciated Allegheny Plateau (Sauer et al., 2003) (Figure 3 - 21). Early successional forest bird species with declining population trends in the Ohio Hills include the golden-winged warbler, northern bobwhite, prairie warbler, field sparrow, yellow-breasted chat, American goldfinch, indigo bunting, brown thrasher, common yellowthroat, eastern towhee, blue-winged warbler, and song sparrow (Sauer et al., 2003). As pointed out in the Partners in Flight Bird Conservation Plan for the Ohio Hills Physiographic Area (Rosenberg and Dettmers, 2004) and the Partners in Flight North American Landbird Conservation Plan (Rich et al., 2004), managing for a diversity of seral stages is necessary to conserve species native to the WNF and the region. Rosenberg and Dettmers (2004) suggested that three percent of the lands in the Ohio Hills Physiographic Region should be comprised of early successional forest habitat to support a full suite of early successional forest species.

The yellow-breasted chat and ruffed grouse, management indicator species associated with early successional forest habitat, were identified as species of conservation concern on the WNF during species viability evaluation (Ewing, 2003d; 2003e). If current management continued (i.e., only uneven-aged management and thinning), early successional habitat would continue to decline until the only early successional habitat available would likely be in utility corridors that are selectively maintained or on newly acquired lands that were recently cutover.



Greater percentages of grassland and shrubland bird species have negative population trends than birds dependent on other habitats.

Figure 3 - 21. Proportion of bird species by habitat group with significant positive or negative trends in the Ohio Hills Physiographic Region 1966-2002 (Sauer et al., 2003).

Affected Environment

Forest stand data show that early successional forest habitat comprises 5.4 percent of the forest cover on the WNF. Early successional habitat less than 10 years of age, which contains a large shrub component, comprises less than 0.5 percent of forest cover on the Wayne. This habitat type occurs in various-sized patches and is randomly scattered across the planning area (WNF Vegetation Database).

The yellow-breasted chat is an open-canopy obligatory species, or in other words, a species that prefers open overstory and brushy understory. It occurs in all counties containing NFS land (Peterjohn an d Rice, 1991). Habitat becomes unsuitable after about 15-19 years (Ewing, 2003d). It has experienced a 3.1 percent declining population trend in the Ohio Hills between 1966 and 2003 (Figure 3 - 22).

A Neotropical migrant, it is considered to be an area-sensitive species that prefers larger early successional patches (i.e., 8-32 acres in size) (Dettmers, 2003; Gram et al., 2003). Studies suggest that area sensitivity could be related to predator avoidance (Woodward et al., 2001), or to loose coloniality behavior (Eckerle and Thompson, 2001). There is evidence that shrubland birds avoid habitat edges and therefore shrubby habitat found in the narrow utility corridors typically found on the WNF are not likely to provide suitable habitat for the chat (Rodewald and Vitz, 2004).

Figure 3 - 22. Yellow-breasted chat population trend for the Ohio Hills Physiographic Region, 1966-2003 (Sauer et al., 2004).

Ruffed grouse need forest less than 20 years old to survive and reproduce. Unlike the yellow-breasted chat, however, it requires contiguous patches of early successional forest habitat mixed with mid- and late-successional forests within its home range (Ewing, 2003e). In the Central Hardwoods, home ranges for grouse may be up to 250 acres (Thompson and Fritzell, 1989). Studies in southern Ohio indicate that early successional forest patches of at least 5-6 acres provide the most benefit to this species (Stoll et al., 1999).

The ruffed grouse has experienced population declines within the Southern Unglaciated Allegheny Plateau since the 1970s after farm abandonment peaked (Ewing, 2003e). These declining ruffed grouse population trends are also similar for its range in Ohio (Figures 3-24 and 3-25). Five long-term ruffed grouse drumming routes within the WNF have been monitored by the Ohio Division of Wildlife since 1971. Ruffed grouse population trends appear to be stable to declining for these WNF routes, and are similar to regional trends for southeast Ohio (Figure 3 - 25 to Figure 3 - 27). The Graysville route has continually seen slightly higher number of drumming males per stop than State or regional averages.

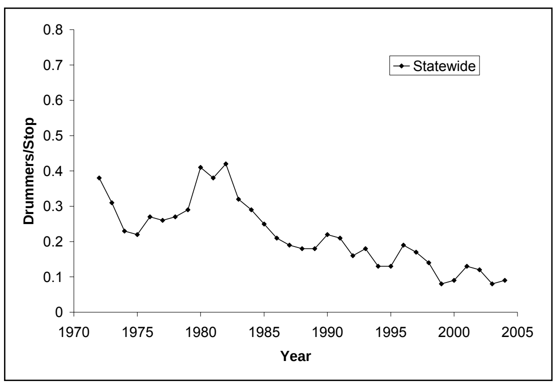


Figure 3 - 23

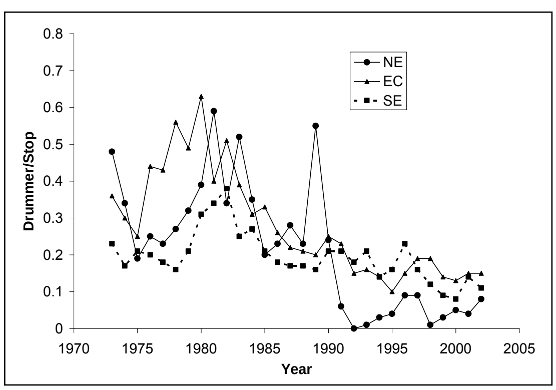


Figure 3 - 24

Figure 3 - **23** and Figure 3 - 24 show ruffed grouse population trends for Ohio (statewide and by region), 1971-2004.

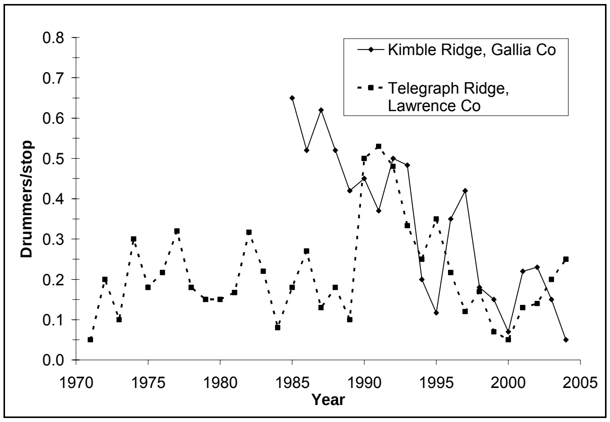


Figure 3 - 25

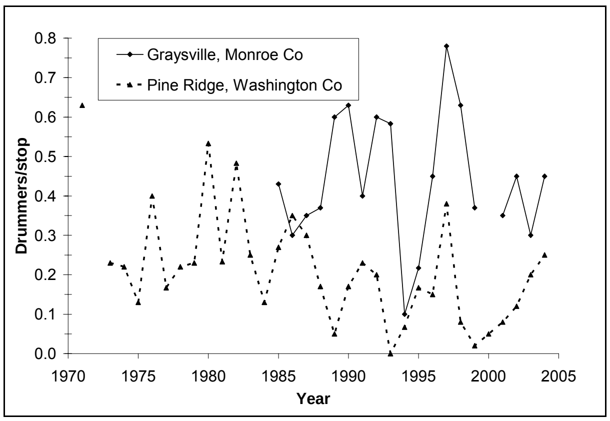


Figure 3 - 26

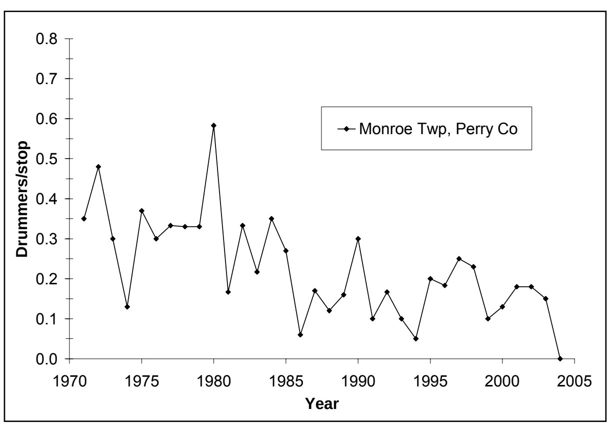


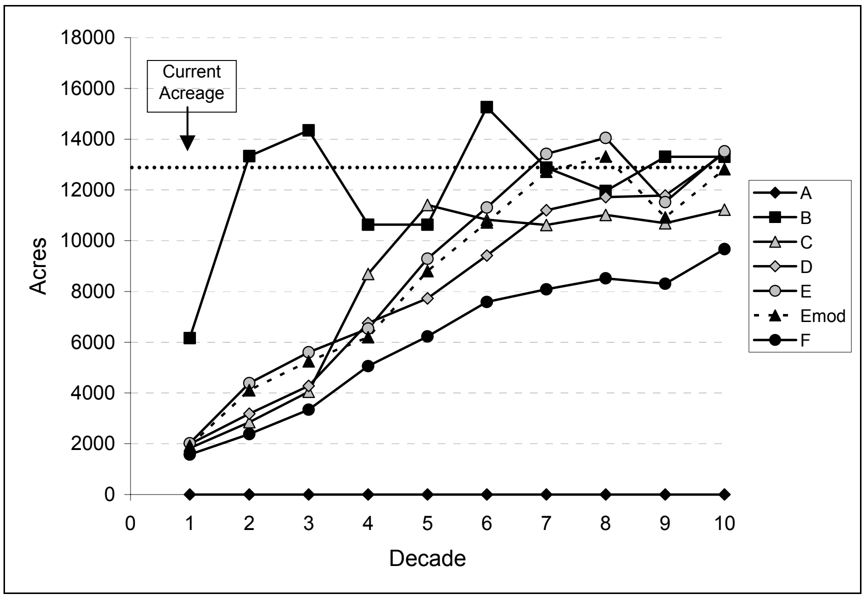
Figure 3 - 27

Figure 3 - 25 to Figure 3 - 27. Ruffed grouse population trends for WNF survey routes, 1971-2004.

Data provided by Ohio Division of Wildlife

Direct and Indirect Effects of the Alternatives

The trend in early successional forest habitat on NFS land in the next 100 years will vary among the alternatives (Figure 3 - 28). Estimated trends for the alternatives are based on Spectrum model outputs (see Appendix B for a description of the model and timber management analyses). The population trends for the yellow-breasted chat and ruffed grouse would be expected to mirror the trend in early successional habitat created in each alternative.



Over the long-term, Alternatives B, D, E, and E Modified would maintain about as much early successional habitat as is currently present on the Forest. Alternatives C and F would provide less early successional habitat, and it would be virtually absent under Alternative A.

Figure 3 - 28. Amount of early successional habitat created each decade through timber harvesting.

Alternative A does not include any prescriptions for even-aged management; therefore a drastic decline in habitat would be expected by the second decade. We cannot assume that private lands that have been cutover will be offered for acquisition in the future, therefore populations of the two management indicator species would be expected to decline for the next 20 years with continued implementation of Alternative A (no action alternative). Some yellow-breasted chats may occur on shrub covered reclaimed mine lands for a time, until they too are reforested. Over time, it is likely that the yellow-breasted chat would disappear from NFS land. The ruffed grouse may utilize mature forest on NFS land for cover and food, but the essential early successional habitat needed for brood rearing would disappear on NFS land over time. Therefore, it is unlikely that viable populations of ruffed grouse could be supported over time on the Wayne with Alternative A.

Alternative B allocates the greatest amount of the WNF to management areas that prescribe even-aged management. The trend for early successional forest habitat would likely be stable with slight decadal increases and decreases from existing levels over a period of 100 years. Population trends for the yellow-breasted chat and ruffed grouse would likely remain stable, but increasing trends could occur on NFS land. Unlike existing conditions where early successional habitat consists of small patches distributed haphazardly across the landscape, patches of early successional forest created under Alternative B would be of appropriate sizes for area-sensitive species such as the yellow-breasted chat. These patches would be distributed across the landscape, but in a manner that could contribute to reduced mortality of ruffed grouse because their habitat needs would be optimized in the FSM and FSMO, and GFM management areas and there would be less need to travel long distances to find suitable habitat. Taxonomic experts indicated that establishment of large, landscape blocks of NFS land, managed on a rotational basis would afford a continual supply of this ephemeral habitat type to plants and animals that use this habitat during some part of their life cycle (Ewing, 2003d; 2003e). This management scheme provides species like the ruffed grouse with the relative ease of travel from one habitat type to forage or escape predation.

Population trends for these two management indicator species will likely decline from present levels in Alternatives C through F during the first decade, but would be expected to stabilize over time as even-aged management harvesting increased (at about decade 3). Even-aged prescriptions call for a 120-year rotation in hardwood stands. Forest stands that are in the 40-79 and 80-99 age classes account for just over 50 percent of the forest stands on the Wayne currently, and would be ready for harvest during decades 3 through 8, thus the increase in early successional forest habitat creation displayed in Figure 3 - 21. After a period of 10 decades, amounts of early successional forest habitat available in Alternatives D or E would likely be similar to that in Alternative B. At the end of 10 decades, there would be less habitat available for the chat and grouse in Alternatives C or F in comparison to Alternatives B, D, E, and E Modified, but more than what would be provided in Alternative A.

Habitat quantity may decline over decades 1 and 2 and then stabilize in Alternatives C through F, but habitat quality would likely be increased in these alternatives as described for Alternative B. Taxonomic experts involved in the species viability evaluation process generally believed that, at a minimum, about 5 percent-10 percent of the Forest should be managed on a 100 to 120 year even-aged management rotation. To ensure that the habitat was optimal and species were well-distributed, the taxonomic experts indicated that at least one large block of contiguous NFS land managed under this rotational scheme should occur on each administrative unit. Alternatives C through F would incorporate this landscape management scheme at varying levels in the FSM and FSMO management areas. They also would integrate even-aged management in the GFM DCF, DCFO, and RC management areas to make certain this habitat type is well-distributed across the planning area.

Habitat Indicator 4: Amount and trends in habitat and populations for the cerulean warbler, worm-eating warbler, and pileated woodpecker

The species viability evaluations demonstrated that mature forest habitat is important to many plant and animal species. However, these evaluations highlighted the fact that one-size does not fit all when it comes to mature forest habitat because species exhibit microhabitat preferences. Federally listed species like the Indiana bat and American burying beetle favor open to semi-open mature forest, whereas species like the umbrella magnolia, rock skullcap and four-toed salamander prefer shaded, closed-canopy conditions. Some mature forest animals that occur on the Wayne are area sensitive, and are referred to as interior forest species. Large tracts of mature forest habitat are needed by interior forest species to reproduce successfully, and these requirements vary by species (Robbins et al., 1989).

The 2004 Partners in Flight NALCP notes that the largest group of birds of Continental Importance inhabits mature deciduous forest, especially those oak-hickory forests in the Eastern Avifaunal Biome (Rich et al., 2004a). The cerulean warbler, worm-eating warbler, Kentucky warbler, hooded warbler and wood thrush are examples of mature forest bird species found on the WNF during the breeding season. Conservation issues for mature forest species in the Eastern Avifaunal Biome include overbrowsing by deer, loss of habitat from urban development, human population growth, mountain top mining and reduction in disturbance-generated mature forest structure (i.e., shrubby understory). The NALCP states that many declining mature forest birds are associated with dense understory conditions.

The cerulean warbler (canopy nester), worm-eating warbler (ground nester) and pileated woodpecker (cavity nester) were selected as management indicator species since they are closely associated with mature forest habitat.

The cerulean warbler is also listed as a Regional Forester sensitive species. It is identified as a Watch List Species in the Partners in Flight NALCP, with a continental population objective of increasing its population by 100 percent (Rich et al., 2004a). The taxonomic experts involved in the species viability evaluation process stated that in their experiences in Ohio, West Virginia, and Pennsylvania, the cerulean warbler is not really a riparian species as it is in other parts of its range but rather a species associated with ridgetops and oak-hickory (Ewing, 2003f). Rosenberg and Dettmers (2004) report that it favors very large oaks, is a canopy nester and needs gaps in the canopy, or in other words a heterogeneous (or uneven-aged) forest with large trees.

The worm-eating warbler is a ground nester which forages in the understory and shrub layers. Moderate to steep slopes are common characteristics of its habitat throughout its breeding range (Ewing, 2003g). In a study conducted on the Wayne, worm-eating warblers were found to primarily use stream bottoms and ravines (Dettmers, 1997). The taxonomic experts involved in the species viability evaluation process stated that a well-developed understory and coarse woody debris on the forest floor (>10 inches dbh) are important components to the species nesting habitat (Ewing, 2003g). It is identified as a Watch List Species in the Partners in Flight NALCP with a continental population objective of maintaining or increasing its population (Rich et al., 2004a).

The pileated woodpecker favors older forests, although it will forage in younger forests. It is a primary cavity excavator, and along with other woodpeckers native to the Wayne, it is responsible for the majority of cavity starts in dead trees. Over time, non-excavating cavity dependant species use abandoned cavities, such as the prothonotary warbler, wood duck, screech owl, and white-breasted nuthatch. It favors extensive mature to overmature forests that possess snags and a relatively open forest floor littered with dying wood (NatureServe, 2004).

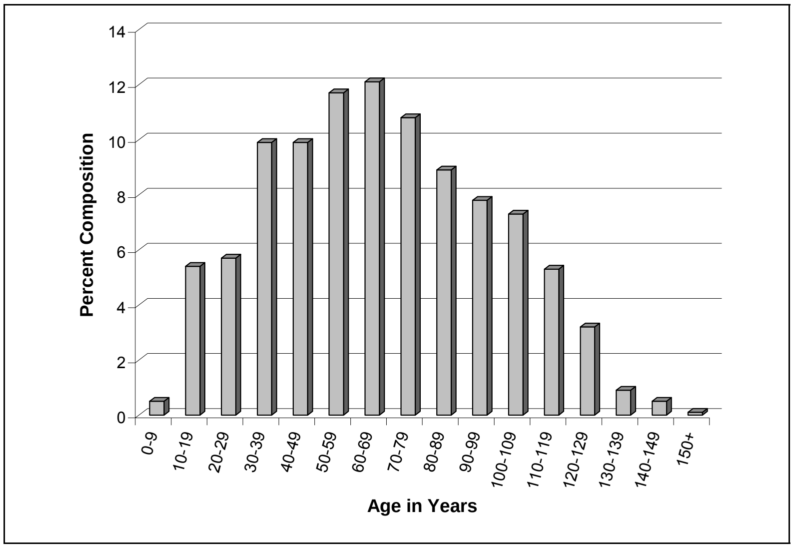
The cerulean warbler, worm-eating warbler, and pileated woodpecker are examples of forest interior species in which the likelihood of their occurrence increases with the size of the mature forest area (Robbins et al., 1989). They are considered area-sensitive species, or species whose occurrence or reproductive success is reduced in smaller habitat patches. Robbins et al. (1989) estimated the minimum area required for breeding for these three species to be: cerulean warbler (1,730 acres); worm-eating warbler (370 acres); and pileated woodpecker (408 acres). However, there are indications that nesting success of the worm-eating warbler (Gale et al., 1997) and other forest interior birds (Rosenberg et al., 1999; 2003) may not be affected in smaller tracts of interior forest when they are located in a predominately forested landscape.

Affected Environment

Ninety-four percent of the WNF is covered by forest. Of those forested lands, 34 percent is 80 years old or older and is considered to be mature forest for this analysis (Figure 3 - 29). The vertical structure of these forest stands is not very diverse, but generally exhibits one tree age class as a result of past management.

Most of the forest stands originated after the iron furnace era (after 1900) or later (i.e., after they were purchased from private landowners). A total of 15.7 percent of the Wayne is comprised of forest stands that have trees within them that are 100 years or older (Figure 3 - 29). When a forest stand is inventoried, a forester ages a statistical sample of trees. A query of the WNF vegetation database showed that there are a few scattered forest stands with trees that originated during the Civil War era and earlier. One small stand has trees in it that originated as early as 1831.

National Forest System lands are not arranged in a solid, contiguous block, but instead are arranged in blocks of different sizes that are scattered across the planning area. Private lands and other ownerships are intermixed among the NFS land. Despite this ownership pattern, there are individual interior forest areas existing on the WNF that would accommodate optimal breeding habitat size requirements by the three mature forest management indicator species. As the literature suggests, smaller forested tracts may provide habitat for these management indicator species since the WNF is within a landscape that is 80 percent forested (Landsat TM, 1994).



Most of the Wayne is forested with trees 40 to 90 years old.

Figure 3 - 29. Age distribution of forest stands on NFS land, 2004.

(Source: WNF Vegetation Database).

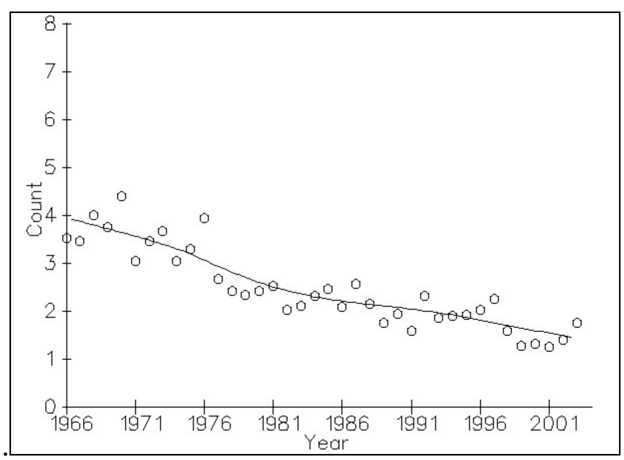
Table 3 - 15 indicates the number of individual interior forest blocks of contiguous NFS land greater than 500 acres in size within the DCF and DCFO areas of Alternative A (no action alternative), where less than 10 percent of the block is managed by someone other than the Forest Service and where NFS land was ≥90 percent forested. Prior to summarizing the data, the edges of each block were buffered by 300 feet to account for possible edge effects from management on non-NFS land. Other large interior forest blocks of NFS land can be found within the FOF, FOFM, HF, HFO, and DR management areas, but were not included in this analysis. The interior forest habitat availability in the DCF and DCFO management areas was displayed because the purpose of these two management areas is to provide mature forest habitat for forest interior species that require canopy disturbance to maintain habitat suitability.

Table 3 - 15. Number of interior blocks in DCF and DCFO.

Interior Forest Block Class (acres)	Number of Blocks
500-1,000	24
1,000-1,500	12
1,500-2,000	7
2,000-2,500	6
2,500+	8

The Wayne is in the core breeding range for both the cerulean warbler and worm-eating warbler. The cerulean warbler was observed along 61 percent of the WNF Breeding Bird Survey routes in 2003 (Ewing 2003c). It has experienced a 2.8 percent declining trend in the Ohio Hills Physiographic Region since 1966 (Sauer et al., 2004) (Figure 3 - 30). The worm-eating warbler was observed along 65 percent of the WNF Breeding Bird Survey routes in 2003 (Ewing, 2003c). It has experienced a plus-2.0 percent trend in the Ohio Hills Physiographic Region since 1966 (Sauer et al., 2004) (Figure 3 - 31). Sample size is too small for these two species to identify a population trend for the three North American Breeding Bird Survey routes found wholly within the WNF.

The pileated woodpecker is a year-round resident and is widespread in distribution on the Wayne. During the Forest's 2003 breeding bird survey, it was observed along 87 percent of the survey routes (Ewing, 2003c). It has experienced a plus-1.7 percent trend in the Ohio Hills Physiographic Region since 1966 (Sauer et al., 2004) (Figure 3 - 32).



The population trend for the cerulean warbler is declining, while trends are increasing for the pileated woodpecker and worm-eating warbler.

Figure 3 - 30. Population trends for the cerulean warbler.

(Sauer et al., 2004)

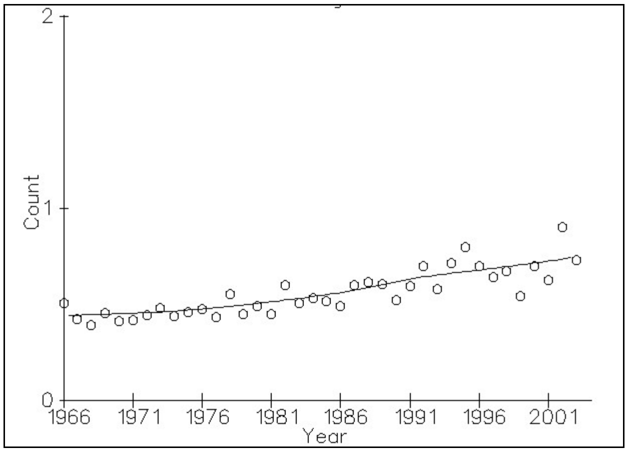


Figure 3 - 31. Population trends for the worm eating warbler.

(Sauer et al., 2004)

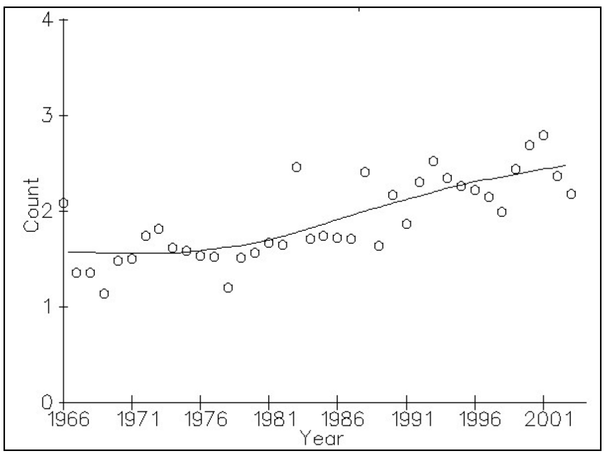


Figure 3 - 32. Population trends for the pileated woodpecker.

(Sauer et al., 2004)

Direct and Indirect Effects of the Alternatives

The Forest Service incorporated four conservation approaches into the alternatives to improve habitat quality for mature forest species like the cerulean warbler, worm-eating warbler, and pileated woodpecker. The following describes how these four conservation approaches are addressed in the alternatives.

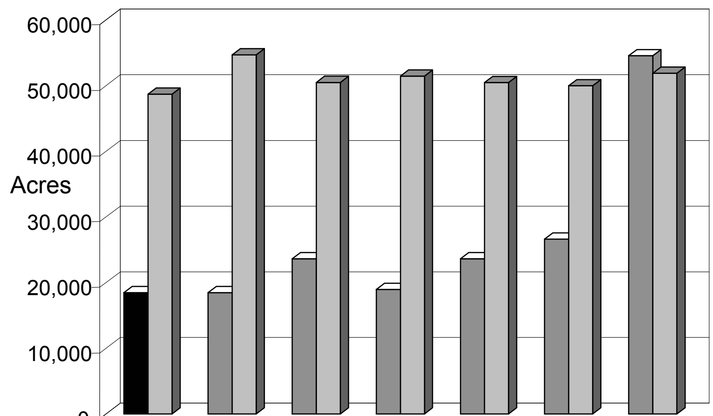
Natural Succession

The FOF and FOFM management areas were developed, in part, for species that depended on larger and older forest communities. These management areas will serve as a long-term control when comparing how forest structure and composition changes in areas with and without active land management practices. Many 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 on bird communities (Rodewald and Abrams, 2002). Natural succession would also be allowed to occur on lands that are defined as unsuitable for vegetation management. As an example, such lands may include land-locked tracts or steep areas, or may occur in management areas that are not suitable for timber production.

For purposes of this 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 pileated woodpecker. 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 finally coarse woody debris on the forest floor. 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.

The alternatives vary in how much acreage would be allotted to natural succession (Figure 3 - 33). Alternative F has the most acreage of forest that would undergo natural succession, followed by (in decreasing order): Alternatives E Modified → C → E → B → D → A. Large-sized tracts of interior forest that would undergo natural succession would occur on each administrative unit.

To give an indication of the trend for older habitat in these forest stands after a period of 100 years, results from a simplified analysis are presented in Figure 3 - 34. The assumptions used for this analysis were (1) existing age distribution of forest stands was uniform across the forest and therefore existing age distributions for the FOF, FOFM and areas unsuitable for vegetation management would mirror the age distributions shown in Figure 3 - 29; and (2) at least some of the trees in the stand today would still be alive in 100 years. Based on this analysis, there could be individual or groups of trees within these forest stands that could range in age from 100 years to more than 250 years of age.



	A	B	C	D	E	E Modified	F
FOF-FOFMA	18,470	18,470	23,649	18,947	23,650	26,632	54,551
Unsuitable for Vegetation Management	48,699	54,699	50,491	51,463	50,471	49,978	51,889

Alternative F would provide the most unmanaged (or natural succession controlled) mature or all-aged forest habitat. Shade-tolerant and fire-intolerant species would increase, while oaks and hickories would decline in these areas.

Figure 3 - 33. Acres of mature forest that would result from natural succession of present day forest stands.

The age class distribution of unmanaged forest areas would be similar under all alternatives, but there is more of this type of habitat in Alternative F.

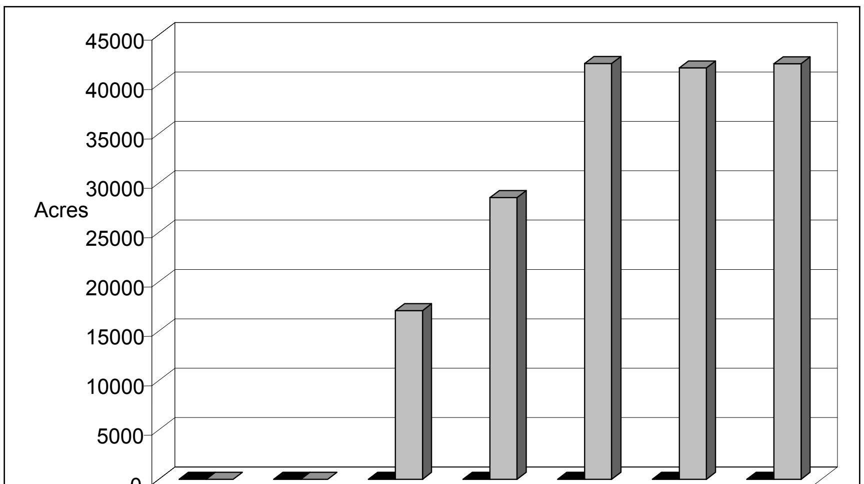
Figure 3 - 34. Age distribution of forest stands (after 100 years) for areas where natural succession is allowed to occur.

Historic Forest Management Prescriptions

The HF and HFO management areas are expected to provide mature forest habitat dominated by oak and hickory species. The open to semi-open character of the forest stands resulting from combinations of thinning, prescribed fire and herbicide application may be optimal for the cerulean warbler and pileated woodpecker. In addition to a high abundance of oak and hickory species, the forest stands will likely develop gaps in the canopy over time, which experts consider important for the cerulean warbler (Ewing, 2003). Each HF or HFO management area represents an extensive tract of interior forest habitat ranging in size from 7,500-17,000 acres in size. Therefore, one block of about 17,000 acres (Alternative C) or two blocks of interior forest totaling about 31,000 acres (Alternatives D through F) would be located on the Ironton Ranger District. Two blocks, totaling about 16,000 acres, would be located on the Athens Unit (Alternatives E, E Modified, and F).

Prescribed fire may negatively affect worm-eating warbler nesting and foraging habitat, and therefore, mature forest derived through Historic Forest management prescriptions may be less optimal for this ground nesting bird. Artman et al. (2001) found that worm-eating warbler population levels did not change in southeastern Ohio study sites after initial, low intensity prescribed fire. However, significant population declines occurred in units that burned hotter and in a more uniform pattern, and in units that were frequently burned. Artman et al. (2001) concluded that worm-eating warbler nest site requirements and habitat preferences appeared to mitigate the effects of initial, low intensity fires, but microclimate changes to the forest floor (i.e., warmer and drier) may reduce suitability for this species. Furthermore, the use of prescribed fire in the HF and HFO management areas is for the purpose of opening the understory so oak can regenerate with less competition from shade intolerant trees. Rodewald and Smith (1998) suggested that removal of the understory structure may affect species like the worm-eating warbler. 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. A quarter to one-third of the Forest landscape is mesic in nature (USDA Forest Service, 1999), therefore some mature forest-dense understory habitat for the worm-eating warbler may be available in portions of the HF and HFO management areas.

At present, there are no forest stands that exhibit the structure and composition desired for the HF and HFO management areas in the future. Alternatives A or B would not allocate any lands to these management areas, so no forest stands would be expected to have mature forest in this condition after 100 years. Over time, it is estimated that Alternative E would provide the greatest amount of mature forest through the HF or HFO prescriptions, followed by (in decreasing order): Alternatives F, E Modified, D, then C (Figure 3 - 35). Estimates for this figure are based on those acres where vegetation management is considered suitable.



	A	B	C	D	E	E Modified	F
Current	0	0	0	0	0	0	0
Decade 10	0	0	17,076	28,534	42,096	41,650	42,080

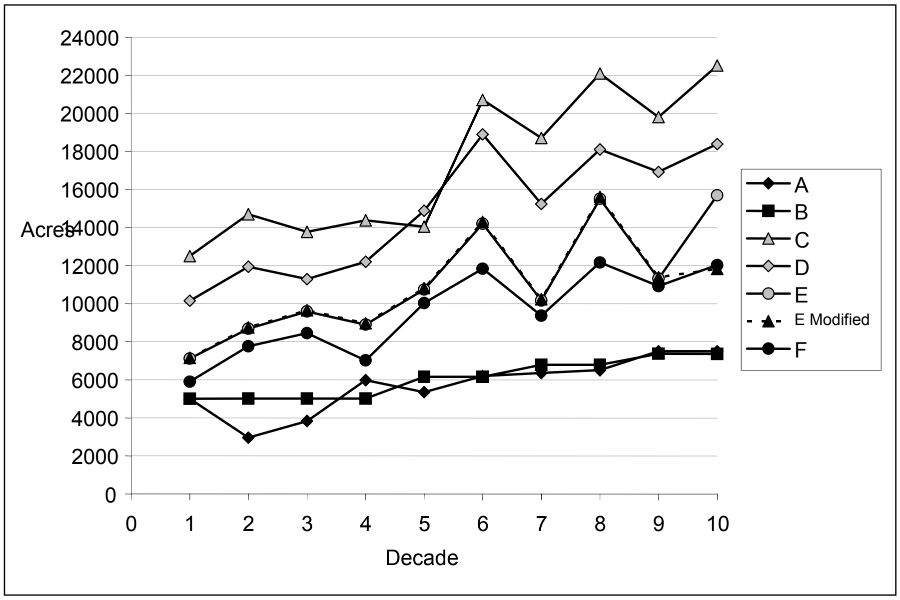
Figure 3 - 35. Acres, by alternative, of potential mature forest resulting from HF and HFO prescriptions.

Uneven-aged Management

Implementation of uneven-aged management methods could provide optimal structural habitat conditions for the cerulean warbler (Ewing, 2003f) and worm-eating warbler (Hengeveld, 1991; TNC, 1998). Each entry opens gaps in the canopy and encourages dense growth in the understory where the gap occurred. 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.

The abundance of oak-hickory in forest communities treated with uneven-aged methods is likely to decline over time, which is not favorable for the cerulean warbler. For this reason, some prescribed fire is likely to be used in stands managed with uneven-aged management methods to aid in oak regeneration at the local scale. Prescribed fire in uneven-aged management areas will generally occur once per decade and only in association with certain timber harvest treatments or projects designed to reduce hazardous fuels, unlike in the HF and HFO management areas where it may occur more frequently. Prescribed fire in uneven-aged management areas is more likely to occur on drier sites where oak is more likely to regenerate, rather than in mesic areas where the success of oak regeneration would be expected to be low. Any prescribed fire that would occur in mesic sites (i.e., worm-eating warbler 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.

Data from the Spectrum model were plotted to show the acres of habitat which could be improved each decade by applying uneven-aged vegetation management techniques (Figure 3 - 36). 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 these species. Averaged across the decades, Alternative C would employ the most uneven-aged management to the landscape (17,324 acres/decade), followed by (in decreasing order): Alternatives D (14,804 acres/decade) → E (11,193 acres/decade) → E Modified (10,872) → F (9,548 acres/decade) → B (6,063 acres/decade) → A (5,717 acres/decade).



Alternatives A and B provide the least improved habitat (open canopy mature or all-aged forest) for the cerulean warbler and worm-eating warbler, while Alternatives F, E, E Modified, D and C provide progressively more improved habitat for these species.

Figure 3 - 36. Acres of cerulean warbler and worm-eating warbler habitat improved each decade, by alternative.

Interior forest habitat managed with uneven-aged management methods would be distributed across the planning area. Table 3 - 16 compares the amount of interior forest blocks of NFS land available in the DCF and DCFO management areas in each alternative. The same methods described under Current Condition were used for this analysis. Smaller tracts of NFS land would be managed primarily with uneven-aged management in the RC management area.

Table 3 - 16. Number of interior blocks in DCF and DCFO by alternative.

Interior Forest Block Class (acres)	A	B	C	D	E	E Modified	F
500-1,000	24	3	15	18	15	15	8
1,000-1,500	12	4	9	7	3	3	5
1,500-2,000	7	1	3	1	1	1	2
2,000-2,500	6	1	4	3	2	2	2
2,500+	8	2	7	4	2	2	3

Even-aged Management Prescriptions

Today's forest communities were primarily derived from forest communities that were harvested primarily with clearcut techniques in the past century. Mature forest communities that originate from clearcut, clearcut with reserves, shelterwood and two-aged timber harvesting techniques can provide habitat for a diversity of species, including mature forest species. Even-aged management also promotes the regeneration of oak and hickory species which is favorable for the cerulean warbler.

In the Missouri Ozarks, there were greater densities of worm-eating warblers in the pole-sawtimber forests that had been managed by clearcutting than in forests with no harvest (Thompson et al., 1992), and Annand and Thompson (1997) observed the worm-eating warbler using mature even-aged stands of at least 50 years of age, as well as 3-to-5-year-old stands regenerated by the shelterwood method. There are indications that they may start using clearcut areas that are as young as 7 years of age where several hardwood trees have been left (Bushman and Therres, 1988 *in* Hanners and Patton 1998). The cerulean warbler uses mature second-growth forest, including that which was once cleared for agriculture (Oliarnyk, 1996, *in* Hamel, 2000). However, stands managed on short rotational regimes do not mature enough to benefit this species. Because of this, even-aged management conducted in any alternative on the WNF would use a longer 120-year rotation regime to provide mature even-aged forest habitat for the cerulean warbler.

Even-aged harvests on the WNF would likely retain several to many trees per acre to provide habitat for species like the Indiana bat, or to improve oak regeneration. Retention of trees could provide habitat components for certain mature forest bird species during the breeding season; however, abundance of brown-headed cowbirds could increase in such stands thereby leading to the potential for reduced nest success (Rodewald and Yahner, 2000). As suggested by research (Rodewald and Yahner, 2000), small-sized even-aged harvests (generally 5 to 30 acres) would be used to provide habitat for early successional forest species and to reduce the likelihood of parasitism effects on mature forest species.

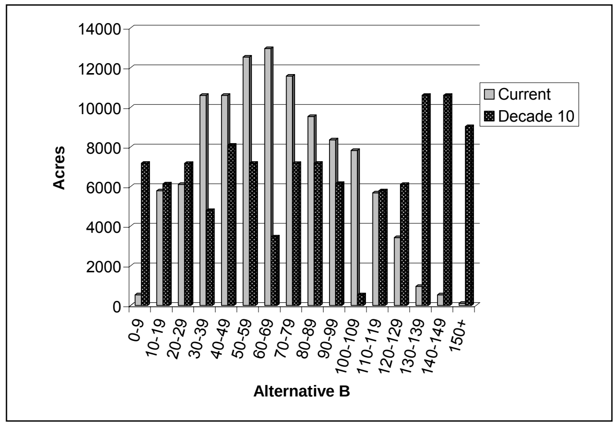
Research in southeast Ohio suggests that mature forest interior species, like the cerulean warbler and worm-eating warbler, move into early successional forest habitats during the post-breeding season until they begin their fall migration (Vitz, 2003). Even-aged management provides shrubby habitat and/or fruit and invertebrate food sources for mature forest interior bird species at a critical time when they may be susceptible to predators and when they may need abundant nutritional resources in preparation for migration. Vitz (2003) found that overall capture rates for mature forest birds during the post-breeding season were higher in early successional forest stands less than 22 acres in size than in those greater than 32 acres. Each of the alternatives incorporates management area guidance to limit even-aged timber harvests to under 20 acres in the DCF and DCFO management areas to provide favorable post-breeding habitat for interior forest species.

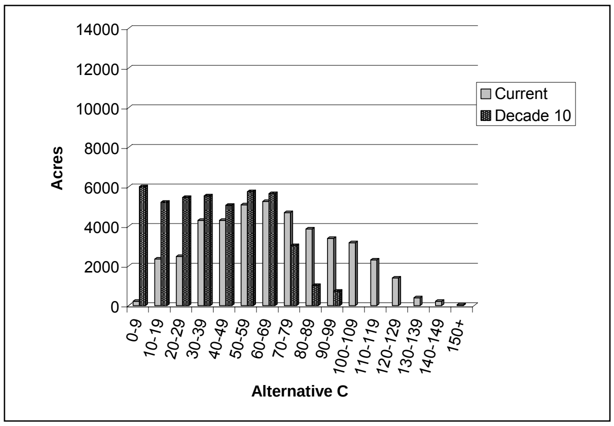
Even-aged management could fragment interior mature forest habitat. The DCF and DCFO management areas were developed to emphasize habitat for interior forest species. Management area guidance is included in each alternative for even-aged harvests to occur on the periphery of the DCF and DCFO management areas or on the periphery of large blocks of interior forest habitat found within these management areas.

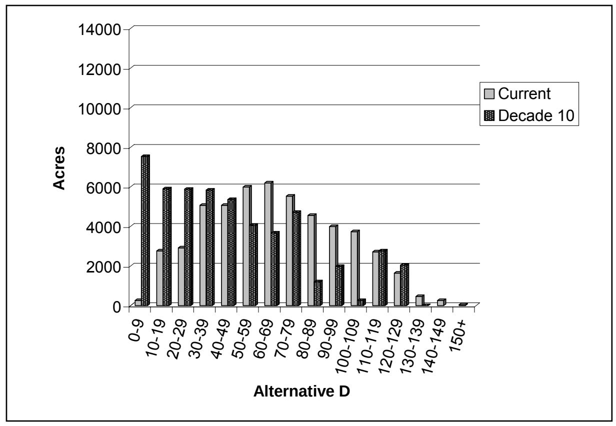
To give an indication of the trend for suitable even-aged mature forest habitat that may be available in 100 years, results from a simplified analysis are presented in Figure 3 - 37. The assumption used for this analysis was that the existing age distribution of forest stands was uniform across the forest and therefore current age distributions for areas managed with even-aged methods would mirror the age distributions shown in Figure 3 - 22. The alternatives vary by how much mature forest habitat would be provided through even-aged management at the end of Decade 10. Alternative B would provide the most acreage (56,012 acres), followed by (in decreasing order): Alternatives E (9,561 acres) → E Modified (8,740 acres) → D (8,246 acres) → F (6,453 acres) → C (1,745 acres) → A (0 acres). Alternative A does not prescribe any even-aged management.

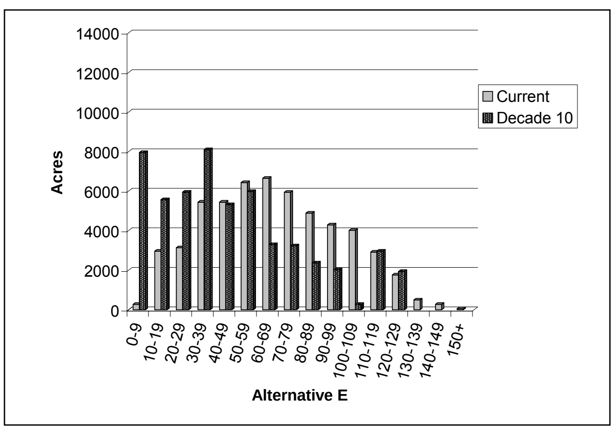
Large, interior forest blocks of NFS land managed with even-aged management methods would be distributed across the planning area, but concentrated in the FSM and FSMO management areas. Unlike the other three conservation approaches, mature forest habitat managed with even-aged methods would be interspersed with younger forest stands, and its spatial location on the ground would change as the rotational management regime is implemented over time.

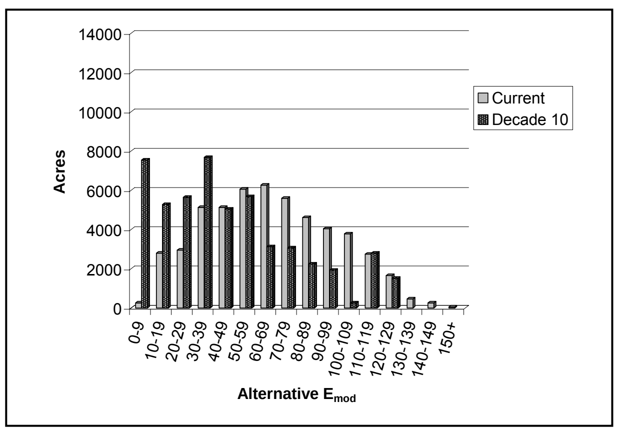
No even-aged management
in Alternative A











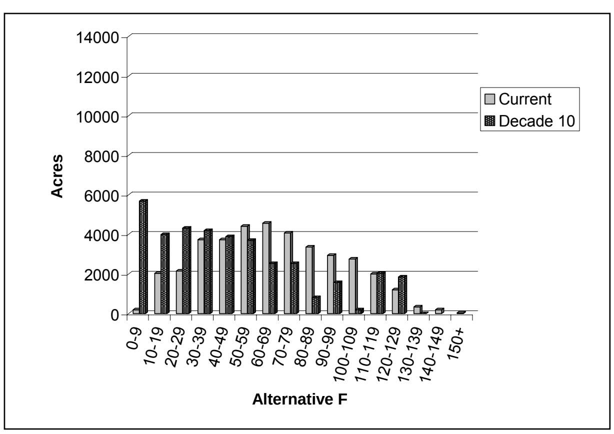


Figure 3 - 37. Trend in mature forest habitat (in 100 years) resulting from even-aged management prescriptions.

Summary of Mature Forest Conservation Approaches

About 34 percent of the Wayne is currently comprised of mature forest habitat (forest stands 80+ years old). Mature forest habitat on the Forest would likely increase after 100 years with implementation of any alternative (Table 3 - 17; Figure 3 - 38).

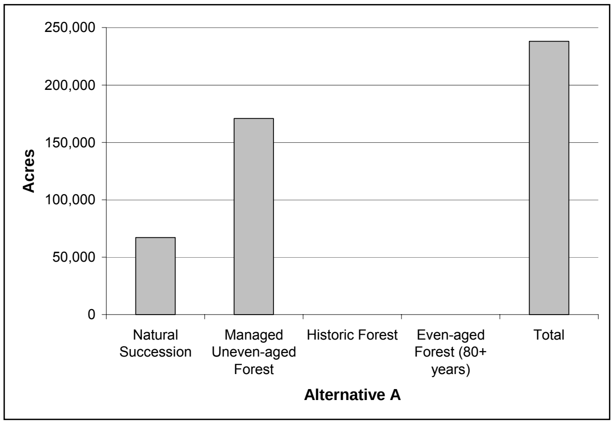
Alternative A would allocate all of the WNF to uneven-aged management and to natural succession prescriptions. Under that alternative, 100 percent of currently forested lands would likely be covered by mature forest at some future point. The majority of forest cover on the Wayne would also be categorized as mature forest habitat under the remaining alternatives (in order of decreasing percent composition): F (86.8%) → C (82.4%) → D (81.9%) → E Modified (81.2%) → E (80.9%) → B (78.5%).

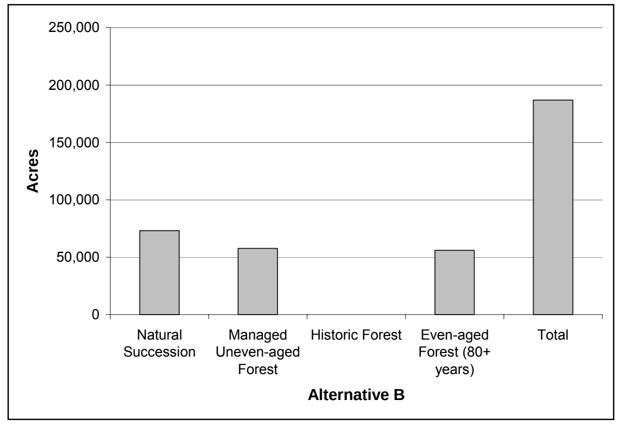
Table 3 - 17. Summary of mature forest habitat trends for each alternative.

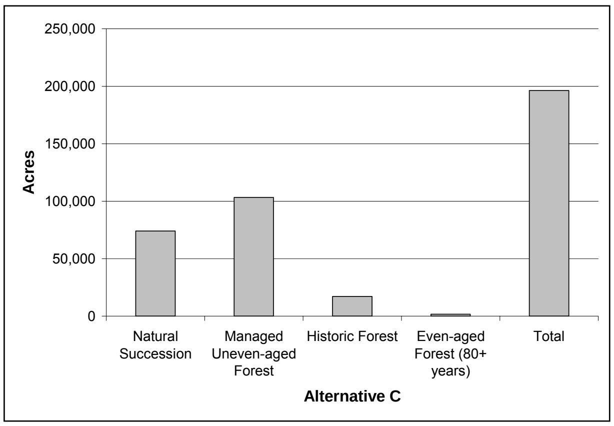
		Estimated Acreage of Mature Forest Habitat Produced after 100 Years of Implementing the Four Mature Forest Conservation Approaches					
Alternative	Current Acreage of Mature Forest Habitat	(a) Natural Succession	(b) Historic Forest	(c) Managed Uneven-aged Management	(d) Even-aged Management (80+ years)	Total*	Change from Current Levels
A	73,388	67,169	0	170,884	0	238,053	+324%
B	73,388	73,169	0	57,715	56,012	186,896	+255%
C	73,388	74,140	17,076	103,344	1,745	196,305	+267%
D	73,388	70,410	28,534	87,920	8,246	195,110	+266%
E	73,388	74,121	42,096	66,867	9,561	192,645	+263%
E Modified	73,388	76,610	41,650	66,358	8,740	193,358	+263%
F	73,388	106,440	42,080	51,803	6,453	206,776	+282%

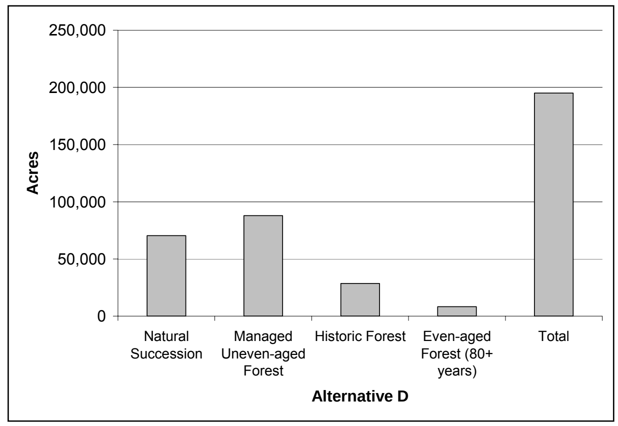
* A small percentage of the WNF (<1%) that is comprised of water or non-forest was not included in estimates of future mature forest habitat for this analysis.

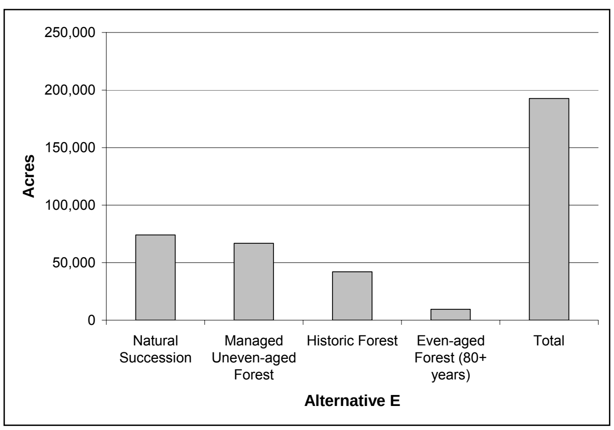
Habitat for interior forest species would increase under all alternatives, as the Wayne's predominately young forest grows older.

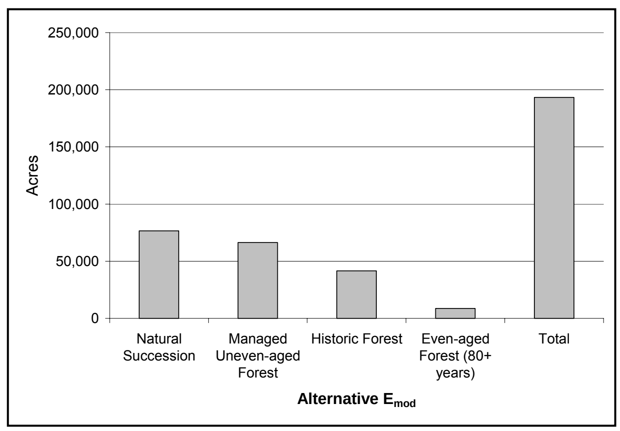












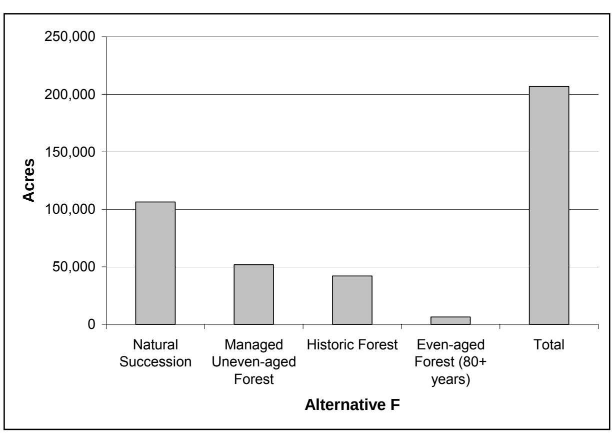


Figure 3 - 38. Estimate of acres, by alternative, of mature forest habitat that could be present on the WNF in 100 years.

As stated previously, one size does not fit all when it comes to mature forest habitat, as evidenced by the diverse habitat structure and composition needs of the three mature forest management indicator species. To determine how each alternative integrated the four mature forest habitat conservation approaches, the alternatives were organized using a simple ranking scheme. For example, even-aged management could provide suitable mature forest habitat after a period of time. A score of 6 was given to the alternative with the highest amount of even-aged mature forest habitat on the landscape after 100 years, a 5 for the alternative with the second highest amount, and so on until the alternative with the least amount received a score of 1. When alternatives had the same score, the rankings would be averaged and an adjusted score would be used.

These scores do not indicate which alternative is best for management indicator species, but is provided only as a means to reflect the diversity of mature forest habitat that could be provided in each alternative. Alternatives with a higher score (C through F) are presumed to have the potential to provide more mature forest habitat diversity than lower scoring alternatives (A or B) (Table 3 - 18).

Table 3 - 18. Index of the integration of the four mature forest conservation approaches into the alternatives.

	A	B	C	D	E	E_{Mod}	F
(a) Natural Succession	1	3	5	2	4	6	7
(b) Historic Forest	1.5	1.5	3	4	6.5	5	6.5
(c) Managed Uneven-aged Forest	7	2	6	5	4	3	1
(d) Even-aged Mature Forest	1	7	2	4	6	5	3
Total Score	10.5	13.5	16	15	20.5	19	17.5

The population trend for the cerulean warbler, worm-eating warbler, and pileated woodpecker is expected to mirror the trend in mature forest habitat quantity and quality. Many factors enter into the equation when it comes to predicting future population trends for species, especially when they include migratory species like the cerulean warbler and worm-eating warbler. The estimates of future population trends take into account only the habitat quantity and quality that could be provided on the WNF over time. However, when considering future population trends for these species, it is important to note that microhabitat preferences may limit their distribution in the planning area to a smaller acreage of mature forest habitat than what is portrayed as potentially being available over time.

Population trends for these three management indicator species would likely remain stable or increase slightly with implementation of Alternative A since there would be a trend for increasing abundance of mature forest. How long-term declines in oak abundance would affect cerulean warbler population trends is unknown.

Population trends for the cerulean warbler could increase under Alternatives C through F because Historic Forest management prescriptions and uneven-aged management could create the forest structure favored by this species. The Historic Forest prescriptions and moderate levels of even-aged management would also increase the likelihood of maintaining oak and hickory communities in the landscape, which this bird is associated with in the Southern Unglaciated Allegheny Plateau.

Population trends for the worm-eating warbler could increase in Alternatives C through F because these alternatives combine the most area that is likely to provide dense understory habitat over the short-term (uneven-aged management) and the long-term (uneven-aged and even-aged management and natural succession). Increases in population trends could be lessened by the fact that these alternatives include Historic Forest management prescriptions that utilize frequent prescribed fire, an activity which may reduce habitat quality for this species. However, some habitat is still expected to be available for this species in the mesic portions of the HF and HFO management areas.

The pileated woodpecker population could increase under Alternatives C through F. These two alternatives combine the most area that would undergo natural succession and fall within the HF and HFO management areas. Both HF and HFO would provide sources of dead wood and could have open, to semi-open, understories.

In 100 years, almost 79 percent of the Forest may be covered by mature forest habitat in Alternative B, but more of the WNF 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 that population trends for these three species could remain stable or decline based upon the potential for periodic habitat fragmentation of extensive interior forest lands on a landscape scale.

Researchers have noted the apparent importance of early successional forest habitat to mature forest interior birds, like the cerulean warbler and worm-eating warbler, during the post-breeding season (Vitz, 2003). However, research is only beginning to try and determine how spatial allocation of even-aged harvest in mature forest habitat affects interior forest species.

Alternatives C through F differ from Alternative B in that even-aged management would be less intense (i.e., amount) and focused in the FSM and FSMO management areas, with scattered harvests occurring in the DCF, DCFO, RC, and GFM management areas. Furthermore, even-aged harvests would be concentrated on the periphery of the DCF and DCFO management areas, or on the periphery of large blocks of interior forest in the DCF and DCFO management areas.

Habitat Indicator 5: Amount and trends in habitat and populations for the Louisiana waterthrush.

Riparian corridors include the riparian area, wetlands, and lands that extend away from the bank or the shore of aquatic ecosystems with direct land-water interaction that may affect ecological structure, function, and composition. They extend in a linear fashion from the tiny, headwater streams to the larger, mainstem tributaries of the Ohio River. Riparian corridors help reduce peak floods, improve water quality, and recharge ground water. They provide key resources that support biological diversity both in riparian areas and the aquatic ecosystem (Vannote et al., 1980; Dolloff, 1994; Crow et al., 2000).

Riparian corridors serve as links between the headwaters and the lowlands for animal and plant dispersal and migration. Plant dispersal occurs when seeds are dropped into the aquatic system and carried downstream and onto floodplains during high flows. Several species of salamanders migrate between stream and terrestrial areas for purpose of breeding. The woodland salamanders will generally disperse into the uplands, but some of the Plethodontids will disperse only a few feet from the stream. Some pond-breeding species can travel quite a distance into the uplands (e.g., up to 0.4 miles) and Gibbons (2003) concluded that adjacent terrestrial areas and corridors are important to species dependent on small, isolated wetlands or ponds.

The diverse vegetation and microclimates found in riparian corridors provide good cover and food for a variety of species. Shading and water temperature are regulated by the amount of forest canopy in the riparian corridor and stream channel size. The fertile soils deposited in the riparian areas after high water events provide high density forage and cover. Many animals depend on riparian or wetland habitat for at least part of their life cycle. On the WNF this would include most frogs, toads, salamanders, and turtles. Others include the northern watersnake, river otter, beaver, muskrat, mink, and birds such as the great blue heron, wood duck, and belted kingfisher. Other animals may not be dependent on riparian areas but use them frequently for hunting or foraging. This would include the opossum, raccoon, deer, garter snakes, ruby-throated hummingbird and wild turkey. Owen et al. (2004) suggested that high levels of bat activity in riparian areas compared to upland areas may relate to increased foraging efficiency in areas where insect abundance is greater.

Allocthanous material, composed of leaves, needles, grasses and woody material, is processed by aquatic invertebrates in the headwater streams. As it is processed by the invertebrates, it is passed downstream for use by other animals. Large woody debris is an integral part of the channel forming process, often helping to form pools in the streams or sometimes helping to create a narrower and deeper channel. Stable woody debris helps to catch and hold organic matter that is utilized by aquatic organisms for food (Allen, 1995). Wood also provides cover and spawning habitat for certain species of fish and aquatic invertebrates. Woody debris makes up the dominant food source for some aquatic flies, beetles, and caddisflies (Merritt and Cummins, 1984).

Riparian corridors have been affected by past land uses: wetlands have been tiled or ditched; riparian forests have been cleared for agricultural production; and streams have been modified through channelization, construction of mills, and by a transportation system that includes roads, railroads, and even barge traffic.

Potential natural vegetative communities on WNF riparian corridors differ slightly across the three administrative units (USDA Forest Service, 1999). On the Marietta Unit, yellow poplar, beech, sycamore, and basswood are likely to dominate the overstory. Honewort, wood nettle, clearweed, and blue phlox would be commonly found in the understory. On the Athens Unit and Ironton Ranger District, riparian corridor vegetation on the south-facing or north-facing sides of the valley will vary. South-facing riparian corridors generally would have an overstory of white oak, yellow poplar, musclewood, yellow poplar and sugar maple with an understory comprised of species like heart-leaved groundseal, upright carrion flower, southern arrowwood, and whorled yam. White oak, green ash, yellow buckeye, beech, basswood, and sycamore are more likely to occur in riparian corridors on north-facing sides of the valley. Understory plants would typically include basil bee balm, Virginia knotweed, black snakeroot, stonecrop, wingstem, and creamy violet.

The Louisiana waterthrush 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. The Louisiana waterthrush is sensitive to declining stream quality and loss of riparian forest, and is listed as a Stewardship Species in the Partners in Flight North American Land Conservation Plan with a continental objective of maintaining its population at its current level (Rich et al., 2004a).

During the breeding season, the Louisiana waterthrush utilizes moist forest, woodland, and ravines along small fast-flowing streams; mature deciduous and mixed floodplain and swamp forests. It prefers a landscape component composed of large blocks of interior forest where herbaceous cover is sparse and shrub cover is moderate to sparse, and where fallen trees with exposed root masses and riparian banks with abundant crevices are present.

Affected Environment

Riparian corridors account for 32,194 acres of the Wayne (NLCD, 1992). NFS lands within riparian corridors are primarily forested (Figure 3 - 39). Other than water or wetlands, there is some agricultural land (i.e., hayfield and grazing permits) and roads found in the riparian corridors.

The Louisiana waterthrush was observed along 35 percent of the WNF Breeding Bird Survey routes in 2003. Of the three North American Breeding Bird Survey routes wholly within the Forest, there were no data for the Louisiana waterthrush for the Wilgus and WNF routes (Sauer et al., 2004). It had been observed along the Dell route, but at such low numbers that a trend estimate could not be made. It has experienced a declining trend (1.5 percent) in the Ohio Hills Physiographic Region since 1966 (Sauer et al., 2004) (Figure 3 - 40). Taxonomic experts involved in the species viability evaluation process considered it to be a stable species on the Wayne (Grove, 2003).

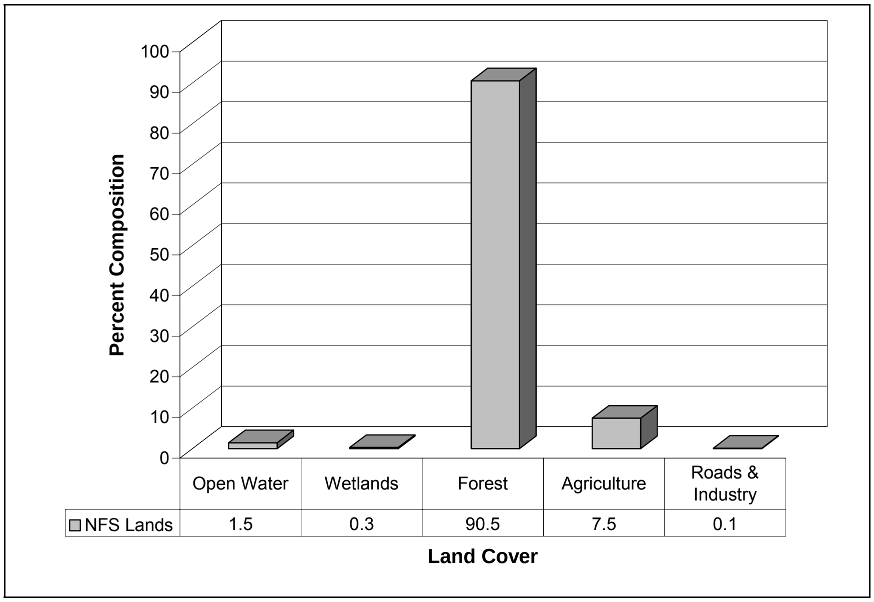


Figure 3 - 39. Composition of riparian corridors on NFS land.

(Source: National Landcover Database, 1992).

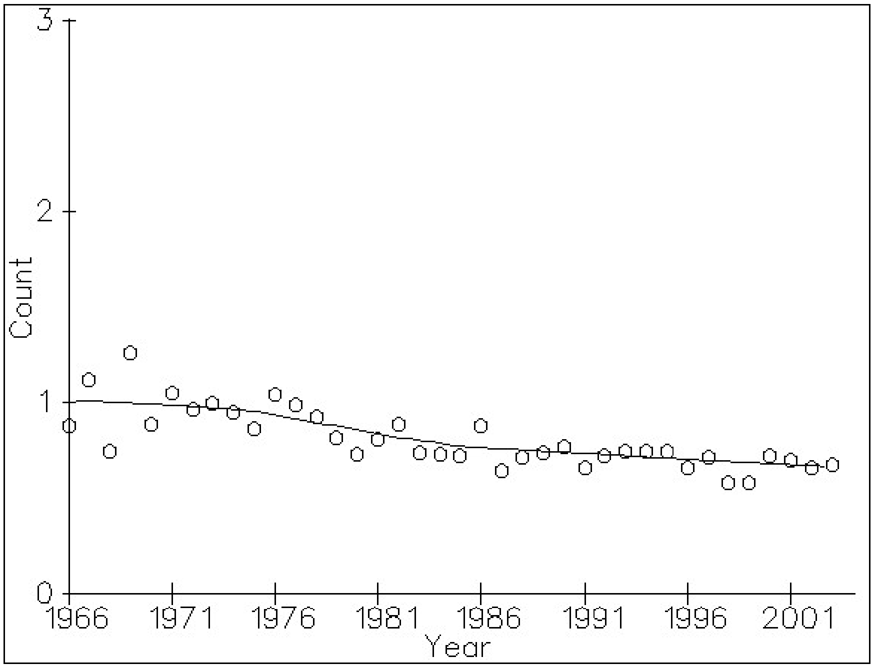


Figure 3 - 40. Population trend for the Louisiana waterthrush in the Ohio Hills Physiographic Region 1966-2003. (Source: Sauer et al., 2004)

General Effects Common to all Alternatives

Each alternative incorporates measures to restore, maintain and improve riparian corridor condition on NFS land.

A Forest-wide goal would directly benefit the Louisiana waterthrush by promoting healthy 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.

Forest-wide objectives would indirectly benefit the Louisiana waterthrush by calling for the improvement of habitat along streams for aquatic and riparian-dependant species and the reduction of sedimentation and improvement of passage for aquatic and semi-aquatic organisms at road and trail crossings. A Forest-wide objective calls for the Forest Service to provide adequate habitat to support viable populations of management indicator species.

Several Forest-wide standards and guidelines would protect Louisiana waterthrush habitat as site-specific projects are implemented. These measures target activities that could occur within the riparian corridor, which includes at a minimum, the riparian area and upland areas within the floodprone area or within 100 feet of the edge of the aquatic ecosystem or wetland (whichever is greater). These measures include guidance for filterstrips, potential earth-disturbing activities that could occur in the riparian area or filterstrip, stream crossings and their design, and removal of materials from streams.

Prescribed fire is projected to be used in all alternatives to regenerate oak-hickory, reduce hazardous fuels, to control non-native invasive species and to improve or maintain herbaceous wildlife habitat. The Louisiana waterthrush is an early ground nester (initiates nesting in March). Prescribed fire that occurs during the spring after March could have an adverse effect on individuals and/or their reproductive success. However, prescribed fire would not be concentrated in riparian corridors, but would occur in various habitats across the planning area annually. All of the alternatives contain measures to minimize adverse impacts to riparian species like the Louisiana waterthrush. For an example, mosaic pattern burning is encouraged during implementation of prescribed burns.

Direct and Indirect Effects of the Alternatives

The alternatives do not vary in the amount of riparian corridor habitat that would be available on the WNF. However, the habitat quality of the riparian corridors would likely vary between the alternatives. The Forest Service incorporated three conservation approaches into the alternatives to improve habitat for riparian-dependent species like the Louisiana waterthrush. The following describes how these three conservation approaches are addressed in the alternatives.

Natural Succession

According to the taxonomic experts that were involved in the species viability evaluation process, the Louisiana waterthrush is a species which responds positively in mature forest areas where little disturbance occurs along headwater streams. Each alternative includes NFS lands which will undergo natural succession. Some of these lands are within FOF and FOFM management areas, but additional areas are in areas defined as unsuitable for vegetation management. There would be no vegetation management in these areas, unless related to energy mineral development in the FOFM management area or in areas that retain a surface occupancy stipulation. These disturbances would be minimal since only 121 acres are projected to be disturbed as a result of oil and gas activities across the entire Forest in the next 10 years, and very little disturbance associated with oil and gas activities would occur in riparian areas. In terms of areas where natural succession would be allowed to occur, there is the potential for Louisiana waterthrush habitat to be most plentiful with the implementation of Alternative F, followed by (in decreasing order) Alternatives E Modified → C → E → B → D→ A.

River Corridor Management Area

This management area emphasizes retaining, restoring, and enhancing the inherent ecological processes and functions associated with specific riverine systems. The boundaries of the management area extend upstream a short distance on mainstem tributaries and often include ravines and small streams that flow directly into the mainstem. Based on the allocation of this management area across the alternatives, Alternatives C through F would likely provide more quality habitat for the Louisiana waterthrush than would Alternatives A and B ().

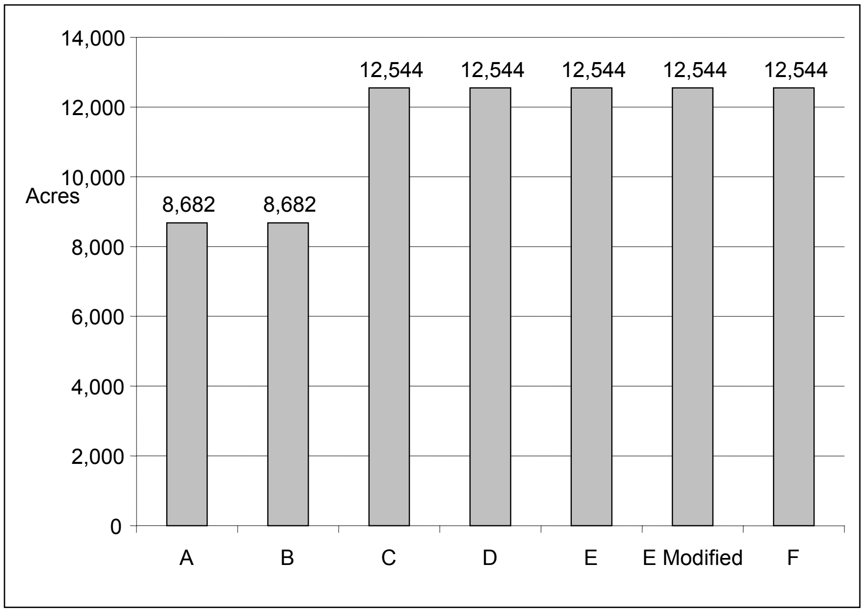


Figure 3 - 41. Allocation of NFS land to the River Corridor Management Area.

Uneven-aged Management along Headwater Streams

The Louisiana waterthrush may be adversely affected by activities that reduce forest canopy cover. Taxonomic experts involved in the species viability evaluation process stated that even-aged management should be avoided in riparian corridors in mature forest management areas since it is a forest interior species that requires closed-canopy conditions (Grove, 2003). The DCF and DCFO management areas were developed to emphasize mature habitat for conservation of forest interior species. Habitat management prescriptions primarily depend upon uneven-aged management methods to improve mature forest habitat for a variety of species, but even-aged management is allowed in up to 25 percent of the management area. The Forest Service developed specific management area guidance which encourages the use of only uneven-aged vegetation management within 100 feet of all headwater streams in the DCF and DCFO management areas, unless it is determined at the site-specific level that Federally listed species or Regional Forester sensitive species require some other form of management to maintain viability. Alternative A allocates the most acreage to DCF and DCFO management areas, followed by (in decreasing order): Alternative C → D → E Modified → E → F → B.

The alternatives were sorted by how well they integrated the three conservation approaches [(a) natural succession, (b) River Corridor Management Area, and (c) uneven-aged management in riparian corridors]. For example, a score of 6 was given to the alternative with the highest amount of River Corridor, a 5 for the alternative with the second highest amount, etc., until the alternative with the least amount of RC received a score of 1. When alternatives had the same amounts of acreage, the rankings would be averaged and an adjusted score would be used. Scores for the three conservation approach categories were totaled. The scores show that Alternatives C through F integrate higher amounts of the combined conservation approaches than do Alternatives A and B (Table 3 - 19).

All alternatives – except B – provide for improved habitat for the Louisiana waterthrush, as the Wayne's currently relatively young forest matures.

Table 3 - 19. Comparison of the integration of conservation approaches for the Louisiana waterthrush into the alternatives.

	A	B	C	D	E	E Modified	F
(a) Natural Succession	1	3	5	2	4	6	7
(b) RC	1.5	1.5	5	5	5	5	5
(c) Uneven-aged Management in Riparian Corridors	7	1	6	5	3	4	2
Total	9.5	5.5	16	12	12	15	14

Because the Louisiana waterthrush is considered to have stable population trends on the Wayne (Grove, 2003), estimates are that stable to increasing populations would be seen over time with the implementation of Alternatives A, C, D, E, or F. Mature riparian forest will be available and distributed across the planning area, based on allocations of the RC, DCF, DCFO, FOF, and FOFM management areas. Furthermore, habitat quality in these mature forest riparian areas will likely be enhanced because Forest-wide direction for riparian corridor management has been improved from that which was found in the 1988 Forest Plan. In addition to providing adequate filterstrip guidance, which was the focus of the 1988 Forest Plan, all alternatives incorporate goals and objectives designed to address the ecological processes that sustain riparian and aquatic plant and animal communities.

A decreasing population trend could occur in Alternative B over time. In 100 years, almost 79 percent of the WNF may be covered by mature forest habitat, but more of the Forest is allocated to even-aged management. Approximately 6,500 acres would be harvested by even-aged methods each decade, and because of the Wayne's topography and large headwater stream network, there is a high likelihood that even-aged management would occur within close proximity to headwater streams. In such instances, individual Louisiana waterthrush may be affected until the forest stands regenerate to mature age classes. This species is highly sensitive to impacts to the riparian area (Grove, 2003).

Habitat Indicator 6: Amount and trends in habitat and populations for the Henslow's sparrow.

Small prairie remnants exist on the WNF, but extensive grasslands did not naturally occur in southeastern Ohio. However, extensive grassland areas have been created within the planning area, and in the Midwest and Appalachian coal mining region by surface mining reclamation since 1977.

Both obligate and facultative grassland bird species have been documented using these reclaimed coal mine areas (McCormac, 2001). Obligate grassland species are those that require habitat almost completely dominated by grasses and notably lacking woody vegetation. Some of these include the northern harrier, savannah sparrow, grasshopper sparrow, and Henslow's sparrow. Facultative grassland species often occur in grasslands and depend on them for habitat, but frequently exploit other habitats such as hayfields dominated by legumes, old successional fields with asters and goldenrods or weedy edges and borders of agricultural lands. Examples of such species include the northern bobwhite, horned lark, field sparrow, blue grosbeak, and eastern meadowlark.

The Henslow's sparrow is a Regional Forester sensitive species that was used to help guide the development of alternatives during the 2006 Forest Plan revision. It is considered an area-sensitive species that successfully nests in larger grassland fields. Preferred field sizes vary across its range (e.g., from 30 acres to greater than 250 acres) (Ewing, 2003b).

The Henslow's sparrow is a species whose distribution has been dictated by human alterations to the landscape (Pruitt, 1996). After European settlement, most prairies suitable for these breeding birds were converted for agricultural use. The species is considered to have adapted to many of these conditions, but more intensive farming with the production of specialized crops has lead to further population declines (INHS, 1983).

Habitat has also been lost to urban development (The Nature Conservancy, 1999). Henslow's sparrow distributions followed the availability of suitable habitat, and therefore, expansions of the historic range occurred as agricultural landscapes replaced forested ones (Pruitt, 1996). As Henslow's sparrow populations began to decline in northern and central Ohio during the 1940s, and disappeared from most of this range by the 1960s, their numbers increased in the unglaciated portion of the state (Swanson, 1996).

Henslow's sparrows have colonized coal mine grasslands in Indiana (Bajema et al., 2001), Ohio (McCormac, 2001), and Pennsylvania (The Nature Conservancy, 1999). Reclaimed coal mines are likely to be productive nesting habitats (not population sinks), perhaps because of low rates of brood parasitism (Bajema et al., 2001), and may therefore be important in conservation of the Henslow's sparrow.

The Forest Service is required to maintain viable populations of native and desired non-native species in the planning area. The Henslow's sparrow represents other obligate and facultative grassland species which have moved into the planning area and are utilizing these extensive reclaimed mine lands.

The 1988 Forest Plan guidance for reclaimed stripmines focused on planting these extensive grassland areas, with designated permanent openings interspersed among the reforested areas. However, not all the tree plantings attempted have been successful. The taxonomic experts involved in the species viability evaluation have found, through their field studies that mining and reclamation processes compact the soil, adversely affect or destroy the aquifer and soil biota, and leave a layer of slag under the topsoil (Ewing, 2003b). We identified the need to change management Forest Plan direction because our reforestation efforts were resulting in the encroachment of woody vegetation, which makes these grassland areas unsuitable for obligate grassland species (Ewing, 2003a).

Affected Environment

There are 6,177 acres of openland habitat dominated by grasses, on NFS land. Of these acres, 1,303 are reclaimed mine lands that remain in an open and primarily grassy condition. The remaining openland includes pastures, hayfields, and utility corridors. Some of these open, grassy areas are extremely small in size (i.e., as small as 0.05 acres), and do not provide habitat for the Henslow's sparrow or other area sensitive species.

There are three general areas with a high abundance of grassland habitat on the WNF: Brady Run area (Ironton Ranger District), Shawnee area and Peabody area (Athens Unit). Of the 1,303 acres of reclaimed mine lands that remain in an open and grassy condition, 973 acres occur in these three areas. The grassland habitat is generally surrounded by a ring of shrubby-herbaceous habitat and then forest.

The Henslow's sparrow was observed along nine percent of the WNF Breeding Bird Survey routes in 2003 (i.e., the Brady Run and Peabody routes) (Ewing, 2003c). Of the three North American Breeding Bird Survey routes wholly within the Forest, there were no data for this species (Sauer et al., 2004). It has experienced a minus-5.1 percent trend in the Ohio Hills Physiographic Region since 1966 (Sauer et al., 2004) (Figure 3 - 42).

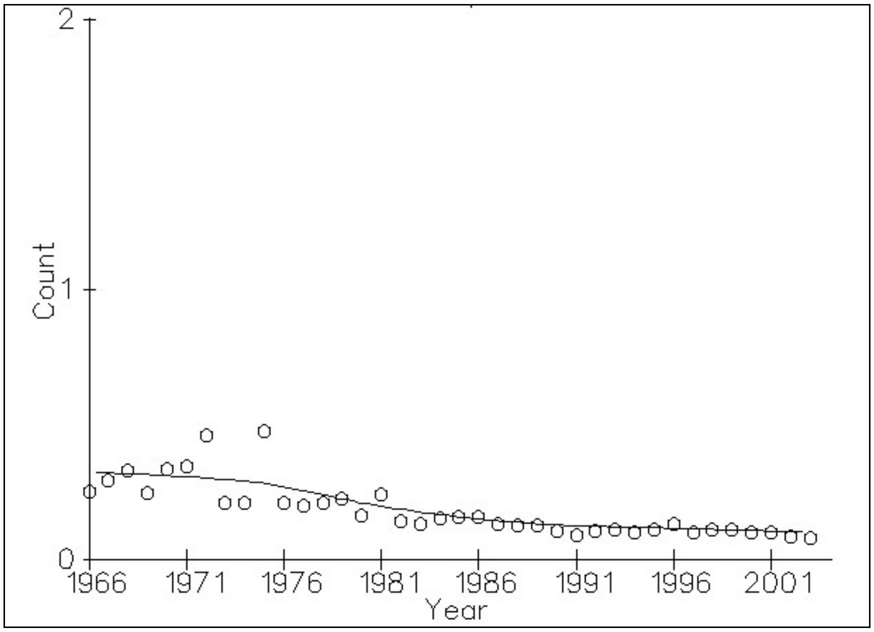


Figure 3 - 42. Population trend for the Henslow's sparrow in the Ohio Hills Physiographic Region 1966-2003 (Sauer et al., 2004)

Direct and Indirect Effects of the Alternatives

The GFM (Grassland-Forest Mosaic) Management Area was developed to accommodate the needs of obligate grassland species using these reclaimed mine lands. Maintaining and improving grassland habitat, as prescribed in the GFM Management Area, would reduce the amount of NFS land that would be forested. Certain plants and animals that are forest-dependant would not find this type of habitat suitable.

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 would be done on a rotational basis to ensure the majority of the grasslands are in a suitable condition for species that use such habitat.

Alternatives C through F would each allocate 5,334 acres of NFS land to the GFM Management Area, while Alternatives A or B would not allocate any NFS land to this management area (Figure 3 - 43). These 5,334 acres includes 973 acres of open, grassy reclaimed mine habitat; the remainder of the management area is in a shrubby or forested condition.

In Alternative A, the 973 acres of open grassy habitat 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% 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.

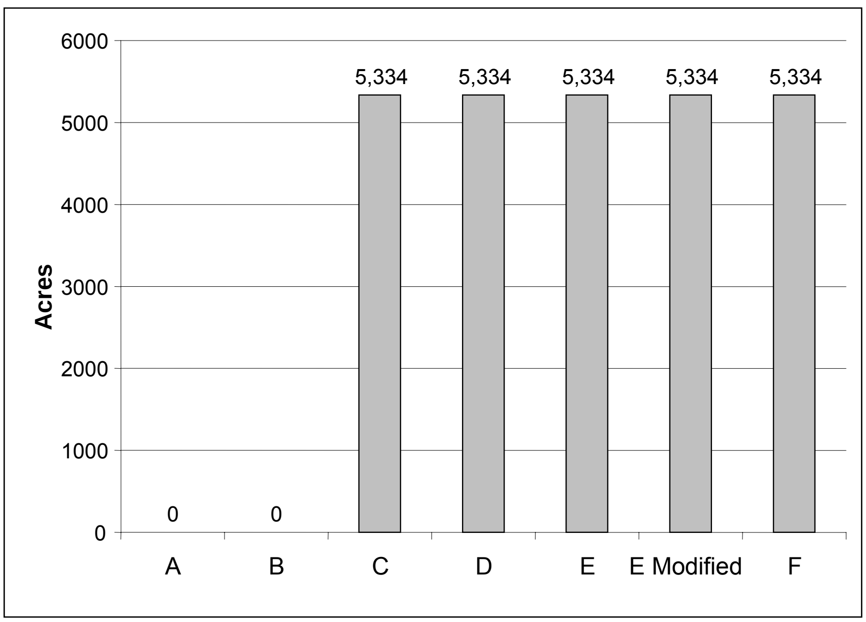


Figure 3 - 43. Allocation of NFS land to the Grassland and Forest Mosaic Management Area.

If population trends for Henslow's sparrow were assumed to be similar to suitable habitat trends, it is likely that the Henslow's sparrow population trends would remain stable or could increase slightly on NFS land in Alternatives C through F. The existing acreage of open, grassy habitat (973 acres) would be maintained or improved for obligate, grassland species. In addition, any open, grassy habitat acquired in future lands acquisition projects within the GFM management area could be managed to provide suitable habitat for Henslow's sparrow and other grassland species. The GFM management area allows up to 40 percent of its land to be retained in a herbaceous condition (i.e., 2,134 acres).

Population trends for the Henslow's sparrow could remain stable or decline on NFS land in Alternatives A and B. As stated above, habitat composition objectives for herbaceous and herbaceous-shrubland habitat in the FSM, DCF, and DCFO management areas accounts for only a small part of the habitat mix. Henslow's sparrow population trends could remain stable if these specific open, grassy lands were identified as priority for maintenance in consideration of all other herbaceous or herbaceous-shrubland acres in these management areas at the project-level. Population trends for the Henslow's sparrow could decline if the need for herbaceous or herbaceous-shrubland habitat in other geographical locations of the management areas was deemed a priority at the project-level.

Summary of Habitat Indicators 1 to 6, 10 and 11

Table 3 - 20 provides an overview of the habitat that could be available in each alternative after 100 years of Forest Plan implementation. A prediction of habitat and population trends is provided. The following are highlights from the analysis of direct and indirect effects of the issue indicators.

- Oak-hickory is expected to decline from present levels in all alternatives. Many species rely on these tree species for food and shelter. Historic Forest management prescriptions and even-aged management will help retain oak-hickory in the landscape.
- Abundance of pine in the landscape was naturally low, but has increased with the planting efforts started by the CCC in the 1930s. Pine is expected to decline in all alternatives, or convert to mixed-pine hardwood stands. Therefore, it is expected that the pine warbler could experience population declines on NFS land.
- The yellow-breasted chat and ruffed grouse are likely to experience drastic population declines after the first decade in Alternative A because it would not create any early successional forest habitat. Alternative C would include what taxonomic experts consider the minimum management prescription and allocation to conserve these species on NFS lands. Alternatives B or D through F would increase the amount of early successional habitat that could be created above the minimum amount in Alternative C.
- Habitat quantity and quality for the cerulean warbler, worm-eating warbler, pileated woodpecker, and Louisiana waterthrush is higher in Alternatives C through F than in Alternatives A or B. Any of the alternatives would result in an increase of mature forest habitat, but

the combination of management prescriptions in Alternatives C through F would provide more diverse mature forest structure and composition.

- Alternatives C through F would allocate grassland habitat to maintain populations of the Henslow's sparrow. Its populations would likely decline or could even disappear from NFS land under Alternatives A of B.

Table 3 - 20. Summary of habitat indicators 1 - 6, 10 and 11.

Issue Indicator	Amount or Trend* Estimate (after 100 years)	A	B	C	D	E	E Modified	F
NFS land allocated to management areas that allow timber harvesting	Amount (acres)	210,939	210,939	205,760	210,462	205,759	202,777	174,858
NFS land allocated to management areas that allow prescribed fire	Amount (acres)	210,939	210,939	205,760	210,462	205,759	202,777	174,858
Oak-hickory Forest	Amount (acres)	18,088	41,082	40,201	49,040	62,118	60,169	57,823
	Trend	↓↓↓	↓↓	↓↓	↓↓	↓	↓	↓
Pine Forest: Pine Warbler	Amount (acres)	**	13,299	11,977	11,805	10,680	10,461	7,876
	Habitat and Population Trends	↓↓↓	↓	↓	↓	↓	↓	↓↓
Early successional forest: Yellow-breasted Chat Ruffed Grouse	Habitat Amount (acres)	0	13,308	11,224	13,434	13,520	12,820	9,664
	Habitat and Population Trends	↓↓↓	− or ↑	↓	− or ↑	− or ↑	− or ↑	↓↓
Mature Forest Habitat: Cerulean Warbler Worm-eating Warbler Pileated Woodpecker	Habitat Amount (acres)	238,053	186,896	196,305	195,110	192,645	193,358	206,776
	Population Trend	− or ↑	− or ↓	− or ↑	− or ↑	− or ↑	− or ↑	− or ↑
Mature Riparian Forest Habitat: Louisiana Waterthrush	Habitat amount (acres)	29,623	29,623	29,623	29,623	29,623	29,623	29,623
	Population Trend	− or ↑	− or ↓	− or ↑	− or ↑	− or ↑	− or ↑	− or ↑
Grassland Habitat: Henslow's Sparrow	Habitat Amount (acres)	973	973	2,134	2,134	2,134	2,134	2,134
	Trend in population	− or↓	− or↓	− or↑	− or↑	− or↑	− or↑	− or↑

* Estimates of population trends for management indicator species are based on habitat trends on the WNF, and do not take into account how environmental conditions or factors related to wintering habitat could affect their population trends.

**No even-aged management prescribed; therefore pine would disappear over time on WNF.

↓ Slight decline from present levels; ↓↓ Moderate decline from present levels; ↓↓↓ Major decline from present levels

− Stable or no change from present levels

↑ Slight increase from present levels; ↑↑ Moderate increase from present levels; ↑↑↑ Major increase from present levels

Cumulative Effects for Habitat Indicators 2 - 6

The previous analysis of direct and indirect effects on each of the management indicator species or habitats could be considered a relatively detailed cumulative effects analysis, however this section will attempt to summarize the effects of the alternatives on these indicators in relation to other past, present, and reasonably foreseeable future actions on all lands in the Southern Unglaciated Allegheny Plateau Ecological Section. This area was chosen as the cumulative effects analysis area because it corresponds to the boundaries of the Partners in Flight Ohio Hills Physiographic Region, an area that is considered one of the highest priorities for conservation attention in the Northeastern Unites States due to its high concentration of high priority and declining species, some of which include the management indicator species (e.g., cerulean warbler, worm-eating warbler, Louisiana waterthrush, Henslow's sparrow). The WNF accounts for about one percent of the lands in this cumulative effects analysis area, but still has the potential to contribute to the conservation of plant and animal species in this physiographic region.

About 54 percent of the area is covered by oak-hickory forests with some northern hardwoods occurring on north-facing hillsides near the edges of the Allegheny Mountains in West Virginia and in the Western Allegheny Plateau in Ohio; 40 percent of the area includes agricultural production or urban development, but most of that is in the northern parts of the cumulative effects analysis area (Rosenberg and Dettmers, 2004). Urban development could increase over time. A policy of fire suppression has been in place in this area since the early to mid-1900s. Forest cover within the cumulative effects analysis area has increased over time, largely due to the abandonment of farms and old fields that have reverted to forest. In Ohio, forest cover (sapling, pole, and sawtimber size classes) has increased by about 41 percent since 1952 (USDA Forest Service, 1991). Increases in forest cover have also been seen in Kentucky (8% since 1952) (University of Kentucky 2003), West Virginia (4% during 1975-1988) (USDA Forest Service 2000) and Pennsylvania (less than 1% since 1978) (USDA Forest Service, 1989).

As described in the cumulative effects analysis for oak-hickory habitat, timber harvesting is expected to occur in the future on private and state-owned lands in Ohio, and will continue to occur on lands in Kentucky, West Virginia, and Pennsylvania. Timber harvesting methods vary on these other lands and are based on the landowner's desired future condition for their land. If current trends continue into the future it is likely that harvests on other lands will occur and some habitat for early successional forest species may be provided, but this habitat will likely occur in a random pattern across the landscape. Maintenance of oak and hickory forest will be subject to the type of timber harvests that occur on other lands. Little prescribed fire is used to treat habitat, with the exception of some minimal fire used to improve habitat for certain plants or animals on lands managed by State or Federal agencies, or by conservation organizations such as The Nature Conservancy.

Alternative A (No Action Alternative)

Pine Habitat

Species that depend on pine habitat (e.g., pine warbler) will likely decline over time on NFS land as pine declines or becomes a minor component in hardwood stands. However, pine planting occurs on private lands and on industrial forest lands and will likely continue to occur on these lands in the future. For example, Escanaba Timber LLC has purchased 130,000 acres of forest land from the MeadWestvaco Corporation in southeast Ohio. It manages its land in a variety of ways to meet different goals, but its main objective is to supply fiber to the NewPage paper mill in Chillicothe in two forms – hardwood pulpwood and softwood pulpwood. To supply the softwood pulpwood, the company has a goal of establishing pine on 30,000 of its 130,000 acres. Most of this pine will be grown on land that was, or is, currently hardwoods, most likely dominated by oak. Prior to its sale, MeadWestvaco distributed free pine seedlings to individuals to plant on their own land; since 1985 MeadWestvaco had distributed an average of 600,000 pine trees per year. Also, MeadWestvaco entered into leasing contracts with private individuals and the company will plant pines on private land; there are approximately 10,000 acres in this program in southeast Ohio. The decline of pine on the WNF is not likely to affect the conservation of the pine warbler in this cumulative effects analysis area.

Early Successional Habitat

The Partners in Flight Conservation Plan for the Ohio Hills estimates that shrub-scrub habitat should comprise about three percent of the cumulative effects area in order to conserve an entire early successional forest suite of species (Rosenberg and Dettmers, 2004). Alternative A would not prescribe any even-aged management and therefore would not contribute to the long-term conservation of species which rely on a continual supply of early successional forest habitat (e.g., ruffed grouse, yellow-breasted chat).

Mature Deciduous Forest Habitat

Almost 5.2 million acres of mature deciduous forest habitat are needed within the Ohio Hills Physiographic Region to support an entire mature forest-species suite (Rosenberg and Dettmers, 2004). In 100 years, the WNF would trend toward all mature forest habitat, possibly with some small isolated pockets of brushy habitat that developed after natural storm events or small group selection harvests. The cumulative effect of Alternative A is that over the long-term the WNF would contribute about 4.5% of the needed mature forest habitat for species which favor relatively closed-canopy forest (e.g. Louisiana waterthrush, pileated woodpecker).

Approximately 192,000 acres are needed to support 32,000 pairs of worm-eating warblers, a species that depends on understory disturbances. Approximately 5,700 acres of uneven-aged management would be implemented each decade in

Alternative A (i.e., 3 percent of the cumulative effects analysis area), a silvicultural treatment which would result in favorable habitat for this species.

Nearly 50 percent of the global cerulean warbler population breeds in the Ohio Hills Physiographic Region. This species favors very large oaks on ridgetops and bottomlands. Oak will likely decline on NFS lands over the long-term (by about 84%), as it probably will on other lands in the Ohio Hills Region. Therefore oak maintenance on NFS land, even at minimal levels under Alternative A, would result in beneficial cumulative effects for this species.

Grassland Habitat

About 74,000 acres are estimated to be needed to conserve a full suite of grassland bird species in the Ohio Hills Physiographic Region (Rosenberg and Dettmers, 2004). Alternative A would not provide for a GFM Management Area, making it is unlikely that existing grassland habitat would be available over time to contribute to the conservation of species that require grassland habitat (e.g., Henslow's sparrow).

Alternative B

Pine Habitat

Alternative B would incorporate the highest amount of even-aged management, likely resulting in more pine communities being maintained than in Alternative A. However, the cumulative contribution to pine habitat management and pine warbler conservation in the cumulative effects analysis area would remain minimal.

Early Successional Habitat

Of all the alternatives, Alternative B would make the largest cumulative contribution to early successional forest species habitat (e.g., ruffed grouse, yellow-breasted chat) in the cumulative effects analysis area. On the average, about 12,000 acres of NFS land would be in an early successional forest age class each decade, or about 2 percent of what is required to support an entire suite of early successional forest species in the cumulative effects analysis area.

Mature Deciduous Forest Habitat

After 100 years, an estimated 78.5 percent of the WNF would likely be covered by mature forest habitat, with the remainder being comprised of early and mid-successional forest communities. Mature forest habitat would occur partially from natural succession (39%) and from active forest management (61%). Mature deciduous forest habitat on the WNF could account for about 3.6 percent of that needed to support an entire mature forest suite of species in the Ohio Hills.

Alternative B would contribute about the same amount of uneven-aged mature forest habitat to conservation efforts for the worm-eating warbler as Alternative A. There is concern about fragmentation and edge effects of urbanization, mountain top mining and increasing abundance of chip mills on interior mature forest habitat in this cumulative effects analysis area (PIF, 2004; Rich et al., 2004). Because of its higher amount of even-aged management, Alternative B could have minimal cumulative habitat fragmentation and edge effects on interior forest species that require large tracts of forest with a relatively closed canopy (e.g., Louisiana waterthrush, worm-eating warbler, cerulean warbler, pileated woodpecker).

The amount of oak-hickory would decline in abundance on NFS lands over the long-term (by about 63%), but not as much as under Alternative A. The cumulative effects to the cerulean warbler and to oak-hickory habitat would be the same as described for Alternative A.

Grassland Habitat

Alternative B would have the same cumulative effects on the Henslow's sparrow as Alternative A.

Alternative C

Pine Habitat

Alternative C would prescribe a minimal amount of even-aged management, therefore pine could be retained to a greater degree than under Alternative A. Still, it will decline from present levels, but the cumulative effects of this on pine warbler conservation would be the same as described in Alternative A.

Early Successional Habitat

An average of 8,300 acres of early successional forest habitat would be available on NFS land each decade for species like the ruffed grouse and yellow-breasted chat. Alternative C would contribute to early successional species conservation in the cumulative effects analysis area by providing about 1.3 percent of the shrub-scrub habitat needed in the Ohio Hills each decade.

Mature Deciduous Forest Habitat

About 82 percent of the WNF would be covered by mature forest habitat in 100 years, with the remainder being covered by early and mid-successional forest communities. Mature forest habitat would occur partially from natural succession (38%) and from active forest management (62%). Mature deciduous forest habitat on the WNF could account for about 3.8 percent of that needed to support an entire mature forest suite of species in the Ohio Hills. Alternative C would provide habitat for species which need relatively closed-canopy forest (e.g. Louisiana waterthrush, pileated woodpecker).

Of all the alternatives, Alternative C would make the largest cumulative contribution to conservation efforts for species like the worm-eating warbler that depends upon uneven-aged forest with dense understory structure. An average of almost 17,300 acres of NFS land would be treated by uneven-aged management methods each decade, or about nine percent of that needed in the Ohio Hills Physiographic Region to support this species.

The amount of oak-hickory would decline in abundance on NFS lands over the long-term (by about 64 percent), but not as much as with Alternative A. Alternative C incorporates the Historic Forest management prescription for the purpose of maintaining oak-hickory for species like the cerulean warbler and ruffed grouse. This management prescription would be focused in one of the eighteen matrix-forming landscapes identified in the Western Allegheny Plateau (a geographical area with similar boundaries as the cumulative effects analysis area) (TNC 2003). Beneficial cumulative effects to cerulean warbler conservation could result from these efforts on NFS land.

Grassland Habitat

This alternative allocates a little over 5,300 acres to the GFM Mosaic Management Area, of which up to 40 percent could be managed for the Henslow's sparrow. This represents a significant contribution to the conservation of the species in the cumulative effects analysis area. Rosenberg and Dettmers (2004) estimated it would need 7,400 acres of grassland habitat to support 2,600 pairs of Henslow's sparrows; the WNF could provide as much as 29 percent of this habitat to the Ohio Hills conservation effort.

Alternative D

Pine Habitat

The cumulative effects on the conservation of the pine warbler and pine habitat would be similar to Alternative C. Alternative D would call for more even-aged management than Alternative C, thereby providing more opportunity to maintain a component of pine in some forest stands.

Early Successional Habitat

An average of 8,500 acres of early successional forest habitat would be available each decade for species like the ruffed grouse and yellow-breasted chat. Alternative C would contribute to early successional species conservation by providing about 1.4 percent of the shrub-scrub habitat needed in the Ohio Hills each decade.

Mature Deciduous Forest Habitat

About 81.9 percent of the WNF would be covered by mature forest habitat in 100 years, with the remainder being covered by early and mid-successional forest communities. Mature forest habitat would occur partially from natural succession (36%) and from active forest management (64%). Mature deciduous forest habitat on the WNF could account for about 3.8 percent of that needed to support an entire mature forest suite of species in the Ohio Hills. Alternative D would provide habitat for species which need relatively closed-canopy forest (e.g. Louisiana waterthrush, woodpecker),

Alternative D would make a cumulative contribution to conservation efforts for the worm-eating warbler. An average of almost 14,800 acres of NFS land would be treated by uneven-aged management methods each decade, about 7.7 percent of that needed in the Ohio Hills Physiographic Region to support this species.

The amount of oak-hickory would decline in abundance on NFS lands (by about 56%), but not as much as in Alternative A. Alternative D incorporates the Historic Forest management prescription for the purpose of maintaining oak-hickory for species like the cerulean warbler. This management prescription would be focused in two of the eighteen matrix-forming landscapes identified in the Western Allegheny Plateau (TNC 2003). Beneficial cumulative effects to cerulean warbler conservation would be greater than in Alternatives A through C.

Grassland Habitat

Cumulative effects on the conservation the Henslow's sparrow would be the same as those described in Alternative C.

Alternative E

Pine Habitat

The cumulative effects on the conservation of the pine warbler and pine habitat would be similar to Alternative C and D. Alternative E uses more even-aged management than Alternative C and D, thereby providing more opportunity to maintain a component of pine in some forest stands.

Early Successional Habitat

An average of 9,200 acres of early successional forest habitat would be available each decade for species like the ruffed grouse and yellow-breasted chat. Alternative C would contribute to early successional species conservation by providing about 1.5 percent of the shrub-scrub habitat needed in the Ohio Hills each decade.

Mature Deciduous Forest Habitat

About 80.9 percent of the WNF would be covered by mature forest habitat in 100 years, with the remainder being covered by early and mid-successional forest communities. Mature forest habitat would occur partially from natural succession (38%) and from active forest management (62%). Mature deciduous forest habitat on the WNF could account for about 3.7 percent of that needed to support an entire mature forest suite of species in the Ohio Hills.

Alternative E would provide habitat for species which need relatively closed-canopy forest (e.g. Louisiana waterthrush, woodpecker), but would make a cumulative contribution to conservation efforts for the worm-eating warbler. An average of almost 11,200 acres of NFS land would be treated by uneven-aged management methods each decade, or about 5.8 percent of that needed in the Ohio Hills Physiographic Region to support this species.

The amount of oak-hickory would decline in abundance on NFS lands (by about 45%), but not as much as in Alternative A. Alternative E incorporates the Historic Forest management prescription for the purpose of maintaining oak-hickory for species like the cerulean warbler. This management prescription would be focused in two of the eighteen matrix-forming landscapes identified in the Western Allegheny (TNC, 2003), and in one other area with a large contiguous block of NFS land. Beneficial cumulative effects to cerulean warbler conservation would be greater than Alternatives A through D.

Grassland Habitat

Cumulative effects on the conservation the Henslow's sparrow would be the same as those described in Alternative C and D.

Alternative E Modified

Pine Habitat

The cumulative effects on the conservation of the pine warbler and pine habitat would be similar to Alternative C, D, or E.

Early Successional Habitat

An average of 8,700 acres of early successional forest habitat would be available each decade for species like the ruffed grouse and yellow-breasted chat. Alternative C would contribute to early successional species conservation by providing about 1.4 percent of the shrub-scrub habitat needed in the Ohio Hills each decade.

Mature Deciduous Forest Habitat

About 81.2 percent of the WNF would be covered by mature forest habitat in 100 years, with the remainder being covered by early and mid-successional forest communities. Mature forest habitat would occur partially from natural succession (40%) and from active forest management (60%). Mature deciduous forest habitat on the WNF could account for about 3.7 percent of that needed to support an entire mature forest suite of species in the Ohio Hills.

Alternative E would provide habitat for species which need relatively closed-canopy forest (e.g. Louisiana waterthrush, woodpecker), but would make a cumulative contribution to conservation efforts for the worm-eating warbler. An average of almost 10,900 acres of NFS land would be treated by uneven-aged management methods each decade, or about 5.7 percent of that needed in the Ohio Hills Physiographic Region to support this species.

The amount of oak-hickory would decline in abundance on NFS lands (about minus-46 percent), but not as much as in Alternative A. Alternative E incorporates the Historic Forest management prescription for the purpose of maintaining oak-hickory for species like the cerulean warbler. This management prescription would be focused in two of the eighteen matrix-forming landscapes identified in the Western Allegheny (TNC, 2003), and in one other area with a large contiguous block of NFS land. Beneficial cumulative effects to cerulean warbler conservation would be greater than Alternatives A through D.

Grassland Habitat

Cumulative effects on the conservation the Henslow's sparrow would be the same as those described in Alternative C, D, and E.

Alternative F

Pine Habitat

Pine is likely to decline in this alternative, but because a minimal amount of even-aged management is prescribed, pine could be retained to a greater degree than in Alternative A. The cumulative effects on the conservation of the pine warbler and pine habitat would be similar to Alternative C through E.

Early Successional Habitat

An average of 6,100 acres of early successional forest habitat would be available each decade for species like the ruffed grouse and yellow-breasted chat. Alternative F would contribute to early successional species conservation by providing about 0.9 percent of the shrub-scrub habitat needed in the Ohio Hills each decade.

Mature Deciduous Forest Habitat

About 86.8 percent of the WNF would be covered by mature forest habitat in 100 years, with the remainder being covered by early and mid-successional forest communities. Mature forest habitat would occur partially from natural succession (51%) and from active forest management (49%). Mature deciduous forest habitat on the WNF could account for about 4.0 percent of that needed to support an entire mature forest suite of species in the Ohio Hills.

Alternative F would provide habitat for species which need relatively closed-canopy forest (e.g. Louisiana waterthrush, pileated woodpecker), but would make a cumulative contribution to conservation efforts for the worm-eating warbler. An average of almost 9,500 acres of NFS land would be treated by uneven-aged management methods each decade or about 5.0 percent of that needed in the Ohio Hills Physiographic Region to support this species.

The amount of oak-hickory would decline in abundance on NFS lands (about minus-48 percent), but not as much as in Alternative A. Alternative F incorporates the Historic Forest management prescription for the purpose of maintaining oak-hickory for species like the cerulean warbler. This management prescription would be focused in the same areas as described in Alternative E. Beneficial cumulative effects to cerulean warbler conservation would be the same as described for Alternative E.

Grassland Habitat

Cumulative effects on the conservation the Henslow's sparrow would be the same as those described in Alternative C, D, E, and E Modified.

Habitat Indicator 7 – Federally Listed and Regional Forester Sensitive Species (T&E and RFSS)

Federally Listed Species

The U.S. Fish and Wildlife Service identified nine Federally listed plant and animal species as occurring within or near the Wayne National Forest (USFWS, 2004). Of these nine, only three are known to occur within the WNF proclamation boundary (Table 3 - 21). The differing effects of the alternatives on these nine species are analyzed in detail in the Biological Assessment (Appendix F). The effects analysis focuses on threats to viability pertinent to the planning area.

Table 3 - 21. Federally listed species occurring within or near the WNF.

Species	Documented on the WNF	Determination of Effect
Northern Monkshood	No	May Affect, Not Likely to Adversely Affect
Running Buffalo Clover	Yes	May Affect, Not Likely to Adversely Affect
Small Whorled Pogonia	No	May Affect, Not Likely to Adversely Affect
Virginia Spiraea	No	May Affect, Not Likely to Adversely Affect
Fanshell	No	May Affect, Not Likely to Adversely Affect
Pink Mucket Pearly Mussel	No	May Affect, Not Likely to Adversely Affect
American Burying Beetle	No	May Affect, Not Likely to Adversely Affect
Bald Eagle	Yes	May Affect, Not Likely to Adversely Affect
Indiana Bat	Yes	May Affect, Likely to Adversely Affect

Federally listed species not present within the Wayne National Forest

A summary of the rationale for the determination of effects for those species which are not present on the Wayne National Forest is provided in this section.

American Burying Beetle (Insect)

The American burying beetle uses carrion, both birds and mammals of 3 to 7 ounces in weight, on which to raise their broods. A pair of beetles will stake a claim to a carcass and defend it against congeneric beetles and other competitors such as flies. After the pair buries the carcass, the female lays eggs in a side chamber near the carcass. The eggs hatch in 6 days; then the larvae requires 12 to 16 days to develop. Both parents initially defend and guard the eggs, but the female usually will remain with and feed the larvae until pupation. The male typically leaves within 10 to 15 days (USFWS, 1991).

A **No Effect** determination is made for the American burying beetle (ABB) for all alternatives because no populations of the beetle have been found on NFS land within the WNF. A reintroduction effort is ongoing at the Ohio Division of Wildlife's Waterloo Wildlife Research Station, located near the Athens Unit. The Forest Service is currently working on a proposal to reintroduce the ABB to NFS land on the Athens Unit in the next 1 to 2 years. If the beetle is reintroduced or discovered on NFS land, consultation would be reinitiated.

A **May Affect, Not Likely to Adversely Affect** determination is made for ABB habitat across all alternatives. The Forest Service is actively contributing to the recovery of the ABB. In addition to proposed reintroduction efforts for the future (Forest-wide Goal 5.1.3), efforts were made to ensure suitable ABB foraging and breeding habitat would be available and well-distributed in all alternatives, both in the short-term and in the future. Timber harvesting and prescribed fire activities integrated into the alternatives may have short-term adverse effects on habitat quality, but over time these activities could improve forest stand conditions, making them more suitable for the American burying beetle.

Roads, trails, and other activities that compact soils would occur on about one percent of NFS land in all alternatives. Conservation measures have been integrated into each alternative to reduce impacts to potentially suitable ABB habitat during implementation of such management (see Forest-wide standards and guidelines TES-21 through TES-26).

Fanshell and Pink Mucket Pearly Mussel (Freshwater Mussels)

A **No Effect** determination is made for the fanshell and pink mucket pearly mussel across all alternatives. These are large river species found in the Ohio River, downstream of the WNF. Their populations are threatened by aquatic habitat degradation and modification. While there is no suitable habitat for the fanshell or pink mucket pearly mussel within the Forest, some of their host fish species occur within watersheds containing NFS land. These host fish would not likely contribute to the colonization of sites within the Forest since habitat is not suitable for these mussels. However, these host fish could play a role in the life cycle of these mussels in the Ohio River.

A **May Affect, Not Likely to Adversely Affect** determination is made for fanshell and pink mucket pearly mussel habitat across all alternatives. Each alternative affords special attention to the restoration and improvement of watershed health and aquatic and riparian habitats (see Forest-wide Goals 2.1 and 3.1, and their associated objectives). In addition, all alternatives incorporate the River Corridor Management Area, a management area which emphasizes retaining, restoring, and enhancing the inherent ecological processes and functions associated with riverine systems. An additional River Corridor management area is allocated along the Ohio River on the Marietta Unit in Alternatives C through F.

Forest-wide standards and guidelines integrated into all alternatives are expected to minimize adverse effects to water quality where take would not be expected to occur (see Forest-wide standards and guidelines in the Watershed Health and Aquatic and Riparian Resources sections). In addition to minimizing or reducing sedimentation and modification of aquatic habitat, protective measures in the Revised Forest Plan would promote management activities that protect or restore structure and function of riparian corridors.

Northern Monkshood, Small Whorled Pogonia, and Virginia Spiraea (Terrestrial Plants)

A **No Effect** determination is made for the northern monkshood, small whorled pogonia and Virginia spiraea across all alternatives. This determination is based on the fact that there are currently no known populations of these plants on NFS land or within the Wayne National Forest proclamation boundary. However, populations of these three species occur in neighboring counties.

A **Not Likely to Adversely Affect** determination is made for northern monkshood, small whorled pogonia and Virginia spiraea habitat across all alternatives. While these species are not known to occur within the planning area, suitable habitat does occur. Each alternative integrates a Forest-wide goal (1.1) to collaborate with conservation partners, such as the U. S. Fish and Wildlife Service, to search for these species and to promote sustainable ecological management practices. Each alternative also includes conservation measures that protect potentially suitable habitat during project-level implementation:

- All alternatives include Forest-wide standards and guidelines to manage non-native invasive plant species and ensure proper pesticide use (WSH-6, WSH-7 and Forest-wide goal 7.2 and its associated objectives, standards and guidelines).
- While ground disturbance could occur during implementation of some management activities, Forest-wide standards and guidelines are incorporated into all alternatives to minimize soil erosion and stabilize disturbed areas (see Goal 2.1, its objectives and standards and guidelines).

  Plant surveys would be conducted on all lands affected by land exchange, ground-disturbing activities, or vegetation removal. Analysis at the project level would identify necessary site-specific mitigation to reduce potentially adverse effects on suitable habitat.

Maintaining potentially suitable habitat on the Forest for these plants is important in the event they naturally disperse from neighboring areas onto NFS land or are reintroduced as part of a recovery project. The Forest Service has ensured potentially suitable habitat is available for the four plants in each alternative.

Northern Monkshood

Northern monkshood is a plant 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. 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 mines on the WNF with a constant flow of cold air or water escaping to the surface, some of which possess potentially suitable habitat near the entrance to the mines. The Forest Service has integrated the FOF and FOFM management areas into each alternative for species such as the northern monkshood which prefer shaded, undisturbed habitat for this species. The allocation of FOF and

FOFM management areas varies between alternatives, with Alternative F have the greatest amount. Recognizing the importance of springs, rock shelters, and rock faces to several animal and plant species, the Forest Service has incorporated Forest-wide direction for protection of these unique habitats during project-level implementation (TES-33 and TES-34).

Small Whorled Pogonia

The small whorled pogonia occurs in a diversity of mixed hardwood or mixed pine-hardwood forests, which tend to be in second- to third-growth successional stages. The plant grows in somewhat young forests as well as in maturing stands that vary in composition. 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 small whorled pogonia sites. Sparse to moderate groundcover is often present, except when in association with ferns. There is also 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. Providing a diversity of habitats and managing occupied sites are the key to conserving this species. Each alternative provides a mix of habitats; however the diversity of habitats that may be provided would be greater in Alternatives C through F.

Virginia Spiraea

Virginia spiraea is 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. Virginia spiraea prefers disturbed or geologically active areas where erosion, deposition, and scouring inhibit competition of other woody plant species. Disturbance, usually by flooding and scouring, is essential to the survival of the plant. Over a third of the plant and animal species on the Wayne that are rare or exhibiting range-wide population declines are riparian-dependant species. Each alternative affords special attention to the restoration and improvement of watershed health and riparian habitats (Forest-wide Goals 2.1 and 3.1 and their associated objectives, standards and guidelines).

Federally listed species that occur within the WNF

A summary of the effects of the alternatives and rationale for the determination of effects for the two species which occur on the WNF is provided in this section.

Running Buffalo Clover

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-stoloniferus *Trifolium* spp. were present that could not be positively identified. Of the 34 individuals, 27 are located on an 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 and a bitternut hickory, provide dappled shading.

There is a second population of running buffalo clover in Lawrence County, but it is outside the proclamation boundary about 8 miles north-northeast of the city of Proctorville, Ohio.

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).

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).

Threats

Habitat loss, alteration and degradation are primary threats to this species. This species appears to have been dependent upon 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.).

Non-native invasive species, including white clover, Japanese stilt grass, garlic mustard, Japanese honeysuckle, amur honeysuckle, wintercreeper, and periwinkle pose risks to this species and its habitat (S. Selbo, pers. comm.).

Direct and Indirect 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.

Conservation approaches or measures to proactively protect and conserve existing running buffalo clover populations and suitable habitat have been incorporated into the alternatives. A Conservation Plan for Federally Listed species was developed and included in the revised Forest Plan. The 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.

Each alternative incorporates a mix of management areas that promote a diversity of habitats, from closed-canopy to brushy young forest. 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. It is often found in areas underlain by limestone or other calcareous bedrock. The plant is not found in mature habitats or in areas of severe disturbance (Cusick, 1989). Uneven-aged management promotes filtered light conditions and is a tool available to manage plant and animal habitat in each alternative. Table 3 - 22 shows that there is a range of acreages that could be managed with uneven-aged timber harvest methods across the alternatives. These acreages were based on desired management area habitat compositions shown in Chapter 3 of the revised Forest Plan.

Table 3 - 22. Acreages or percent of WNF that could be managed to provide filtered or dappled sunlight conditions for the running buffalo clover.

	A	B	C	D	E	E Modified	F
Acreage of WNF available for uneven-aged timber harvesting treatments	136,707	57,716	120,093	108,363	108,636	108,008	93,554
Percent of NFS land	57	24	50	46	46	45	39

Forest-wide direction has been incorporated into the alternatives 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 populations in potentially suitable habitat would be implemented prior to any ground or canopy disturbing activity (TES-31).

Activities which may directly or indirectly affect the running buffalo clover and its habitat would likely be distributed across the landscape and over time, such as road construction or prescribed fire. Second-level project analysis would occur and at that time, any additional protective measures needed to minimize or eliminate adverse effects to discovered populations or habitat would be identified.

Cumulative Effects

Partial or filtered light is important to this species. Researchers believe that the southeast Ohio 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 southeast Ohio 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.

Forest-wide standards and guidelines will protect all known populations, however various management projects are projected to occur on the WNF over the next ten years, including projects that could affect running buffalo clover habitat or undiscovered populations. Cumulatively, the Forest Service could implement about 74,000 acres of projects that could adversely affect the species or its habitat (i.e., prescribed fire, road and trail construction, even-aged management). These disturbances would be distributed across the WNF and over the decade. The actual disturbance would be 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.

Any potential adverse cumulative effects would be minimized through the implementation of Forest-wide standards and guidelines. 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 cumulative effects analysis area.

Effects Determination

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 alternatives could potentially cause adverse impacts to the clover or its habitat, implementing any of the alternatives 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 alternatives to aid in the recovery of this species.

The alternatives incorporate 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 which 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.

Forest-wide direction has been incorporated into the alternatives 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 populations in potentially suitable habitat would be implemented prior to any ground or canopy disturbing activity (TES-31).

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.

Bald Eagle

Bald eagles have been occasionally sighted on or near the Forest, mostly in the winter: along the Ohio River and the Hocking River, around Burr Oak Lake and Lake Vesuvius. During summer months, bald eagles are occasionally sighted along the Ohio River near the Ironton and Marietta units. No nests have been found within the Wayne, and mid-winter bald eagle surveys have failed to identify any winter roost sites on NFS land to date.

Eagles select areas with low human disturbance, suitable forest structure, and abundant prey for nesting sites. They will usually nest near large bodies of water, 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. Most eagles build their nests in supercanopy trees with large diameters and canopies. Suitable nesting 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.

Eagles forage along rivers, streams, lakes, and marshes. Suitable foraging habitat exists along the larger river systems and lakes in the Forest. Wetlands on the Wayne are not managed to maintain populations of fish and, therefore, offer limited foraging opportunities for eagles. 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 may be used by an individual 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. Suitable roosting habitat may be found with the WNF near larger watercourses or waterbodies.

Threats

Habitat degradation resulting from the removal of supercanopy trees along larger streams and lakes has been identified as a threat, as has contamination of aquatic ecosystems from point source and non-point sources of pollution. Human disturbance of occupied sites could be a threat if individuals became established on the WNF in the future.

Direct and Indirect Effects

The River Corridor and Timbre Ridge Lake management areas should provide long-term benefits to the bald eagle as it expands its range in Ohio. The Forest Service developed the River Corridor Management Area to retain, restore, and enhance the inherent ecological processes and functions associated with riverine systems. The desired future condition of the Timbre Ridge Lake 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. Both management areas would provide feeding opportunities as well as suitable roosting or nesting habitat.

All alternatives incorporate the River Corridor Management Area, but more area is allocated to it in Alternatives C through F because an additional corridor was added along the Ohio River along the Marietta Unit. Alternatives C through F also incorporate the Timbre Ridge Lake Management Area, but Alternatives A and B do not. Timbre Ridge Lake would continue to be managed to provide a quality fishery in all of the alternatives, but a primary difference is that potential disturbance of eagles may be less in Alternatives C-F because a No Surface Occupancy stipulation for development of Federal oil and gas leases is placed on the Timbre Ridge Lake Management Area in these alternatives.

Conservation measures are integrated into each alternative to ensure potentially suitable roosting or nesting habitat is protected. If discovered in the future, bald eagle nests, roosts or concentration sites would be protected during site-specific project implementation (TES-16). Similarly, any supercanopy trees that could provide suitable roosting or nesting habitat along large rivers and lakes would be protected (TES-18). If eagles were to occupy sites in the Wayne National Forest in the future, each alternative contains measures to minimize disturbance to individuals during prescribed fire activities (TES-19).

Cumulative Effects

Forest cover has increased across Ohio from about 15 percent in 1940 to almost 30 percent today. Eighty percent of all the lands within the WNF proclamation boundary are forested, as are 70 percent of lands that occur in riparian corridors. The bald eagle has benefited from these reforestation trends because potentially suitable roosting or nesting habitat has increased in abundance. Water quality has also improved. Eagle populations continue to increase in Ohio, and observations of eagles are occurring within counties containing NFS land. In 2004, eagles were observed in Scioto and Gallia counties during mid-winter eagle searches.

Few NFS lands occur along the Ohio River, and development of private land along the Ohio River will likely continue as it is a major transportation route for industry. Inland, within the WNF, riparian corridors on private lands may remain in their existing condition (i.e., forested or under agricultural production) or could be affected by an increasing trend for development of private residences “out in the country”. Impacts from this may be minimal, however, because floodplain development is discouraged by local zoning commissions. Such impacts could be further reduced since any activities that could affect streams or wetlands would be regulated by the Ohio EPA and possibly by the U.S. Army Corps of Engineers.

Any potential adverse cumulative effects that may occur as a result of implementing any of the alternatives would be minimized through the implementation of the Forest-wide standards and guidelines incorporated into each of the alternatives. Furthermore, the Forest Service is taking an active role in bald eagle recovery in each of the alternatives by incorporating objectives for annual mid-winter bald eagle searches, by allocating NFS land to the River Corridor and Timbre Ridge Lake management areas, and by promoting watershed health goals and objectives.

Determination of Effect

A **Not Likely to Adversely Affect** determination is made for the bald eagle across all alternatives. Loss of habitat (i.e., removal of suitable nesting or roosting trees) or disturbance could occur as a result of timber harvesting activities, prescribed fire, development of oil and gas wells, surface mining activities, road construction and maintenance, road reconstruction, trail construction and maintenance, or construction of facilities. However, conservation measures integrated into the alternatives would not only protect occupied roosts or nesting sites if they were discovered (Goal 5.1.2; TES-16, TES-17, TES-19, TES-20, they would ensure potentially suitable habitat would be available on NFS land in the future (TES-18). Each alternative carries with it goals and objectives for promoting watershed restoration, as well as the protection and restoration or riparian and aquatic ecological structure and function (Forest-wide Goal 2.1 and 3.1).

Indiana Bat

The Indiana bat is present year round on the WNF. A large part of the Forest has been surveyed for the presence of the Indiana bat during the summer and fall seasons, and surveys completed to date suggest that two areas on the Wayne are especially important. The southwestern part of the Athens Unit (an area bounded by Haydenville, Dorr Run, Snake Hollow, and Monkey Hollow) and the Bear Run area of the Ironton Ranger District include foraging habitat and either fall swarming sites or a known hibernaculum. Lactating or post-lactating females have been captured in both areas, indicating maternity colonies may be in or near these two areas. Winter surveys have identified one abandoned limestone mine on the Ironton Ranger District as an Indiana bat hibernaculum.

The Indiana bat is a forest-dwelling bat that hibernates in caves and abandoned mines. Females, and sometimes males, travel to summer roosting habitat after emerging from the hibernacula in the spring. Researchers believe females will travel to the same roosting and foraging areas each year, where they will give birth to a single pup. The females and pups form a maternity colony where they roost in snags or living trees with loose or exfoliating bark, cavities, or broken trunks or limbs. Larger diameter trees are preferred by the maternity colony, but smaller diameter trees may be used by individuals or by some males. Sunlight, and the warmth it provides, aids in the development of the young. Some roost trees, therefore, may be found in forest canopy gaps or in the open, but other roost trees may be located in the forest interior. Researchers speculate that interior trees may provide roosting habitat during inclement weather.

The Indiana bat is an insectivore and conducts nightly foraging trips from the daytime roost sites. Using radio telemetry, researchers have tracked individuals and have found that they generally forage within one mile of their roosts, but individuals have been known to travel up to about 2.5 miles to feed. Optimal foraging habitat is generally characterized as semi-open forest, in the uplands or bottomlands, but they will forage around open water and open land.

Threats

Causes of the Indiana bat population decline have yet to be determined. Disturbance of winter habitat and loss of foraging and roosting habitat have been identified as potential threats to this species on the WNF.

Direct and Indirect Effects

Winter Habitat

Human disturbance and modifications of hibernacula has been attributed to the decline of the rangewide Indiana bat population. 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.

To prevent human disturbance of wintering individuals, there is a Forest-wide goal to protect all known Indiana bat hibernacula (5.1.1) and a Forest-wide objective incorporated into each alternative that calls for the installation of bat-friendly gates at mine entrances where this species is known to be hibernating (5.1.1a). In addition to that, conservation measures to reduce disturbance outside known hibernacula are integrated into each alternative. These measures deter human use of areas around known hibernacula by closing or relocating trails that lead to or pass within easy viewing distance of the site, and prohibit new road and trail construction and surface occupancy for exploration or development of Federal minerals within one-quarter mile of known hibernacula (TES-2 and MIN-10).

In order to protect individuals roosting within known hibernacula, all alternatives specify that prescribed fire burn plans specify weather conditions that would prevent smoke dispersal into known hibernacula (TES-4).

Known fall swarming sites associated with underground coal mines 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 all alternatives 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).

Foraging and Roosting Habitat

The Forest Service incorporated four conservation approaches into the alternatives to improve short-term and long-term foraging and roosting habitat for the Indiana bat. These four approaches (described below) would result in the development or maintenance of mature hardwood forest communities with diverse forest structure and composition. Potentially suitable habitat would be widely distributed across the planning area. Over the long-term (decade 10), mature hardwood forest habitat would likely dominate the landscape of the Forest with implementation of any alternative (Table 3 - 23).

Table 3 - 23. Summary of mature hardwood 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 Forest Habitat	(a) Natural Succession	(b) Historic Forest	(c) Managed Uneven-aged Management	(d) Even-aged Management (80+ years)	Total*	Change from Current Levels
A	73,388	67,169	0	170,884	0	238,053	+324%
B	73,388	73,169	0	57,715	56,012	186,896	+255%
C	73,388	74,140	17,076	103,344	1,745	196,305	+267%
D	73,388	70,410	28,534	87,920	8,246	195,110	+266%
E	73,388	74,121	42,096	66,867	9,561	192,645	+263%
E Modifed	73,388	76,610	41,650	66,358	8,740	193,358	+263%
F	73,388	106,440	42,080	51,803	6,453	206,776	+282%

* A small percentage of the WNF (<1%) that is comprised of water or non-forest was not included in estimates of future mature forest habitat for this analysis.

Natural succession would 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 (e.g., FOF, FOFM). These forest stands would likely have older forest characteristics within 100 years. They may possess trees of great age (typically 150-200 years old), 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). In the long-term, the abundance of oak-hickory in forest communities treated with uneven-aged methods is likely to decline, an unfavorable development for the Indiana bat. Many species of oak and hickory possess exfoliating bark, a structural characteristic that makes trees suitable for Indiana bat roosting. Areas that that undergo natural succession would occur in all alternatives.

Uneven-aged timber harvesting opens gaps in the canopy, which may directly benefit the Indiana bat. This harvesting method 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 shaded locations (Schultes, 2002). Opening the canopy via uneven-aged harvest methods could also improve Indiana bat foraging habitat. It forages among the tree canopy, but foraging habitat declines as canopy cover approaches 100 percent. Canopy cover of 50 to 70 percent is considered optimal for bat foraging (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 may not favorable for the Indiana bat. Uneven-aged timber harvesting would occur in each alternative, but in varying amounts.

The Historic Forest management prescriptions call primarily for the use of uneven-aged vegetation management combined with prescribed fire to create forest communities with more open understory and which are dominated by oak and hickory species. This forest structure would be similar to that which occurred in southeast Ohio in the late-1700s and early-1800s (Hutchinson et al., 2003). In addition to a high abundance of oak and hickory species, trees would likely be widely spaced with relatively open understory. Historic Forest prescriptions occur only in Alternatives C through F.

Even-aged management removes a major part of the canopy, allowing sunlight to reach the forest floor and encourage sprouting and growth of oak-hickory. Optimal foraging habitat may be reduced in the short-term, but as the regenerated stand matures, it would again be capable of providing potentially suitable roosting and foraging habitat. Today's forest communities were primarily derived from forest stands that were harvested with clearcut or shelterwood harvests in the past century. 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 with long-term benefits to this species.

The vegetation management and prescribed fire projected to occur during the first decade would contribute to the long-term goal of retaining or developing Indiana bat roosting and foraging habitat (Forest-wide Goal 5.1.1). However, implementing such activities may alter roosting or foraging habitat for a short time. Other activities, not associated with Indiana bat conservation, may also occur during the first decade and could temporarily alter potentially suitable Indiana bat habitat for a period of time (Table 3 - 24). The acreages that may be affected vary somewhat for each alternative and may seem substantial, but the following must be considered:

- Established Forest-wide standards would be in place in each alternative to minimize the potential for removal of any currently suitable roost tree (TES-10). Measures are also in place to ensure trees are available to recruit into roost trees out into the future (TES-12 and TES-13). In addition, shagbark and shellbark hickories are retained, unless removal is needed to ensure long-term resource protection important to the Indiana bat (TES-9).
- Uneven-aged timber harvest, thinning, crop tree release, and prescribed fire are designed to improve short-term and long-term foraging habitat for the Indiana bat. These activities account for the majority of the activities that could potentially alter suitable Indiana bat habitat. 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 nor would they be conducted in a short amount of time.

- Care would be taken to avoid impacts to young Indiana bats from prescribed fire activities while they are unable to fly (TES-11).
- 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 time (i.e., not permanently), plays a role in regenerating oak species and their retention in the landscape over the longer term. The amount of even-aged management would vary across the alternatives from none (Alternative A) to about 6,000 acres planned in Alternative B during the first decade, or about 2.5 percent of NFS land. Even-aged management is focused within the FSM, FSMO, and GFM management areas, but can occur in small amounts in other management areas.
- Approximately 316 acres (Alternative A) to 893 acres (Alternative C) would 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 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 the alternatives.
- 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). Based on studies in the various parts of the Indiana bat's range, these sites may provide foraging opportunities for the bat.
- Utility corridors are narrow and linear. Those located in road rights-of-way would not change the habitat condition existing along a road. Corridors that occur through forest areas remain in some vegetated condition, thereby offering a potential foraging site.
- Closure of open mine portals and subsidence features for the purpose of protecting public safety or to eliminate sources of acid mine drainage would occur only after biologists have reviewed the sites for potentially

suitable habitat characteristics, and then conducted fall-swarming surveys (TES-5).

- Individual trees with Indiana bat roosting characteristics may need to be felled during implementation of site-specific projects to protect human safety. Management of hazard trees is usually accomplished during the hibernation season. A short-term increase in the amount of hazard trees that need to be removed is expected to increase for the next 2 to 4 years as a result of the 2003 ice storm. About 71,000 acres on the Ironton Ranger District were affected, and trees damaged by the storm continue to die and pose threats to human safety. During implementation of projected management activities in each alternative, many of which would be of long-term benefit to the Indiana bat and its habitat, some hickory trees may need to be removed to enable a project to proceed without causing adverse effects to other resources important to the Indiana bat and its habitat. When possible, removal of such trees would be done during the hibernation season.

Table 3 - 24. Projected management activities that could result in the alteration of potentially suitable Indiana bat habitat.

	A	B	C	D	E	E Modified	F
Timber Harvest	5,000	11,160	18,890	18,680	18,150	17,941	16,040
Crop Tree Release	1,150	3,250	3,239	2,786	2,142	2,113	1,719
Prescribed Fire	69,819	69,819	69,819	69,819	69,819	69,819	69,819
Temporary Roads, Skid Trails and Log Landings	316	571	893	885	863	886	774
Hazardous Fuels Reduction – Mechanical Methods	10,181	10,181	10,181	10,181	10,181	10,181	10,181
Development of Permanent Openings	500	500	500	500	500	500	500
Utility Corridor Development	50	50	50	50	50	50	50
Closure of mine features	232	232	232	232	232	232	232
AMD Treatments	270	270	270	270	270	270	270
Total (Acres)	**87,518**	**96,033**	**104,074**	**103,403**	**102,207**	**101,992**	**99,585**
Percent NFS land Affected	**36.7**	**40.3**	**43.7**	**43.4**	**42.9**	**42.8**	**41.8**
Percent Cumulative Effects Analysis Area Affected	**7.9**	**8.7**	**9.4**	**9.3**	**9.2**	**9.2**	**9.0**
Hazard Tree Removal	2,550	2,550	2,550	2,550	2,550	2,550	2,550
Hickory Tree Removal	320	692	1,160	1,148	1,115	1,142	987

To accomplish vegetation management and prescribed fire activities, access to sites must be provided. One or more entries may be made in each forest stand over a certain period (e.g., 100 years) depending upon the management prescription. Initially, permanent roads would need to be constructed to some areas, but road reconstruction would most likely occur to a larger degree in the short-term and long-term. Over time, the road footprint would remain unchanged because existing roads would be reconstructed when access to an area is needed.

Roads reduce forest cover and are, therefore, an activity that may permanently affect suitable Indiana bat habitat. Other activities, not associated with Indiana bat conservation, may also occur during the first decade and could permanently affect forest cover (Table 3 - 25). Less than one percent of potentially suitable Indiana bat habitat on the WNF could be permanently affected in any of the alternatives during the first decade. Any permanent loss of habitat is of concern, but the following must be considered:

- Established Forest-wide standards are in place in each alternative 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. Suitable roost trees are avoided when possible.
- Approximately 500 acres (Alternative A) to 693 acres (Alternative D) 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. Past mist net surveys on the Wayne National Forest 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.
- 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 percent canopy, so it is possible they could use such areas for foraging.
- Projected surface mining activities hold the greatest potential for habitat loss during the first decade. From 61 to 65 percent of the habitat acreage that could be lost permanently could be affected by surface mining. The potential for the 1,200 acre surface mine at the Ironton Ranger District is uncertain.
- Development of oil and gas wells converts forest land into non-forest land, marking the landscape in a fashion similar to roads and trails. Access roads could serve as travel corridors, and the small canopy gaps created by well pads could alter forest canopy conditions to a range more suitable for Indiana bat foraging. No surface occupancy stipulations for Federal

minerals occur within ¼-mile of all known hibernacula. In addition, timing-controlled surface occupancy stipulations are placed on Federal mineral leases to reduce impacts to potentially suitable roost trees during the non-hibernation season.

Table 3 - 25. Projected management activities that could result in the permanent loss or alteration of potentially suitable Indiana bat habitat.

	A	B	C	D	E	E Modified	F
Permanent Road Construct. and Reconstruct. (acres)	197	291	394	391	385	392	355
Recreation Trails (acres)	303.5	303.5	265	302	265	265	225
Recreation Facility & Parking Lot Construct. (acres)	60	60	60	60	60	60	60
Surface Mining (acres)	1,250	1,250	1,250	1,250	1,250	1,250	1,250
Oil & Gas Well Development (acres)	121	121	121	121	121	121	121
Total (acres)	**1,931.5**	**2,025.5**	**2,090**	**2,124**	**2,081**	**2,088**	**2,011**
Percent of NFS land	**0.81**	**0.85**	**0.88**	**0.89**	**0.87**	**0.87**	**0.84**
Percent of Cumulative Effects Analysis Area	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**

Cumulative Effects

Winter Habitat

No adverse cumulative effects are expected to occur to Indiana bat winter habitat within the WNF proclamation boundary as a result of implementing any of the alternatives. The majority of open underground mines are located on NFS land, and protective measures are in place to prevent disturbance of known hibernacula and fall swarming sites.

Roosting and Foraging Habitat (Alteration of Habitat)

Potential adverse cumulative effects to roosting and foraging habitat in Alternative A resulting from temporary alteration of habitat are expected to be short-term in nature and would be mitigated through protective Forest-wide standards and guidelines incorporated into each alternative. Forest cover has increased within the WNF proclamation boundary since the 1940s, but it has a different structure and composition than what occurred prior to 1800 and the coming of European settlers. 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 pre-1800 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 the forest understory and midstory (Abrams, 1992; Abrams, 1998). However, no available scientific information can ascertain whether the increasing density of forest communities is a contributing factor to the Indiana bat's decline.

Timber harvesting and prescribed fire would be used under Alternative A to provide short-term and long-term Indiana bat habitat improvements to some of these forest communities.

In Alternative A, the no-action alternative, foraging and/or roosting habitat could be temporarily altered on 87,248 acres of NFS land, or on about 8 percent of the cumulative effects analysis area (Table 3 - 24). Some suitable Indiana bat habitat could be altered on other ownerships in the planning area, primarily through timber harvesting since little to no prescribed fire occurs on private lands. Construction of utility corridors and temporary roads may occur to some degree on other ownerships, but are not likely to increase over current levels. Timber harvesting projects that occur on other ownerships generally involve small-sized harvests. Approximately 98 percent of the acres of potentially suitable habitat that could be altered on NFS land accounts for management activities designed to provide long-term benefits to this species. These activities would open dense understories and could reduce canopy cover to levels thought to be more optimal for Indiana bat foraging.

Cumulative effects of Alternatives B through F on foraging and roosting habitat resulting from alteration of habitat are expected to be similar to those described for Alternative A (Table 3 - 24). The alternatives do vary in the amount and type of timber harvesting and acreage of temporary roads, but any adverse cumulative effects are expected to be short-term in nature (0-50 years) and would be mitigated to the degree possible through protective Forest-wide standards and guidelines. Cumulative beneficial effects to Indiana bat roosting and foraging habitat are expected to occur over the long-term.

Cumulative impacts of these activities in spatial relationship to the Nelsonville Bypass will warrant further consideration at the project-level. Any cumulative adverse effects resulting from the spatial allocation of management areas in Alternatives C through F are expected to be short-lived but beneficial in the long-term. The potential for cumulative adverse effects on amount and spatial allocation of foraging and roosting habitat in the southwestern part of the Athens Unit would be higher in Alternative B than in any other alternative. When compared to the other alternatives, larger amounts of even-aged timber harvesting could occur in Alternative B in the immediate area of the Nelsonville Bypass and southwestern part of the Athens Unit where Indiana bats have been found. This could result in the cumulative reduction of optimal foraging and roosting habitat in this localized part of the Athens Unit. The Forest Service has no authority over the location of the Nelsonville Bypass; however, the Forest Service can use the project level planning process to consider how timber harvesting projects might influence short-term and long-term available habitat in this part of the Athens Unit.

Roosting and Foraging Habitat (Permanent Loss of Habitat)

Permanent loss of Indiana bat roosting and foraging habitat would be the most severe adverse consequence of likely cumulative effects to the species in the next 10 years. Under Alternative A, 1,931.5 acres of potentially suitable Indiana bat habitat on NFS land could be permanently affected in the next 10 years. This amounts to a permanent alteration of about 0.2 percent of the cumulative effects analysis area (Table 3 - 25). A possible surface coal mine that would be located north of the Bear Run area on the Ironton Ranger District could account for 65 percent of potentially lost habitat acreage. Just how many acres of suitable habitat could be lost permanently on private and other public lands within the proclamation boundary during the planning period can only be hypothesized. New oil and gas wells, roads, home sites, and industrial and commercial sites will very likely be developed in the planning area on non-NFS land. Some detail of one project is known, however. The Nelsonville Bypass, a planned four-lane highway would travel through the southwestern part of the Athens Unit, converting 768 acres within the cumulative effects analysis area to highway corridor with associated off-ramps. This project will likely be located in one of the two general locales in the planning area, both with several recent Indiana bat records.

The cumulative effects of Alternatives B through F on foraging and roosting habitat would vary only slightly from the no-action alternative in the amount of acres of potentially suitable Indiana bat habitat that could be permanently affected in the coming 10 years (Table 3 - 25). The differences can be accounted for in the acres of permanent roads or trails that may be constructed. Such variations are minor when compared to the entire planning area. None of these alternatives would be expected to have a significantly lesser or greater cumulative effect on the permanent loss of Indiana bat habitat than that already described for Alternative A.

Effects Determination

A **Likely to Adversely Affect** determination is made for the Indiana bat across all alternatives. 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 and summer habitat that is unknown. Implementation of management activities that require the removal of trees may accidentally cause direct take through the removal of an undetermined roost tree. Although the potential for this take is extremely small, given 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 could be affected under any of the alternatives, none of the expected adverse impacts would likely impede this species recovery. Each alternative would incorporate conservation approaches or other measures to proactively protect and conserve Indiana bat habitat.

- Winter habitat would be actively protected from human disturbance and microclimate modification in each of the alternatives.
- Each alternative would incorporate habitat management tools to provide a diversity of mature forest habitats that could be favorable to the Indiana bat both in the short-term and the long-term.

- A suite of established Forest-wide standards and guidelines would provide added protection of the Indiana bat and its habitat during project implementation (TES-1 to TES-14).

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.

Regional Forester Sensitive Species

The affected environment and evaluation of direct, indirect, and cumulative effects for Regional Forester sensitive species is available in the Biological Evaluation (Appendix F). This section summarizes the key findings for the 23 terrestrial and aquatic plants and animals listed as Regional Forester sensitive species (RFSS).

Regional Forester sensitive species are plants and animals species for which viability is a concern as evidenced by a downward trend in population or habitat capability. 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
- 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.

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.

These 23 species occur on NFS land in a wide variety of environmental conditions, ranging from highly isolated and existing at very low abundance to broadly distributed and abundant conditions. For some species, the effects of past or current management practices have led to reduced habitat quantity or quality and fewer opportunities for population interactions on the landscape. For other RFSS, suitable habitat may not be greatly influenced by management. They may have historically always been naturally rare.

The prescriptions set forth in the management areas, along with the projected management activities may positively or negatively affect RFSS and their habitats, and the likelihood of maintaining their viability in the planning area. Also, factors outside the control of the Forest Service may affect the likelihood that these species may remain viable within the planning area.

Effects Common to all Alternatives

All of the alternatives would promote the protection, maintenance, or enhancement of RFSS and their habitats. Because of their diverse needs, habitat for all of these species cannot be optimized in each alternative. Rather, the alternatives vary in the amounts of suitable habitat conditions they would provide in the future. All of the action alternatives were designed to increase the likelihood of maintaining RFSS viability by providing well-distributed habitat for them in the planning area. Where adverse impacts from management activities cannot be avoided, management should, at the least, not contribute to a trend toward Federal listing.

Direct, Indirect, and Cumulative Effects

The comparative effects of the alternatives on RFSS were evaluated using information collected from currently accepted and applicable scientific literature, other scientific sources, and from taxonomic experts, along with the professional judgment of Forest Service biologists. The Biological Evaluation provides two assessments of impacts to the species: habitat outcomes and determination of effects.

Habitat Outcomes

Anticipated habitat outcomes (also known as viability outcomes in the species viability evaluations) for RFSS were based on scientific analysis using information gathered from the literature and obtained from discussions with taxonomic experts. Outcomes projections should be considered an index of the environment's capability to support population abundance and distribution of RFSS, not definitive predictions of RFSS population occurrence, size, density, or other demographic characteristics (T. Schenck, pers. comm.). Projected habitat outcomes are described for the direct effects analysis area (NFS land –Table 3 - 26 and for the cumulative effects analysis area (all lands within the WNF proclamation boundary –Table 3 - 27).

Habitat outcomes were estimated for different time periods. The analysis focused on risk factors pertinent to the species within the planning area, and most RFSS were included in the species viability evaluation process. This process, summarized in Appendix E, 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 data about the effects of management activities on individual or groups of species. For RFSS not included in the species viability evaluation process, habitat outcomes were estimated by the Forest Service after review of conservation assessments and discussions with taxonomic experts.

A judgment of historical environmental conditions provides a reference or context within which to evaluate the impacts of the alternatives. The assessment of current and future habitat conditions took into account species distributions, habitat quality, 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 through C because their natural condition may be D or E. “Future” is defined as decades 2, 5, and 10 of Forest Plan implementation.

Determinations of the historic, current and likely future habitat outcomes on NFS land are displayed in Table 3 - 28 for each of the RFSS by alternative. Judgments of habitat outcomes within the cumulative effects analysis area (i.e., all lands within the WNF proclamation boundary) are displayed for each species by alternative in Table 3 - 29.

Summary of Direct, Indirect, and Cumulative Effects

Since historical times, up until the present, similar types of disturbances and management practices have occurred in the cumulative effects analysis area as have occurred on NFS land. Habitat outcomes for the direct effects analysis area (NFS land) and for the cumulative effects area are estimated to be the same for all RFSS.

Habitat outcomes for seven RFSS species were estimated to positively or negatively change across the alternatives, while the habitat outcomes for the remaining 16 are not expected to change from current levels. The following paragraphs highlight those species for which habitat outcomes may change.

Aquatic Species (4)

Based on their habitat requirements, likely historical conditions, and comparison to other Regional Forester aquatic sensitive species, the eastern sand darter, round hickorynut, salamander mussel and lilliput probably had the widest distribution in the planning area in the long past. Today they are located in specific sections of at least two watersheds, but their potential distribution is limited by water quality and the habitat degradation that has resulted from past mining activities. 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 would not be expected to occur immediately. Watershed restoration activities incorporated into all of the alternatives could result in an increase in the habitat outcomes for these four species in the long-term across all alternatives (decade 10).

Cerulean Warbler

The cerulean warbler is identified as a management indicator species for the Revised Forest Plan. The warbler is generally associated with interior oak-hickory forest habitat in southeastern Ohio. An analysis of how the alternatives would address the habitat needs of this species is detailed in this chapter’s section entitled “Providing a Variety of Habitats for Plants and Animals, Issue Indicator 8.”

Some management activities incorporated into each of the alternatives could fragment interior forest habitat, leading to increased rates of nest predation or parasitism. The Wayne’s location within a heavily forested landscape could moderate the intensity of these adverse effects. Each alternative would allocate some NFS land to the DCF and DCFO management areas, which were specifically developed to emphasize management for interior forest species. Within these management areas, the protective measures integrated into each alternative would help maintain the quality of interior forest habitats.

Alternatives A or C through F are unlikely to have either short- or long-term effect on cerulean warbler habitat suitability to change the habitat outcomes from the environmental conditions. The proactive habitat management activities contained in each of these alternatives should result in the maintenance of mature forest cover on most of the WNF over time. The structure and/or composition of the mature forest would vary depending on whether the mature forest habitat came about through uneven-aged or even-aged management, Historic Forest prescriptions, or through natural succession. For instance, communities managed with Historic Forest prescriptions may have a more open structure and would likely have more oak-hickory species, whereas an uneven-aged community may have a denser understory with fewer oaks.

There is low likelihood that implementation of Alternative B would change the habitat outcome from the current level over the short-term. However, in the long-term (e.g., decade 10), possible habitat fragmentation resulting from even-aged management could lead to a lower habitat outcome in Alternative B. Almost 79 percent of the WNF may be covered by mature forest habitat after 100 years of implementation of Alternative B, but 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.

Henslow’s Sparrow

The Henslow’s sparrow is identified as a management indicator species for the 2006 Forest Plan. It is a grassland-obligate species that occupies reclaimed mine lands on NFS land. An analysis of how the alternatives address habitat needs for this species is detailed under Habitat Indicator 6.

Alternatives C through F allocate NFS land to the GFM management area, while Alternatives A and B do not. Management of reclaimed mine lands within the GFM management area, with implementation of management area direction and guidance, could enhance habitat quality for this species. Habitat outcomes would likely remain the same as current levels under Alternatives C through F.

In Alternatives A and B, the potential exists for future habitat outcomes to decline (decades 5 and 10). Under Alternative A, occupied Henslow's sparrow habitat would fall within the DCF and DCFO management areas, areas that emphasize management for mature forest interior species. In Alternative B, occupied habitat would fall within the FSM and DCFO management areas. Existing grassland habitat may or may not be maintained in Alternatives A or B because composition objectives for these management areas call for only so much herbaceous habitat to be maintained (3 to 6% in FSM; 2 to 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.

Rock Skullcap

Rock skullcap was thought to be associated with closed-canopy mature forest until botanists discovered it in ice-damaged stands of varying light intensities and along old logging roads on the WNF in 2004. Ohio's State botanist also found this species in more exposed habitats in 2004, suggesting it may be able to tolerate higher light intensities than previously believed. Until more data is obtained, closed-canopy mature forest will continue to be regarded as its preferred habitat.

According to taxonomic experts involved in the species viability evaluation process, the rock skullcap may be able to disperse and increase in abundance when suitable habitat is available. Timber harvesting is the principal management activity that could alter light intensity within their forest communities. Alternative A would incorporate the least amount of timber harvesting; therefore mature, closed-canopy forest would dominate the landscape over time. Habitat outcomes for this species would not likely change in the short-term, but may increase in the long-term (i.e., decade 10) as forest cover increases and grows older. Alternatives B through F call for a significantly greater amount of timber harvesting, and such disturbances could decrease habitat suitability over time. Therefore, the habitat outcome for rock skullcap could decrease (i.e., decade 10) in Alternatives B through F. However, closed-canopy mature forest habitat would be available under each of these alternatives in the DR, FOF, FOFM, SA, and TRL management areas, as well in areas unsuitable for timber production. Potentially suitable habitat would continue to be available across the planning area with Alternatives B through F.

Determination of Effect

Judgments of how the effects of each alternative would impact RFSS are displayed in Table 3 - 30. These determinations are expressed as "likelihoods" or "risk" because of the uncertainty inherent in evaluating future scenarios and because the environmental conditions of many RFSS are often not well understood.

In summary, the Forest Service concluded that for all but one RFSS, the alternatives would impact individuals but would not likely cause loss of viability in the planning area or trend toward Federal listing. For one species, the Henslow's sparrow, there is a high risk of losing viability in the planning area in Alternatives A or B, but this would not likely cause a trend toward Federal listing. No GFM management area is allocated in these two alternatives, therefore there is a high probability that existing occupied habitat could decline in suitability over time.

Table 3 - 26. Definition of habitat outcomes used to estimate current and likely future conditions for RFSS on NFS land.

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 recolonization 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 3 - 27. Definition of habitat outcomes used to estimate current and likely future conditions for RFSS on all lands in planning 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.

Table 3 - 28. Comparison of habitat outcomes for Regional Forester sensitive species on NFS land.

Species	Historic /Current	Alt. A			Alt. B			Alt. C			Alt. D			Alt. E			Alt. E Modified			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	C	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	B	C	C	D	C	C	D	C	C	D	C	C	D	C	C	D	C	C	D
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 3 - 29. Comparison of habitat outcomes for Regional Forester sensitive species on all lands in the planning area.

Species	Historic /Current	Alt. A			Alt. B			Alt. C			Alt. D			Alt. E			Alt. E Modified			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	<u>E</u>	<u>E</u>	D	<u>E</u>	<u>E</u>	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Cerulean warbler	A/B	B	B	B	B	B	<u>C</u>	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	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>
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	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>
Salamander mussel	C/D	D	D	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>	D	D	<u>C</u>
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	<u>B</u>	C	C	<u>D</u>	C	C	<u>D</u>	C	C	<u>D</u>	C	C	<u>D</u>	C	C	<u>D</u>	C	C	<u>D</u>
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 3 - 30. Summary of the determination of effects for RFSS.

Species	A	B	C	D	E	E Modified	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

The affected environment and evaluation of direct, indirect, and cumulative effects for species proposed for RFSS designation is available in the Biological Evaluation (Appendix F). This section summarizes the key findings for the 20 terrestrial and aquatic plants and animals listed as species proposed for RFSS designation.

The species viability evaluation identified plant and animal species for which viability was a concern in the planning area. Federally listed species and RFSS species were addressed in the previous sections. The plant and animal species addressed in this section are not currently listed as RFSS, but were recommended for listing after risk evaluations were conducted, in accordance with (FSM 2670, Supplement 2600-2001-1). The formal RFSS update process is scheduled for 2005. Until this process is completed, these species will be identified as species proposed for RFSS designation. However, they will be treated as though they had formal RFSS status. In other words, Forest-wide and management area direction and guidance for RFSS will apply to these species proposed for RFSS designation.

These 20 species occur on NFS land in a wide variety of environmental conditions, ranging from highly isolated and existing at very low abundance, to environmental conditions that are broadly distributed and abundant. For some species, effects of past or current management practices have led to reductions in habitat quantity or quality and opportunities for population interactions on the landscape. For other species proposed for RFSS designation, suitable habitat may not be greatly influenced by management, but may have historically always been naturally rare.

The prescriptions set forth in the management areas, along with the projected management activities, may positively or negatively affect species proposed for RFSS designation and their habitats, and their likelihood of viability in the planning area. Also, factors outside the control of the Forest Service may affect the likelihood that these species may remain viable within the planning area.

Effects Common to all Alternatives

Because of the diverse needs of these species, habitat for each cannot be optimized in every alternative. Rather, the alternatives vary in the amounts of suitable habitat conditions they would provide in the future, but the action alternatives were developed to provide a likelihood of maintaining viability and well-distributed habitat for these species in the planning area. Where adverse impacts cannot be avoided, management must not result in a trend toward Federal listing.

Direct, Indirect, and Cumulative Effects

Effects of the alternatives on the species proposed for RFSS designation were evaluated using information collected from currently accepted and applicable scientific literature, other scientific sources, and from taxonomic experts, along with the professional judgments of Forest Service biologists. The Biological Evaluation provides two assessments of impacts to the species: habitat outcomes and determination of effects.

The habitat outcomes and determination of effects were assessed in the same manner as described for RFSS, in the previous section (Table 3-24 and 3-25). Habitat outcomes for species proposed for RFSS designation on NFS land and for all lands in the cumulative effects analysis area are displayed in Table 3-29 and Table 3-30. The determination of effects for each species proposed for RFSS designation is identified in Table 3-31.

Summary of Direct, Indirect, and Cumulative Effects

From ancient times until the present, similar types of disturbances and management practices have occurred in the cumulative effects analysis area as have occurred on NFS land. Habitat outcomes for the direct effects analysis area (NFS land) and for the cumulative effects area are estimated to be the same for all species proposed for RFSS designation.

Habitat outcomes for one species (the four-toed salamander) may decline with implementation of some alternatives, while the habitat outcomes for the remaining 19 species proposed for RFSS designation are not expected to change from current levels. The following summarizes the potential differences in habitat outcomes for the four-toed salamander across the alternatives.

Four-toed salamander

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 for this species. The four-toed salamander has been found in two sites on the Ironton Ranger District, both in the Bear Run area. 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. Occupied sites would be protected at the project level and no alternative should have an 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).

The amount of mature forest habitat may increase over the long-term in all of the alternatives. Habitat outcomes under Alternative A would not likely change in either the short- or long-term because only a minimal amount of uneven-aged timber harvesting would occur and mitigation measures would protect suitable habitat. However, the long-term habitat outcome could be reduced by Alternative B. In 100 years, almost 79 percent of NFS land could be covered by mature forest habitat under Alternative B, but more of the Forest would be allocated to even-aged management. 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). Periodic fragmentation of mature forest habitat on a landscape scale, however, could adversely affect dispersal of this species.

Prescribed fire could affect this species or its habitat, but no information about this was found 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 Area prescriptions, found in Alternatives C through F. Short-term and long-term habitat outcomes could be reduced in Alternatives D through F because the Historic Forest management prescription would be applied in proximity to known locations of this species. NFS land in this area could be treated with prescribed fire as often as twice per decade. The effects could 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. Furthermore, occupied habitats could be protected with appropriate buffers at the project level.

Table 3-31. Comparison of habitat outcomes for species proposed for RFSS designation on NFS land.

		Alt. A			Alt. B			Alt. C			Alt. D			Alt. E			Alt. E Modified			Alt. F		
Decade		2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10
Amphibians																						
Green salamander	E/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	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	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	E
Mussels																						
Sheepnose mussel	*	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Insects																						
Rapids clubtail	E/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	E
Plants																						
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	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	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	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	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	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	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	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	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	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	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	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	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	D
Summary of Habitat Outcome Changes from Current Outcomes																						
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	19	18	19	19	19	18	18	18	18	18	18	18	18	18	18	18	18
Negative change		0	0	0	0	0	1	0	0	0	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 3-32. Comparison of habitat outcomes for species proposed for RFSS designation on all lands in cumulative effects analysis area.

		Alt. A			Alt. B			Alt. C			Alt. D			Alt. E			Alt. E Modified			Alt. F		
Decade		2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10
Amphibians																						
Green salamander	E/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	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	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	E
Mussels																						
Sheepnose mussel	*	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Insects																						
Rapids clubtail	E/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	E
Plants																						
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	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	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	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	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	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	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	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	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	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	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	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	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	D
Summary of Habitat Outcome Changes from Current Outcomes																						
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	19	18	19	19	19	18	18	18	18	18	18	18	18	18	18	18	18
Negative change		0	0	0	0	0	1	0	0	0	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 3 - 31. Summary of the determination of effects for species proposed for RFSS designation.

	A	B	C	D	E	E Modified	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

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

Habitat Indicator 8 – Species of Public Interest

Certain plant or animal species are of public interest because they are hunted, fished, trapped, or collected. Three such species are of special interest to the public: white-tailed deer, American ginseng and grouse. The decline in early successional forest habitat has raised concerns about long-term grouse populations on the Forest. This species is addressed in an earlier section of the Final EIS, Habitat Indicator 3. The white-tailed deer and American ginseng are addressed in this section.

White-tailed Deer

The white-tailed deer is a popular game species. Bow and gun seasons were expected to harvest almost 200,000 deer in 2004 (ODNR, 2004a).

Deer hunting can provide an economic boost to local communities near the WNF.

Concerns have been raised that oak regeneration and sensitive plant populations on the Forest may be threatened by deer browsing. Deer browsing has been implicated in negative effects on the morphology and growth rates of young trees and herbaceous or shrubby vegetation. However, the intensity of these effects may be related in part to deer density (Russell et al., 2001). Deer are herbivores that graze and browse on a variety of leaves, plants, and twigs. They require high energy foods; some of the more favorable food items include wild crabapple, sumac, grasses, greenbrier, Japanese honeysuckle, jewelweed, clover and acorns (Gottschang, 1981). Deer take advantage of the corn, soy bean, wheat, and alfalfa crops produced on agricultural land.

The 2004 statewide fall deer population was estimated at 700,000 animals, with the highest numbers located in the forested regions of eastern and southern Ohio (ODNR, 2004). Pre-hunt population estimates for 2004 were slightly above targeted pre-hunt population levels for the counties that contain the WNF (Table 3 - 32). Deer densities in these counties are similar or slightly higher than average densities for Kentucky (21 deer/mile^2), but much lower than average densities in West Virginia (42 deer/mile^2) (M. Tonkovich, pers. comm.).

Table 3 - 32. Estimated deer densities* for Ohio counties that contain NFS land (M. Tonkovich, pers. comm.).

County	Estimated Fall 2004 Population (Pre-hunt) (Deer per square mile)	Target Population (Pre-hunt) (Deer per square mile)
Athens	28.1	19
Gallia	24.9	19
Hocking	24.6	23
Jackson	23.7	19
Lawrence	17.1	19
Monroe	25.8	19
Morgan	26.2	19
Noble	28.6	19
Perry	26.7	19
Scioto	9.5	10
Vinton	21.1	19
Washington	19.9	19

*These deer density figures are average for the county. There is a possibility that higher or lower densities could occur within areas in each county based upon habitat quality and availability.

No deer browse studies have been conducted on the WNF to confirm or deny any effects of deer browsing on tree regeneration or sensitive plant populations, and research is warranted. However, a deer exclosure study addressing the effects of deer browsing on the height, density, and composition of woody regeneration in oak-hickory forests is ongoing near the Forest in Ross and Vinton counties. Deer densities in this study area were similar to those for counties containing the WNF. After the first study season, researchers found that the percentage of oak stems browsed were only 2.5 percent higher outside the fenced plots than inside them. No evidence has been found to show that browsing affected species richness, community composition, or oak seedlings after two study seasons (Apsley and McCarthy, 2003). This study will continue in the future and may provide more information on the effects of deer browsing on oak seedlings as seedlings grow taller.

Effects of deer browsing on large white trillium have been studied in the Cuyahoga Valley National Park in northeastern Ohio where deer densities are much higher than what are found within the WNF. Researchers found that browsing had a negative impact on trillium; stems were taller inside exclosures than outside and individual plants producing flowers decreased (NPS, 2003a). The Cuyahoga Valley National Park deer densities were estimated to be as high as 107 deer per square mile when this study occurred (NPS, 2003b).

Localized plant populations could be adversely affected by deer, especially if harsh environmental conditions occur, but the overall deer herd condition suggests that overbrowsing may not be a widespread problem in the WNF. One-third of all fawns are breeding, which is considered an indication of good herd condition. Fawn breeding generally ceases when the herd reaches 60 percent of the carrying capacity of the land, or in other words 60 percent of what any one area can support. The current deer herd is most likely at only 45 to 50 percent carrying capacity, based on these reproductive data (M. Tonkovich, pers. comm.). Overbrowsing would be more likely to occur if the number of deer was greater than what the land could support, as evidenced in some urban areas of Ohio where deer browse lines can be seen in the woods.

Antler beam measurements from young bucks harvested each fall are also used to assess the relative condition of the deer herd. Young bucks are still growing rapidly and much of their energy intake is devoted to body growth rather than antler development. Body growth will take precedence when deer are faced with dietary deficiencies, and antler beam diameter would be expected to decline (ODNR, 2002). Ohio Division of Wildlife biologists consider Ohio’s deer herd in good condition, although they have observed a gradual decline (0.09 inch) in antler beam measurements for young bucks in the east-central and southeastern parts of Ohio between 1972 and 2002 (ODNR, 2003a). This decline has coincided with the decrease in early successional forest habitat and the maturation of Ohio’s forests. Mature forest habitat provides less food for deer, whereas it is estimated that early successional forest habitat (i.e., less than 20 years of age) can provide the most food (i.e., up to 200 pounds per acre) (Gottschang, 1981).

Direct and Indirect Effects

The quantity and quality of future white-tailed deer habitat may vary among the alternatives. Alternative A (the no action alternative) prescribes only minimal uneven-aged management as an active habitat management tool. No even-aged management would be allowed; therefore early successional forest habitat would decrease and then disappear from the WNF. Even-aged management is not only a tool used to produce an important source of food for deer, it useful in regenerating oaks that produce the acorn crops important for deer's survival winter. Alternative A prescribes no Historic Forest management prescriptions that would combine uneven-aged management and frequent prescribed fire to maintain oak-dominated communities. Within Historic Forest management areas, mature oak trees would likely dominate the area, ensuring acorn availability for deer. Oak-dominated stands would decline in abundance, but oaks would likely remain a minor component of forest stands on drier sites (i.e., ridges and south-west facing hillsides).

Table 3 - 33 summarizes how Alternatives B through F differ from Alternative A in their potential to provide early successional forest habitat and oak-dominated forest communities over the long-term (100 years).

Table 3 - 33. Availability of major forest community types that provide food for the white-tailed deer.

	Current Acreage	A	B	C	D	E	E Modified	F
Acres of early successional forest habitat (in 100 years)	12,759	0	13,308	11,224	13,434	13,520	12,820	9,664
Acres of oak-dominated stands	111,885	18,088	41,082	40,201	49,040	62,118	60,169	57,823

Over time, the amount of early successional forest habitat would be similar to current levels in Alternative B, D and E, while Alternative C would provide slightly less early successional forest habitat than what is available currently. There would likely be 25 percent less early successional forest habitat in Alternative F than what currently exists.

There would likely be a declining trend in oak-hickory forest stands on NFS land with the implementation of each alternative, which suggests decreased acorn abundance could occur. There could be a minus-84 percent trend in oak-hickory stands after 100 years with implementation of Alternative A. Alternative E would likely maintain the most oak-hickory on NFS land after 100 years, but there could be a declining trend of about 45 percent from current amounts. A decline in oak-hickory could affect animals which rely upon these species for food, like the deer. This concern may be exacerbated with the cyclical oak mast trend seen in the Appalachian region. In all alternatives, oak and hickory trees would likely remain scattered across the WNF as individuals, or found in small groups on ridges and southwest facing slopes. In Alternatives C through F, extensive oak and hickory communities would also be concentrated on the landscape where Historic Forest management prescriptions are implemented.

Cumulative Effects

By 1904, the white-tailed deer was no longer present in Ohio. Increasing forest cover and reintroduction efforts by the Ohio Division of Wildlife have resulted in the reestablishment of a large, healthy deer herd. Within the WNF proclamation boundary, some timber harvesting occurs on private and State lands and will likely occur in the future at levels similar to present. It is impossible to estimate the long-term effects of deer browsing on WNF plant resources since no baseline data are available at this time. We can speculate that active management of NFS land to create early successional forest and maintain oaks could contribute to maintaining a healthy deer herd, and that contribution would be greater in Alternatives B through F than in Alternative A.

Wild American Ginseng

American ginseng (*Panax quinquefolius*) is a native perennial herb highly sought for its medicinal value. Ginseng harvest requires digging the taproot, which kills the plants. The increasing demand and concurrent market value for wild ginseng has intensified collection pressures in forested systems and has called into question the sustainability of current harvest levels and practices on ginseng population viability. Because of recent concerns raised due to declining populations, the Nature Conservancy updated the global rank of ginseng reclassifying it from "common" (G4) to "rare/common" (G3/G4) (NatureServe, 2004). American ginseng was listed as a species of concern in the CITES (Convention on International Trade in Endangered Species) treaty in 1975. In Canada, ginseng is listed as rare and all natural populations are protected.

Wild American ginseng is found in moderate to densely shaded hardwood forests with cool microclimates (Anderson et al., 2002). It is endemic to Eastern North America occurring from southern Quebec and Ontario west to South Dakota and south to Georgia and Oklahoma; overall it is known to occur in 34 states and 3 Canadian provinces (NatureServe, 2004). Common associates of ginseng include bloodroot, wild ginger, Solomon's seal, mayapple, goldenseal and jack-in-the-pulpit. Ginseng reproduces exclusively by seed with plants only reproducing once they reach an age of five years or more (ODNR, 2004b). Extended seed dormancy is rare in American ginseng (Gagnon, 1999).

Wild American ginseng was first harvested and exported by explorers and missionaries in Canada during the 1700s. It has been an important source of supplemental income for Appalachian people since the mid-1800s. Cultivated ginseng plants have smoother roots and bring a lower price ($10-$15 per pound) than wild grown or wild-simulated plants ($200-$265 per pound), creating a preference for ginseng harvesters to seek wild grown roots. Overall harvest levels in Ohio have decreased significantly (51%) in the last decade from an average of 7,675 pounds of dry root between 1992 and 2001 to 3,757 pounds in 2002 (USFWS, 2002).

The number of roots per pound in Ohio has increased substantially (81%), indicating that smaller roots are being collected (Anderson et al., 2002). A study of herbarium specimens found a significant decrease in overall size of similar-aged plants in Appalachian and Mid-Western states since 1900 (McGraw, 2001). The reason for this decline is unknown, but harvesting practices (selection of largest and oldest plants) may be driving natural selection for smaller plants. Herbarium specimens, however, may not provide an unbiased sample and should not be extrapolated to natural populations without supporting field data. A 10-year monitoring project in North Carolina found an overall decrease in number, density, and size of ginseng plants and similar results were found during monitoring in the Great Smoky Mountain National Park of Tennessee (NatureServe, 2004). Trends in Ohio are unknown.

Other studies looking at ginseng population dynamics are few, especially at a local level, to verify if ginseng populations are declining. A demography study in Canada found that mortality rates for smaller plants are higher than for larger ones (Charron and Gagnon, 1991). Another Canadian study used a projection model to predict ginseng survival under differing harvesting pressures based on four known populations (Nantel et al., 1995). In this study, the model simulations suggested that a minimum viable population size is 172 plants under conditions where 30 percent of the population was harvested every five years. A field study looking at reproductive ability of different cultivated population with varying numbers of individuals found that populations with fewer individuals had lower reproduction than larger populations, likely due to pollinator limitation (Hackney and McGraw, 2001).

The WNF is one of two forests in Region 9 that still allows the collection of ginseng. The Forest Service has adopted restrictions on ginseng harvesting to help protect ginseng population viability on the WNF. These restrictions are consistent with State of Ohio's Ginseng Management Program (ODNR, 2004c) and require an annual permit that authorizes only the collection of up to one pound dry weight of ginseng per person on NFS land (see Forest-wide standards and guidelines, VEG-18). Since 2000, the amount of permits for root collection has been recorded. On average, approximately 149 permits a year have been sold for root collection in the last three years. These permits include all medicinal roots that can be harvested, thus it cannot be inferred that all 149 permittees collected ginseng. Reporting by permittees of amounts and species of roots collected is voluntary, and usually represents a low percentage of the total permits sold.

Population size and composition necessary to maintain ginseng viability on the Forest is currently not known, and such research is warranted. The WNF has included monitoring goals within the 2006 Forest Plan to monitor American ginseng populations (see Chapter 4 of the Forest Plan). In time, these efforts along with permit information will help acquire basic population data and harvest pressures in southeast Ohio. These data can then be used to monitor the effects of root harvesting over time and allow for adaptive management of ginseng populations. In addition, Forest-wide goals incorporated in all alternatives include providing opportunities for collection while managing to sustain viable populations and increasing public awareness of ginseng harvest impacts (Goal 6.3), use of interpretation and education to increase public understanding of the WNF's natural environment and its use (Goal 11.1c); and collaborating with partners to promote education, conservation and sustainable ecological management practices (Goal 1.1).

The greatest threat to wild American ginseng is irresponsible digging of its roots, where digging exceeds the reproductive rates of plants. Poaching of roots in protected areas is often reported (Gagnon, 1999). Other threats include logging of mesic hardwood forests (NatureServe, 2004) and grazing (Anderson et al., 2002). Grazing and logging are threats because they tend to open the forest canopy and increase light reaching the forest floor.

Direct and Indirect Effects

The quantity and quality of future American ginseng habitat may vary among the alternatives. The three main threats to ginseng have been identified as irresponsible digging of its roots, grazing and activities that involve opening of forest canopies. Within all alternatives there are Forest-wide guidelines and standards which require a permit to collect medicinal roots, including ginseng, on Forest Service lands (VEG-18) and allow for rotational areas or Forest-wide closure orders to let stressed populations to recover from over collection (VEG-20). Wild ginseng collection is prohibited in the management areas SA, RNA, CA, FOF, FOFM, DR and developed recreation areas of TRL. The acreage of these management areas varies by alternative (Table 3 - 34).

Table 3 - 34. Total area (in acres), and percent of NFS land, where ginseng collection is prohibited in each Alternative.

	A	B	C	D	E	E Modified	F
Total area	28,953	28,953	36,371	31,669	36,372	39,354	67,273
% NFS land	12	12	15	13	15	17	28

On the WNF, grazing is restricted to suitable open land; no woodland or brushland will be converted to rangeland. Thus grazing activities on the Forest will have little, if any, impact on ginseng habitat. Uneven-aged management methods require that 60 percent of canopy cover be retained (TES-8). This would maintain shaded environments required by wild ginseng and would not likely affect population viability (Anderson et al., 2002).

Even-aged management could threaten current populations of ginseng by increasing light penetration to the understory. A temporary reduction in the amount of suitable habitat for the species would result until trees regenerate and canopies recover. The amount of even-aged management in hardwood stands projected for the first decade of Forest Plan implementation would vary by alternative. Other activities that could have similar short-term impacts on ginseng include temporary road construction and oil and gas development. Activities with the potential to cause permanent loss of suitable habitat involve permanent road and parking lot construction, trail and recreation facility construction, utility corridor construction, and surface mining. The acreages projected for these activities in each alternative over the next decade are provided in Table 3 - 35. Forest biologists and botanists review all areas where management activities involve land exchange, vegetation removal, or soil disturbance before implementation. Because of regional viability concerns, the Forest Service would undertake efforts to maintain habitat for those populations discovered during project implementation. Therefore, direct impacts to existing ginseng populations from management activities are unlikely. While any seedbanks without germinated plants could be lost, the species does not have long-lived seedbanks. Loss of seedbanks, thus, would pose little threat (Gagnon, 1999).

Table 3 - 35. Acres and percentage of NFS land projected for management activities over the next decade with potential to impact ginseng populations or suitable habitat.

	A	B	C	D	E	E Modified	F
Even-aged management in hardwoods	0	5,960	1,630	1,780	1,820	1,725	1,370
Road, log landing and skid trail construction	513	862	1,287	1,276	1,248	1,278	1,129
Recreational trail and facility construction	363.5	363.5	325	362	325	325	285
Oil and gas	121	121	121	121	121	121	121
Surface mining	1,250	1,250	1,250	1,250	1,250	1,250	1,250
Utility corridor construction	50	50	50	50	50	50	50
Total	**2,297.5**	**8,606.5**	**4,663**	**4,839**	**4,814**	**4,749**	**4,205**
% NFS land	**1.0**	**3.6**	**2.0**	**2.0**	**2.0**	**2.0**	**1.8**

Over time, the amount of shaded forest habitat on the Forest will increase from reforestation efforts, land acquisition, watershed improvements (i.e. tree planting and mine reclamation). In all alternatives, the potential ginseng habitat that could be impacted is minimal (Table 3 - 35) when compared to the acreage where collection is prohibited (Table 3 - 34) and to the acreage where no adverse impacts from management activities would likely occur.

Cumulative Effects

Forest cover across Ohio has increased from about 15 percent in 1940 to almost 30 percent today (Ohio Division of Forestry 2004). Historical aerial photos show many areas of the WNF consisted of eroded, abandoned agricultural fields and cut-over areas that today have returned to forested conditions. Almost 80 percent of the land (public and private) within the WNF proclamation boundary are forested (Ohio Land Use Cover, based on Landsat TM 1994). This reforestation has drastically increased the amount of lands suitable for ginseng habitat in contrast to what existed during the Industrial Revolution and Great Depression eras.

The WNF is one of few public land owners that allow ginseng collection on its lands. State managed lands do not allow ginseng. Ginseng harvesting takes place on privately owned properties at land owner discretion. Poaching and illegal digging is believed to be common, however, and some form of ginseng harvest likely occurs across all land ownerships. Poaching also can occur accidentally because of poorly marked land boundaries. Adaptive management of ginseng populations would result from the implementation of the monitoring and evaluation program in Chapter 4 of the 2006 Forest Plan. Therefore, cumulative effects of harvesting on NFS land would be decreased through public education and awareness programs (see Forest-wide Goals and Objectives 1.1, 6.3 and 11.1c) and adaptive management decisions.

Short-term or permanent loss of suitable habitat could occur in the future on private land within the WNF proclamation boundary, primarily from construction of roads and homes, oil and gas extraction, even-aged timber harvest, and surface mining. Any of these activities could disturb or decrease suitable habitat for, or existing populations of, this species. However, with the exception of the potential 1,250 acres of surface mining (reserved rights), these activities would not be expected to increase significantly from current levels. Any potential adverse cumulative effects that may occur on NFS land as a result of implementing any of the alternatives would be mitigated through the implementation of protective Forest-wide standards and guidelines and individual project mitigations. The cumulative impacts of vegetation removal activities on NFS land is unlikely to increase pressures on ginseng population viability beyond that created by similar activities on neighboring non-NFS land.

Habitat Indicator 9 – Non-native Invasive Species

Affected Environment

Background

An estimated 50,000 non-native species are established in the United States (Pimentel, et al. 2000), and 700 to 800 of those are known to occur in the wild in Ohio (ODNR and TNC, 2001). Many of these introduced species play a neutral role on the landscape or are beneficial and/or essential to daily subsistence. On the other hand, some non-native species are invasive and cause substantial economic and environmental harm. In the United States, invasive plants have infested 100 million acres, and continue to infest an additional 3 million acres every year (National Invasive Species Council, 2001).

A recent estimate of damages and losses due to non-native invasive species (NNIS) cost an estimated $137 billion per year (Pimentel, et al., 2000). This is likely a gross underestimate, since numbers were compiled primarily from commercially important sectors (e.g., agriculture and livestock). More intangible, non-market impacts, including impacts to natural ecosystems, were generally omitted from analysis due to lack of data (GAO, 2002).

Environmentally, NNIS pose a serious threat to plant and animal community health and diversity. Since NNIS have been transplanted outside their original range, they often lack natural controls (e.g., disease, predators, parasites, or climate), which allows them to out compete and eventually replace more sensitive native species. Not only do they compete with native species for resources, they also:

- Cause loss of habitat and food for wildlife
- Alter soil structure and chemistry (Ehrenfeld, 2003)
- Modify fire regimes (Brooks et al., 2004)
- Alter plant succession
- Serve as reservoirs for pathogens
- Hybridize with natives to compromise local genetic diversity.

The resulting change in community composition can severely alter ecosystem dynamics and functions over time. As a result, non-native invasive species are considered the second-leading threat to biodiversity and are the primary threat to 49 percent of all imperiled or federally listed species (Stein et al., 2000). Approximately 100 known invasive plant species are capable of invading and compromising natural areas in Ohio (TNC, 2004).

Legal and Administrative Framework

Law, policy, and direction pertaining to the control and management of noxious and non-native species include, but are not limited to:

- Federal Noxious Weed Act of 1974 (as amended 1988 and 1994)
- Plant Protection Act
- Executive Order 13112, February 1999
- National Invasive Species Council Act, 2003.

Table 3 - 36. Non-native invasive plant species on the Wayne National Forest.

Common Name	*Species*	Rank
Amur honeysuckle	*Lonicera maackii*	1
Asian bittersweet	*Celastrus orbiculatus*	1
Autumn olive	*Elaeagnus umbellata*	1
Cinammon vine	*Dioscorea batatas*	3
Common buckthorn	*Rhamnus cathartica*	1
Common Privet	*Ligustrum vulgare*	2
Common reed grass	*Phragmites australis*	3
Crown-vetch	*Coronilla varia*	1
Dames rocket	*Hesperis matronalis*	4
Dodder (non-native species)	*Cuscuta* spp.	4
Eulalia	*Miscanthus sinensis*	2
Eurasian water-milfoil	*Myriophyllum spicatum*	1
Garlic mustard	*Alliaria petiolata*	1
Giant knotweed	*Polygonum sachalinense*	4
Gill-over-the-ground	*Glechoma hederacea*	3
Glossy buckthorn	*Rhamnus frangula*	2
Indian strawberry	*Duchesnea indica*	3
Japanese barberry	*Berberis thunbergii*	1
Japanese honeysuckle	*Lonicera japonica*	1
Japanese knotweed	*Polygonum cuspidatum*	1
Japanese silt grass	*Microstegium vimineum*	1
Japanese wisteria	*Wisteria floribunda*	3
Kudzu	*Pueraria lobata*	1
Mile-a-minute	*Polygonum perfoliatum*	1
Morrow honeysuckle	*Lonicera morrowi*	1
Multiflora rose	*Rosa multiflora*	1
Narrow-leaved cattail	*Typha angustifolia*	5
Periwinkle or myrtle	*Vinca minor*	2
Poison hemlock	*Conium maculatum*	4
Porcelain berry	*Ampelopsis brevipedunculata*	4
Princess tree	*Paulownia tomentosa*	2
Purple loosestrife	*Lythrum salicaria*	1
Reed canary grass	*Phalaris arundinacea*	3
Roadside penny-cress	*Thlaspi alliaceum*	3
Russian olive	*Elaeagnus angustifolia*	1
Small Carpgrass	*Arthraxon hispidus*	4
Smooth brome	*Bromus inermis*	2
Sweet autumn virginsbower	*Clematis ternifolia*	4
Tatarian honeysuckle	*Lonicera tatarica*	1
Tree of heaven	*Ailanthus altissima*	1
Water milfoil	*Myriophyllum heterophyllum*	5
White sweet-clover	*Melilotus alba*	2
Wineberry	*Rubus phoenicolasius*	4
Winged burning bush	*Euonymus alatus*	2
Wintercreeper	*Euonymus fortunei*	1
Yellow sweet-clover	*Melilotus officinalis*	2

Rankings:

1-highly invasive,

2-moderately invasive,

3–widespread non-native,

4–local concern and monitoring,

5-native invasive

Current NNIS Conditions on Wayne National Forest

Plants

A list of 47 non-native plant species (Table 3 - 36) considered to be substantial threats on the Wayne was compiled from species targeted by Region 9, the State of Ohio, The Nature Conservancy, Ohio Chapter and local botanists. This list is by no means exhaustive and is likely to change as new threatening species are identified within the region.

In 2002, the Forest Service reported 4,300 acres (or 2%) of the Forest to be infested with non-native invasive species. This initial study was based only on agricultural lands (i.e., old fields) on the WNF; about one-third of these lands were infested. This method did not accurately represent all areas of infestation on the Forest and thus underestimated acres actually infested. In the summer of 2002, a non-native invasive plant inventory and mapping program was initiated on the Athens Ranger District and continued in 2003. At the end of 2003, 17,730 acres were surveyed of which 2,280 acres were infested with NNIS. To date, approximately 7.5 percent of the WNF has been surveyed and mapped for NNIS. The initial mapping of NNIS occurrences on the WNF is projected to take at least 5 years. It is estimated that approximately one-third of the Forest, or 94,000 acres are infested with NNIS (2005 Wayne NF NNIS program assessment).

Currently, treatment and prevention of NNIS on the Wayne consists of project designs and mitigations to limit NNIS, some mechanical treatment, one biological control site, education, and detection surveys for species yet unknown to occur on the Forest. To date activities include:

- Pulling garlic mustard on the Little Storm's Creek Special Area on the Ironton Ranger District since 1998
- Pulling garlic mustard and Oriental bittersweet from the Paines Crossing Special Area and Japanese stiltgrass in the Buffalo Beats Research Natural Area on the Athens Ranger District
- Grubbing and mowing 12 acres of multiflora rose on a bottomland field in the Rutherford wetland complex (Athens RD) prior to planting the site with native tree species
- Mechanical grubbing of autumn olive near camp sites on the Ironton Ranger District
- Releasing Galerucella beetles on a 2-acre purple loosestrife infestation along Leith Run (Marietta Unit of the Athens RD)
- Converting a fescue/canary grass field in the Handley Branch wetland restoration area (Ironton RD) to native warm season grasses

- Using goat grazing to treat a kudzu infestation on the Ironton Ranger District
- Removing starling and house sparrow nests and eggs from nesting boxes provided for native bird species
- Public educational signs and bootbrush stations at trailheads to inform hikers on threats and prevention of garlic mustard and Japanese stiltgrass
- Public educational signs on the identification and prevention of aquatic invasive species along Ohio River access sites and inland lakes
- Surveys for zebra mussel in streams of Marietta Unit
- Surveys for Eurasian water-milfoil in strip ponds at Hanging Rock (Ironton RD).

In general, herbicides have not used on the WNF in the past to treat NNIS; however, the use of herbicides to treat NNIS is considered in the proposed 2006 Forest Plan (Goal 7.2; Objective 7.2b). Methods for control of invasive species may include: mechanical removal (e.g. hand pulling, mowing or cutting), biological (e.g. *Galerucella* beetles to control purple loosestrife) or chemical (e.g. herbicide spot spraying individual plants, basal spray of saplings or stump spraying).

Insects and Diseases

Forest ecosystems are subjected to many biotic and abiotic stresses. Native insects and diseases, droughts, tornadoes, windstorms, and wildland fire periodically impact forests or specific tree species, leaving dead or weakened trees. The effects of these stresses may be manifested locally or over a large area, yet they do not cause species extinction. In contrast, exotic pests can threaten the continued existence of a species. Often host species have not evolved genetic resistance to exotic pests, as co-evolutionary processes have not occurred. Following are descriptions of the exotic organisms that are currently causing significant effects in the region in or near the WNF. It is very possible that other unknown exotics will be discovered over the next few decades.

Chestnut Blight

At the turn of the 20th century, the American chestnut was one of the most important trees in forests from Maine south to Florida and from the Piedmont west to the Ohio valley. In the heart of its range, a count of trees would have turned up one chestnut for every four oaks, birches, maples and other hardwoods. Many of the dry ridgetops of the central Appalachians were so thoroughly crowded with chestnut that, in early summer, when their canopies were filled with creamy-white flowers, the mountains appeared snow-capped.

American chestnut was eliminated from eastern forests as a dominant species, however, by chestnut blight (*Cryphonectria parasitica*), an Asian fungus to which native chestnuts had very little resistance. In its wake, it left only dead and dying stems. By 1950, except for the shrubby root sprouts the species continually produces (and which also quickly become infected), the keystone species on some nine million acres of eastern forests had disappeared. Figure 3 - 44 depicts the natural range of the American chestnut. (The American Chestnut Foundation, 2004)

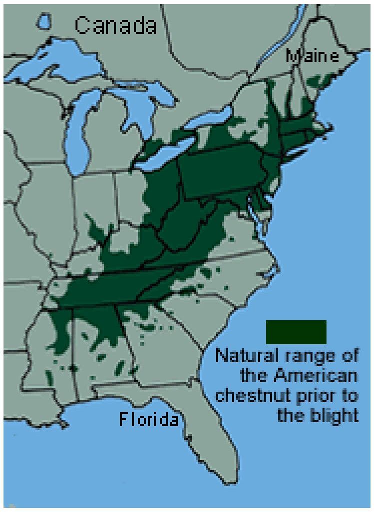


Figure 3 - 44. Nature range of the American chestnut prior to the blight.

Butternut Canker

In 1995, the Forest Service estimated that 77 percent of the butternuts in the Southeast were dead due to the canker-causing fungus *Sirococcus clavigignenti juglandacearum*. This fungus disrupts nutrient flow through cambium areas, which generally kills the trees (USDA Forest Service, 1995). Surviving butternuts are usually found in riparian zones, and the majority of trees are heavily infected and not reproducing. In contrast to American chestnut, butternuts usually will not sprout after stem death. Young trees are subject to mortality, and fungal spores can be carried on the fruit husks. Therefore, when a population becomes infected, that particular gene pool has the potential to be lost permanently. Research is being conducted to develop laboratory and field protocols to screen trees for resistance, host range studies, *in vitro* clonal propagation, and the role of insects in dissemination of the fungus (Schlarbaum et al., 1997).

Dutch Elm Disease

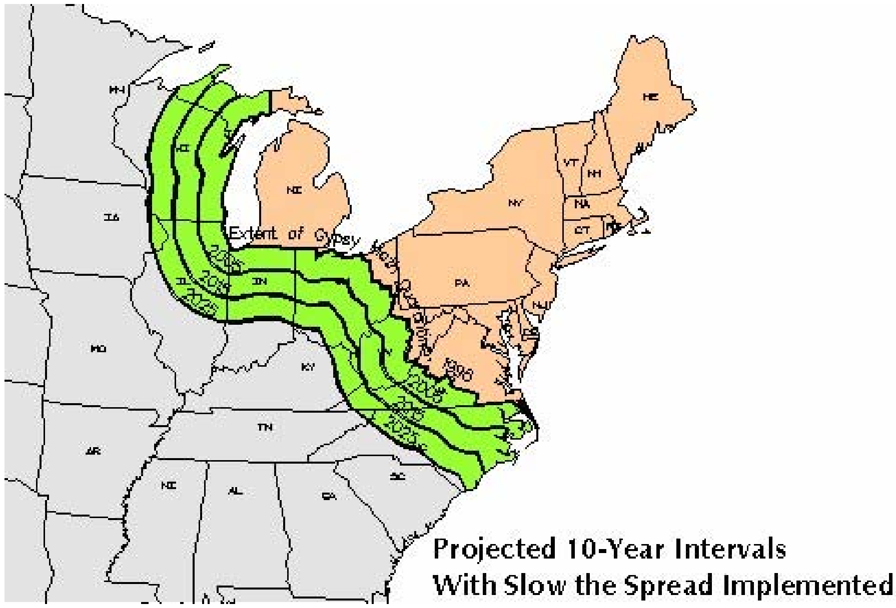
American elm usually occurs in a mixture of other hardwood species. The species' is distributed throughout eastern North American forests, extending well into the Great Plains. The streets of North American cities were once lined with American elms, a fast growing, stress tolerant tree, with a vase-shaped crown. Wood from the species was used for furniture, flooring, construction, hardwood dimension, and veneer. Forest and urban populations of American elm have been devastated by two strains of Dutch elm disease (DED), a non-aggressive strain (*Ophiostoma ulmi*) and an aggressive strain (*O. nova-ulmi*). The disease entered the country on shipments of unpeeled veneer logs from Europe. Dying American elms were first observed in Cleveland, Ohio, in May 1930. The disease spread through eastern forests from three infection centers and had spread through most of country by 1977. Dutch elm disease has proven to be the most devastating shade tree disease in the United States. Although trees with good tolerance to DED have been found, very little is known about the mechanisms of tolerance. Some forest populations, however, still contain large American elms, about 29 inches dbh and greater. (Schlarbaum et al., 1997).

Gypsy Moth

The gypsy moth, *Lymantria dispar*, is one of North America's most devastating forest pests. The species originally evolved in Europe and Asia and has existed there for thousands of years. In 1868 or 1869, the gypsy moth was accidentally introduced near Boston, MA. About 10 years after this introduction, the first outbreaks began. Attempts to eradicate the moth ultimately failed and since that time, the range of gypsy moth has continued to spread.

In spite of the recent declines in the Gypsy Moth populations as a result of a fungal pathogen (*Entomophaga maimaiga),* the gypsy moth will likely continue to expand its range in the future. Eventually, *E. maimaiga* may cause the gypsy moth to behave more like a native insect and less like an unstoppable invasive force. This change in behavior would result in less forest damage. But, the gypsy moth is unpredictable. Numerous environmental factors influence its population dynamics, many of which are not fully understood. *E. maimaiga* will probably not affect all gypsy moth populations the same way in a given year. In some areas gypsy moth populations will totally collapse, some areas will show a population reduction, while others show little impact on the gypsy moth population. Many areas at the leading edge of an infestation do not even harbor the fungus. It usually takes 2 to 4 years for the fungus to establish itself naturally in a gypsy moth population. The initial outbreak will have already occurred and the most severe tree mortality often results from these first defoliation events (Balser and Baumgard, 2004).

Figure 3 - 45 shows the predicted progress of the infestation. As can be seen, Gypsy Moth infestation is currently on the eastern edge of the WNF and will likely move across the Forest in the next 10 to 15 years (USDA Forest Service, 2003).



(map courtesy Virginia Tech Univ.)

Figure 3 - 45. Projected 10-year intervals with Slow the Spread Implemented.

The gypsy moth is known to feed on the foliage of hundreds of species of plants in North America, but its most common hosts are oaks and aspen.

Figure 3 - 46 shows the average defoliation by species on the Western Allegheny Plateau in 1986, which translates into the of species preference for the Gypsy Moth. Note that the most preferred species are the oaks. Therefore, it is reasonable to expect that when the Gypsy Moth infestation does arrive on the Wayne National Forest, the impact will be important since oaks are a predominant species.

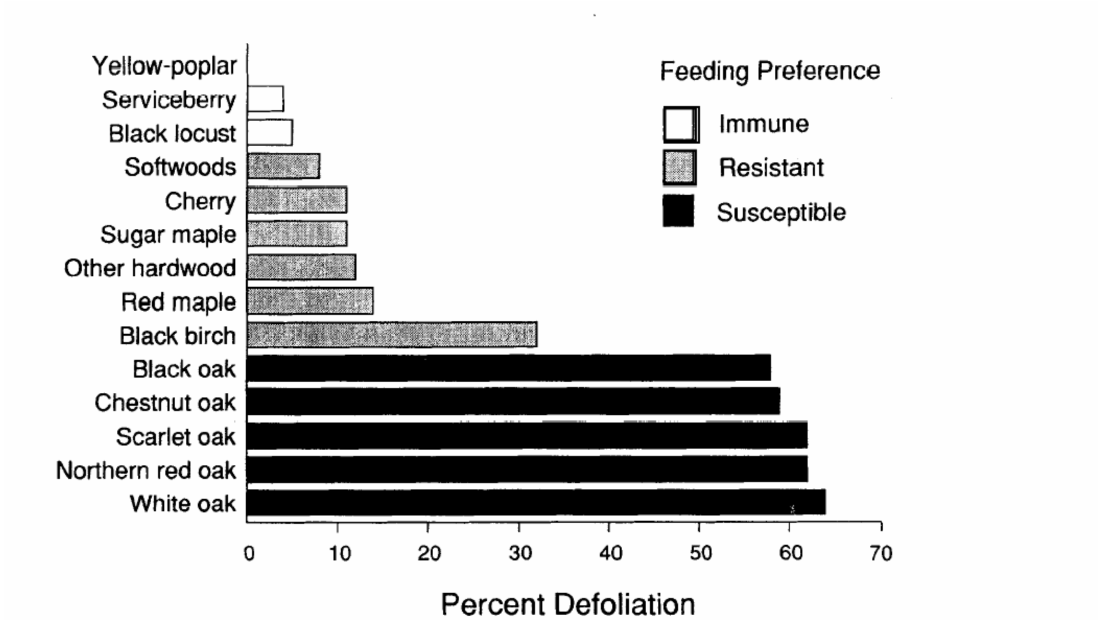


Figure 3 - 46. Average defoliation by species from gypsy moth on the Western Allegheny Plateau in 1986.

Gypsy moth populations are typically eruptive in North America; densities may fluctuate in any forest stand from near one egg mass per hectare to over 1,000 per hectare. When densities reach very high levels, trees may become completely defoliated. Several successive years of defoliation, along with contributions by other biotic and abiotic stress factors, may ultimately result in tree mortality (USDA Forest Service, 2003).

Other Insects and Diseases

An exotic beetle from Asia – the emerald ash borer (*Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae) – was discovered feeding on ash (*Fraxinus* spp.) trees in southeastern Michigan in July 2002. The larvae feed in the phloem and outer sapwood, producing galleries that eventually girdle and kill branches and entire trees (Michigan Entomological Society, 2002).

The Asian longhorned beetle (ALB) has been discovered attacking trees in the United States. Tunneling by beetle larvae girdles tree stems and branches. Repeated attacks lead to dieback of the tree crown and, eventually, death of the tree. ALB probably traveled to the United States inside solid wood packing material from China. In the United States the beetle prefers maple species (*Acer* spp.), including boxelder, Norway, red, silver, and sugar maples. Other known hosts are alders, birches, elms, horsechestnut, poplars, and willows. Currently, the only effective means to eliminate ALB is to remove infested trees and destroy them by chipping or burning. Early detection of infestations and rapid treatment response are crucial to successful eradication of the beetle (USDA Forest Service, 1999b).

Dogwood anthracnose was first reported as a disease of flowering dogwood in the United States in 1978. In 15 years, it had caused serious losses to flowering dogwood found in the forests and in ornamental plantings over large portions of the eastern and southern United States. The disease kills dogwoods of all sizes, but it is most severe on young seedlings and in understory forest dogwoods. Infection of dogwoods is most likely to occur during cool, wet weather in spring and fall, but can occur at any time during the growing season. Overall, vigorous trees tend to be less damaged than weak trees. The disease is often more severe on trees growing in full shade, and it is reported to be greatest on northeast-facing slopes and in areas where dogwood are abundant. Drought and winter injury appear to increase susceptibility. Consecutive years of infection have killed high proportions of woodland and ornamental dogwood populations (Anderson, et al., date unknown).

Other invasive species not yet documented on the Wayne, but their existence seems inevitable include beech bark disease and hemlock wooly adelgid.

Direct and Indirect Effects

Non-native invasive plant species tend to invade and establish in areas where disturbance has occurred. Disturbance in the form of vegetation removal, canopy opening, or soil exposure, coupled with the introduction of non-native seed, creates ideal conditions for NNIS success. Once established, NNIS can continue to spread along established corridors such as roads, trails, and streams where continued disturbance provides favorable conditions for establishment and transportation. NNIS propagules are able to travel on people, vehicles and machinery, animals, birds, wind, water, and fire. People spread NNIS by transporting propagules on clothing, shoes, camping gear, and recreational equipment. Vehicles and machinery transport NNIS on undercarriages and tires (Westbrooks, 1998; Parendes and Jones, 2000; Lonsdale and Lane, 1994). Animals and birds move NNIS in their hair/feathers, hooves, or by passing seeds through their digestive tracts. Dependent on the species, non-natives can also be dispersed by wind, rain, or fire.

Shade-tolerant species, such as garlic mustard and Japanese stilt-grass, do not require disturbance, only transportation to their preferred habitats from where they are able to spread and invade the forest interior. Likewise, other species actively planted by humans, such as Japanese barberry, can spread from old home sites and cemeteries into the forest interior over time. These shade-tolerant species pose a severe threat to forest understory biodiversity.

Negative impacts of NNIS can be minimized through implementation of Forest-wide goals objectives, standards, and guidelines in the 2006 Forest Plan. Integrated pest management (IPM) methods to control and contain current NNIS infestations are emphasized in the Plan. Prevention methods are to be incorporated in project analysis, planning, implementation, and monitoring to prevent spread of current NNIS infestations and to prevent new invasions. Use of NNIS for revegetation and landscaping activities is prohibited, and use of locally adapted native species is emphasized to maintain biological diversity and health of ecosystems. Education and cooperation with adjacent landowners are also tools identified in NNIS management.

Effects of Roads and Facilities Management

Roads, as fragmenting agents, provide ideal habitat and opportunities for NNIS plant growth by increasing the amount of forest-edge habitat. Road construction, maintenance, and use provide continuous soil disturbance, act as corridors for NNIS dispersal, and contain reservoirs of propagules for future NNIS invasion (Forman and Deblinger, 2000; Parendes and Jones, 2000). Cleaning large machinery used to create roads can decrease the NNIS invasion potential during construction, but the long-term use by vehicles provides the continued opportunity for NNIS to invade and spread. Logging roads, while often short-term in use, are prime areas for NNIS invasion due to their intense use by heavy equipment that often travel between multiple areas and ownerships during logging activities.

The decommissioning of roads can reduce areas populated by NNIS over the long term. After a road is decommissioned and vehicle use prohibited, roadbeds will eventually revegetate through succession. However, the ground disturbance involved in decommissioning and the potential introduction of seed by heavy machinery could at first increase NNIS potential.

A preliminary study on the WNF suggests that roadsides provide habitat and serve as corridors for multiflora rose establishment and spread (Christen and Matlack, 2004). The preliminary data from the Wayne's NNIS inventory and mapping project on the Athens District (NRIS Terra database, housed at Supervisor's Office), along with field experience, show that non-native species have high densities along oil and gas roads, old haul roads, and other access roads. Aside from effects on the natural ecosystem (see introduction), these invaders also detract from visual quality along roadsides, which may affect tourism. The increased edge-effect created by disturbance initially allows for NNIS establishment and spread over time, but studies have shown that if the edge develops into dense vegetation, these edges can decrease the dispersal potential of NNIS into the Forest (Brothers and Spingarn, 1992; Cadenasso and Pickett, 2001). However, in many cases, non-native invasives comprise a large percentage of the species in edge vegetation and, therefore, can facilitate the dispersal of NNIS further beyond edge habitat.

Analysis of Alternatives

Miles of newly constructed road varies by alternative, and includes all roads projected for all management activities (Vegetation and Habitat, Minerals, Watershed, etc.) over the next decade (Figure 3 - 47). Those alternatives with the greatest amount of new road construction will provide the greatest potential for NNIS habitat. The acreage projected for parking lot construction is consistent across all alternatives: 10 acres over the next decade (Table 3 - 37). Miles of decommissioned road is projected to be 10 miles, or 29 acres, per decade for all alternatives. Forest standards and guidelines that minimize soil disturbance and erosion during construction will help minimize the area available to NNIS invasion and spread.

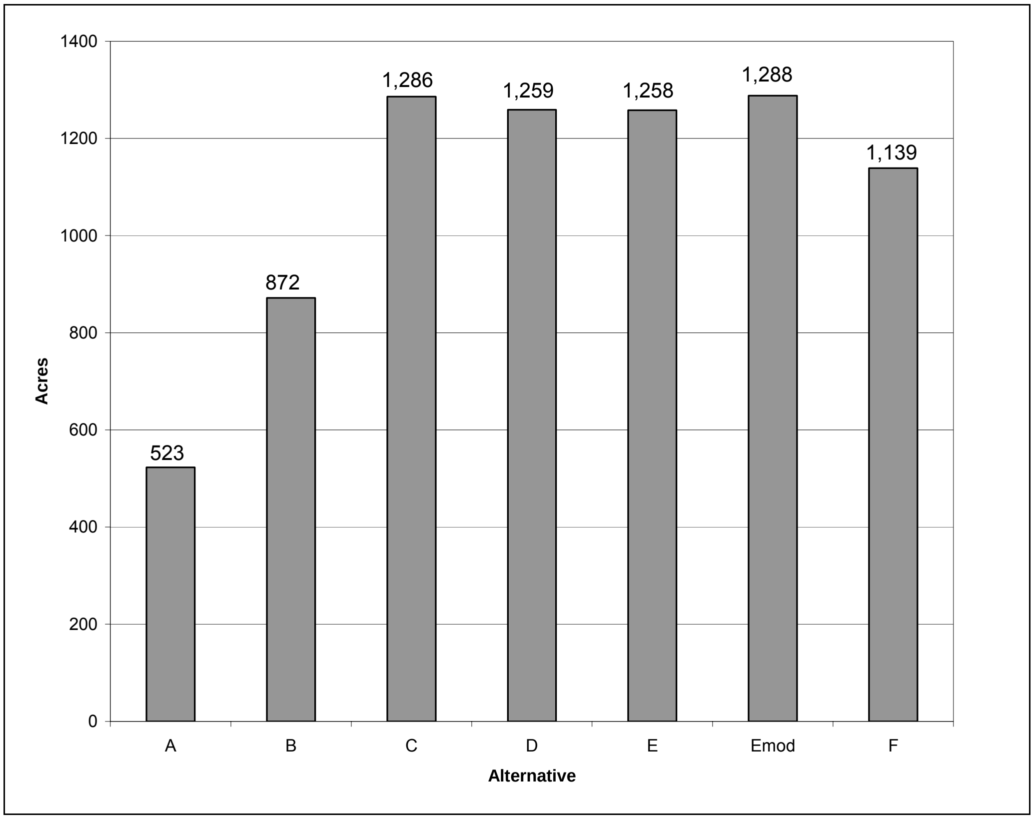


Figure 3 - 47. Total Acres of Road, Skid Trail, Log Landing and Parking Lot Construction projected for first decade.

Table 3 - 37. Measures of projected Road and Facilities Management Activities that could create potential NNIS habitat in the next decade (in acres).

	A	B	C	D	E	E Modified	F
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	317	311	311	318	284
Timber Transportation (skid trails and landings)	198	441	739	718	718	740	634
Parking Lots	10	10	10	10	10	10	10
Total Road and Facilities Disturbance	**523**	**872**	**1286**	**1259**	**1258**	**1288**	**1139**

Effects from Recreation Management

Recreational activities create soil disturbance and provide transport mechanisms that facilitate NNIS invasion and spread. Most spread occurs along roads and trails where there is concentrated soil disturbance and vectors for spread. Other recreational sites often contain bare or disturbed soil, ideal for NNIS establishment. These include trailheads, parking lots, developed and dispersed recreational sites, popular fishing locations, and other heavily used areas. NNIS are transported by vehicles, ATVs, OHMs, trailers, people and their recreational equipment, and livestock (hair, hooves and digestive tracts). Currently the Wayne has 116 miles of ATV trail, 74 miles of horse trail, 97 miles of trail shared by mountain bikers and hikers, and 61 miles of exclusive hiking trail.

Recreational vehicles, boats, and trailers can transport and introduce aquatic and wetland NNIS that can negatively impact native aquatic species.

Construction of new ATV trails will involve heavy equipment and have impacts similar to road construction (see Road section). Construction of horse, bike, and hiking trails may be constructed by hand or with heavy equipment, depending on various variables. Trails built by hand will have lower NNIS invasion potential than heavy machinery construction.

Analysis of Alternatives

In general, alternatives with the fewest miles of trails and recreational acres on the landscape would result in fewer opportunities for NNIS populations to spread across the Forest (Figure 3 - 48). Alternatives A and B propose increasing OHV trails the most (by 223 acres over the next decade) (Table 3 - 38). Likewise, the increase in all types of new trail construction would be largest under Alternatives A, B, or C.

A Forest-wide guideline (FH-15) recommends the installation and use of trailhead cleaning stations to help prevent the spread and introduction of NNIS by recreationists and their equipment.

A Forest-wide Objective (11.2h) in the Proposed Revised Forest Plan sets a goal of closing a minimum of 20 miles of illegal ATV trails per decade.

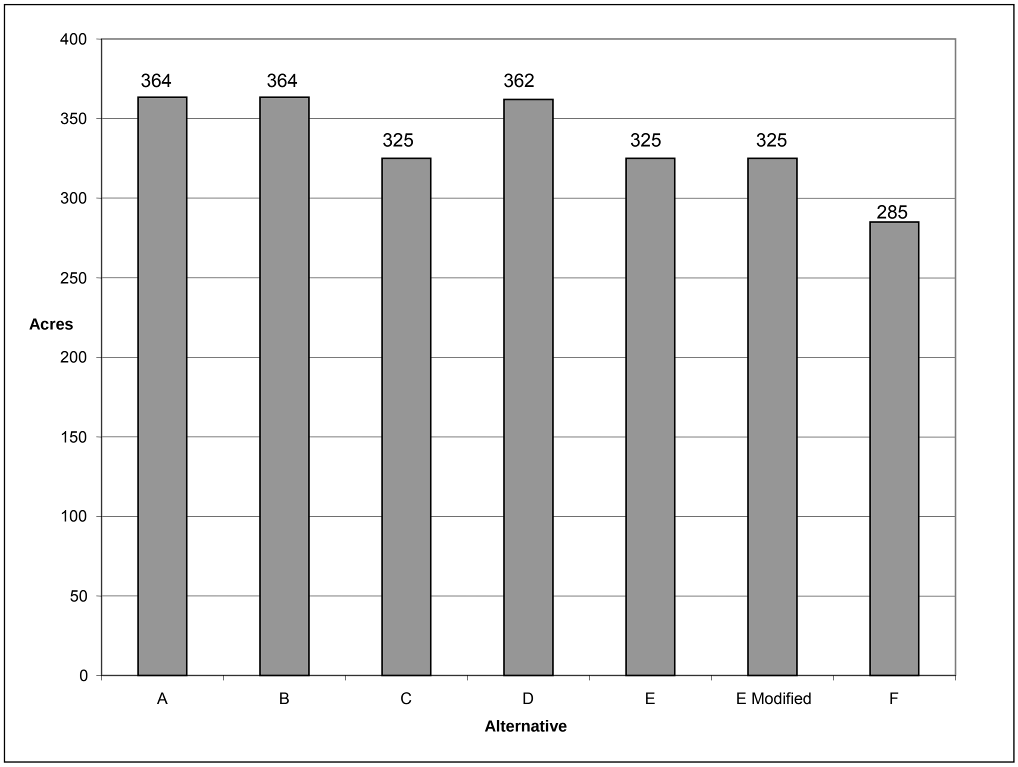


Figure 3 - 48. Total Acres of Recreation Trail and Facility Construction projected for first decade.

Table 3 - 38. Measures of *all* projected Recreation and Facilities Management Activities that could create potential NNIS habitat in the next decade (in acres).

	A	B	C	D	E	E Modified	F
ATV/OHV trails	223	223	150	187	150	150	110
Foot trails	9	9	18	18	18	18	18
Mountain bike trails	36	36	36	36	36	36	36
Horse trails	36	36	61	61	61	61	61
Recreation Facility Construction	60	60	60	60	60	60	60
Total Recreation and Facilities Disturbance	**364**	**364**	**325**	**362**	**325**	**325**	**285**

Effects from Fire and Fuels Management

Severe wildfires can remove litter and vegetation cover, resulting in bare soil and altered light regimes, all of which can facilitate NNIS invasion. Vehicles and other equipment brought from various locations to control wildland fires could spread or introduce NNIS seed.

Prescribed burns have less chance of spreading or introducing NNIS since they are often mosaic in pattern and seldom result in large areas of bare soil. Furthermore, NNIS control measures (e.g., equipment cleaning, evaluation of nearby NNIS seed sources and threat) will be addressed during project planning and implementation. However, prescribed fires still involve:

- Soil disturbing activities during fireline construction
- Vegetation and canopy reduction through burning
- The reduction of soil protecting litter.

All of these can facilitate NNIS establishment or spread.

For Ohio and the surrounding region, little is known about the role fire plays in NNIS spread. A preliminary study in southeast Ohio found an increase of tree-of-heaven after thin and burn projects, however the effects of prescribed fire on NNIS is still widely unknown (Hutchinson, et al., 2004). In the past six years (1998-2004), the Wayne has burned approximately 600 acres; however, monitoring fire effects on these areas has been limited by funding and manpower.

Fire has also been considered a tool to control NNIS, with success depending on species' biology, treatment timing, and extent of the invasive problem. Preliminary projects in the Northeastern U.S. have found that fire alone rarely solves an invasive species problem (Richburg and Patterson, 2003), rather it is used in conjunction with other management tools to increase control success. An additional 200 acres of burning for NNIS control was projected across all alternatives for the next decade, in addition to the numbers represented below, in the event fire can be used as an effective NNIS eradication tool.

Mechanical Hazardous Fuel Removal will have more potential to increase NNIS when construction of temporary trails and roads for motorized equipment access in needed (see Road and Recreation sections). In areas where work is done by ground crews, NNIS threats will be much reduced.

Analysis of Alternatives

While the amount of wildfire is impossible to predict, the projected use of prescribe fire for fuels treatment would be greatest in Alternatives A and B (Figure 3 - 6). Overall, the more acres burned by fire, the greater the chance of spreading existing NNIS populations or introducing new invasive species (Table 3 - 39). Dozer fireline construction is projected to account for 14 to 15 acres of disturbance over the next decade.

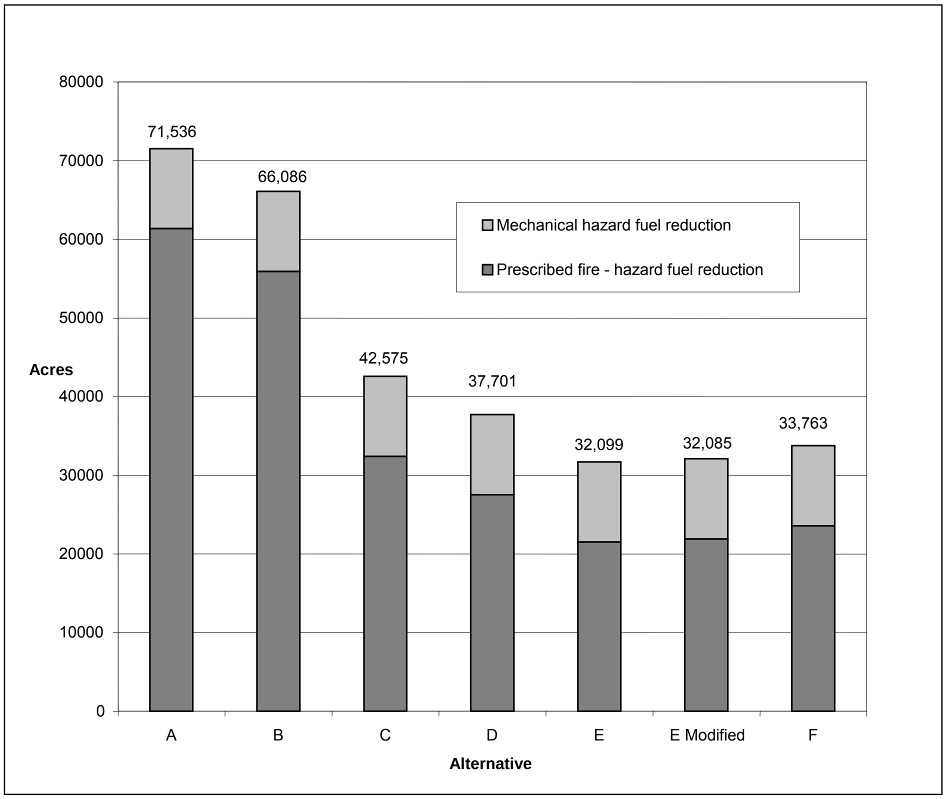


Figure 3 - 49. Total Acres of Fuels Reductions projected for first decade.

Table 3 - 39. Measures of projected fuels reduction-related activities that could create potential NNIS habitat in the next decade (in acres).

	A	B	C	D	E	E Modified	F
Prescribed fire hazard fuel reduction	61,355	55,905	32,394	27,520	21,508	21,904	23,582
Mechanical hazard fuel reduction	10,181	10,181	10,181	10,181	10,181	10,181	10,181
Dozer line construction	15	15	14	14	14	14	14
Total Fire Disturbance	**71,551**	**66,101**	**42,589**	**37,715**	**31,703**	**32,085**	**33,777**

Effects of Vegetation and Habitat Management

Prescribed fire may also be used to improve wildlife habitat, control NNIS, or regenerate oak communities. In addition to fire, various silvicultural techniques may be employed to improve habitat and maintain forest health. Prescribed fire impacts are identified above.

Timber harvesting may help spread NNIS plants through direct introduction on heavy machinery and through site alteration caused by canopy removal and earth disturbance. Movement of forest products can also spread NNIS insects and diseases. The projected acreages for transportation of timber products (skid trails, logging road, etc) are included in the Roads section of this chapter. Timber sale contracts require cleaning of equipment coming from areas known to contain NNIS populations, and may be applied to log trucks, skidders, and other off-road equipment. Reseeding efforts require the use of NNIS-free seed.

While timber harvesting can help spread NNIS plants, insects, and diseases, it can also be applied to reduce potential impacts of NNIS insects and diseases. Timber harvests are designed to increase the vigor of the residual stand and thus reduce mortality from future outbreaks of NNIS, such as the gypsy moth.

Reforestation activities primarily involve prescribed burning and handheld herbicide applications to larger trees. Acreages provided below do not double count those areas projected to be burned twice within the first decade. For burning impacts on NNIS, see the Fire Section of this chapter. Herbicide for oak stand improvement will create increased light environments within the forest. Whether invasive species increase depends on the proximity of established NNIS populations or seedbanks in the vicinity. Since heavy equipment is not used in these activities, there is little, if any, soil disturbance and lower chances of NNIS introduction.

Timber Stand Improvement (TSI) activities primarily involve crop tree releases and grape vine removal in young stands (approximately 15 years old). If these stands are dense and young, it is likely the areas have sustained a lot of disturbance in the past and established NNIS are likely to already occur. TSI improvements involve removal of trees and vines by ground crews using hand held chainsaws, not heavy equipment. While light penetration is likely to change, soil disturbance and introduction of NNIS to the areas should be minimal. Pine site preparation may require scarification of small amounts of soil to encourage pine regeneration if timber harvest and burning activities do not provide enough soil disturbance. Pine site prep will require equipment and soil disturbance and will have similar impacts as skid trails on NNIS.

Wildlife habitat improvement projects can either increase or decrease the potential for NNIS. Projects including soil disturbance and large machinery are likely to increase NNIS invasion potential, while projects that focus on native plant establishment and NNIS control could reduce NNIS and create healthier communities resistant to NNIS invasion.

Analysis of Alternatives

Tree harvesting activities and timber transport (covered in the Roads section) are the vegetation management activities with the highest overall disturbance and potential for NNIS habitat creation (Figure 3 - 49). However, Forest-wide standards and guidelines reduce the potential spread of NNIS by including NNIS-specific clauses for timber contracts (FH-8), cleaning of Forest Service field equipment between uses (FH-9), using NNIS-free mulch when available (FH-13) and encouraging the use of native species for revegetation projects (FH-11). In terms of timber harvesting, Alternative C holds the highest potential for NNIS spread and establishment followed in decreasing potential by Alternatives D, E, F, B, and A, with A having the lowest overall potential for NNIS habitat. Fewer impacts to NNIS spread would occur from TSI and reforestation activities (Figure 3 - 50).

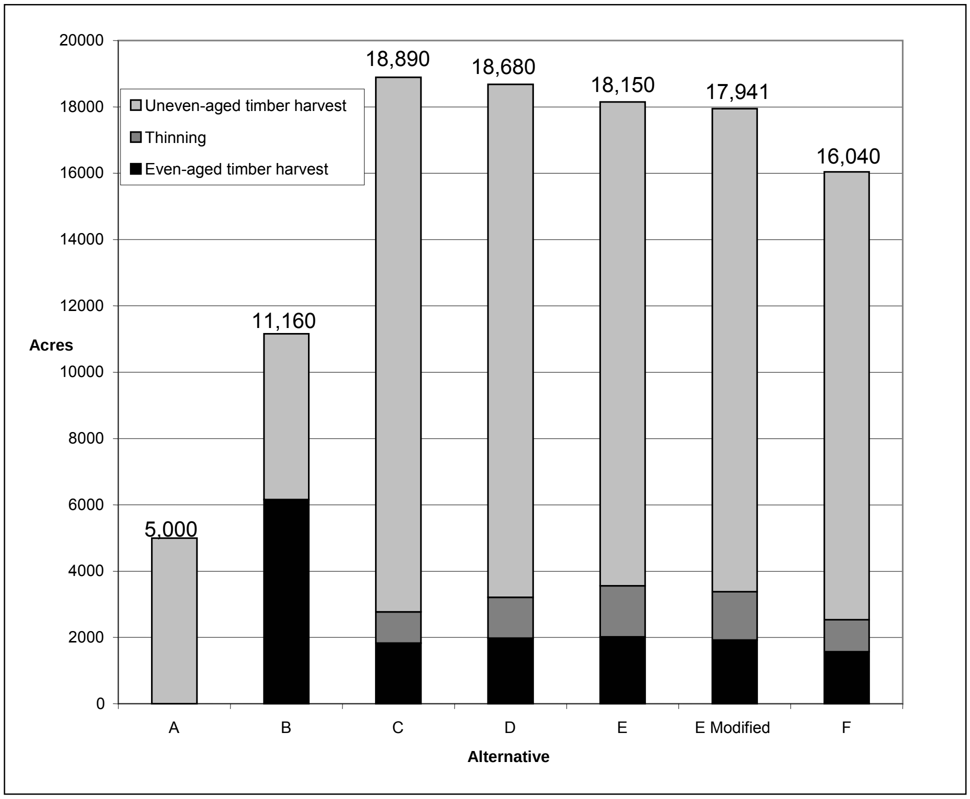


Figure 3 - 50. Total Acres of Timber Harvest projected for first decade.

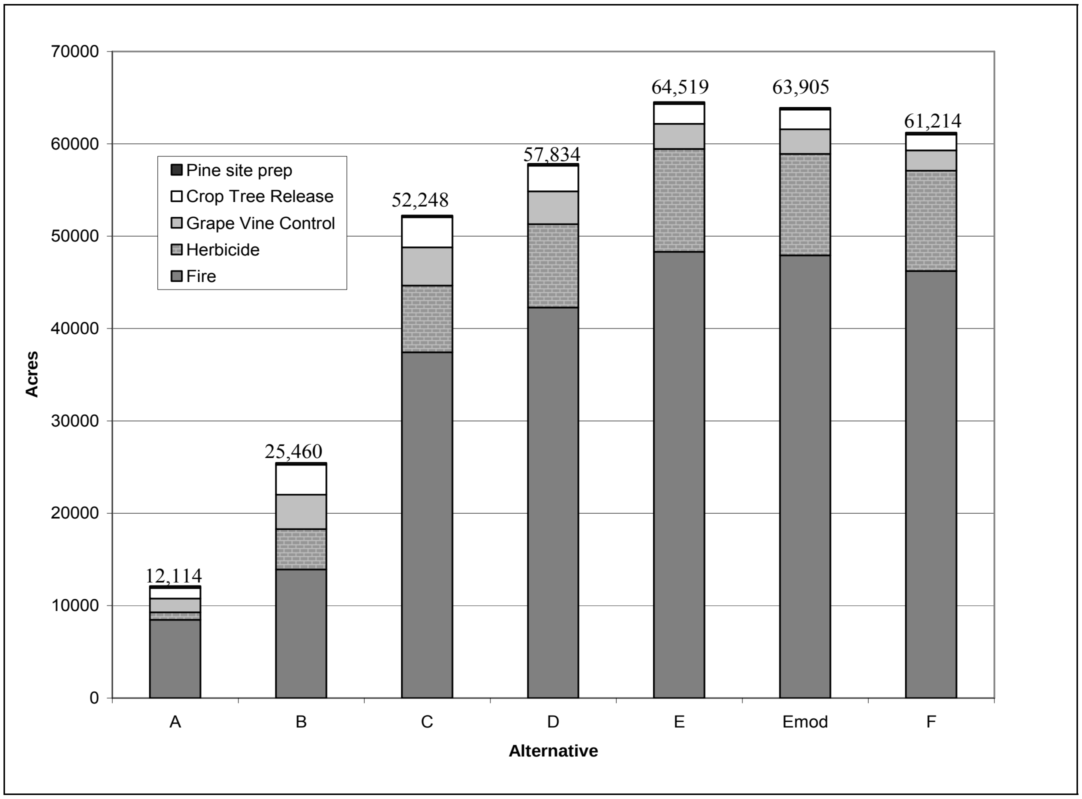


Figure 3 - 51. Total Acres of TSI, Reforestation, and Prescribed Fire for oak regeneration projected for first decade.

Table 3 - 40. Measures of projected Habitat and Vegetation Management Activities that could create potential NNIS habitat in the next decade (in acres).

	A	B	C	D	E	E Modified	F
Uneven-aged timber harvest	5,000	5,000	16,120	15,470	14,590	14,556	13,500
Even-aged timber harvest	0	6,160	1,830	1,980	2,020	1,925	1,570
Thinning	0	0	940	1,230	1,540	1,460	970
Prescribed Fire	8,464	13,914	37,425	42,299	48,311	47,915	46,237
Herbicide Application	800	4,376	7,236	9,005	11,155	10,994	10,846
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
Pine Site Preparation	200	200	200	200	200	200	200
Total Vegetation and Habitat Disturbance	**17,114**	**36,620**	**71,138**	**76,514**	**82,669**	**82,046**	**77,254**

Effects from Energy and Mineral Development

The impacts of road construction and maintenance for mineral exploration and development would be similar to those described in the Roads section. Production site preparation and pipeline installation would also create areas of disturbed soil that could invite NNIS infestation.

Analysis of Alternatives

Mineral development activities with potential to create NNIS habitat would be similar across alternatives, 1,441 acres over the next decade.

Effects from Special Uses

Utility corridor construction creates soil disturbance and potential NNIS habitat. Maintenance activities to maintain corridor accessibility prevents the natural succession of these areas and maintains open light environments preferred by many NNIS.

Special Use requests vary widely in the amount of disturbance and thus their potential for NNIS introduction and establishment. While road construction activities to provide access to private land can increase NNIS, mowing of hayfields can reduce NNIS by controlling invasive species like multiflora rose. Likewise, while grazing permits for livestock can introduce and move NNIS to new areas, livestock can also be used to control invasives like kudzu (Luginbuhl, 1996 and 1999).

Analysis of Alternatives

Utility Corridor and Special Use activities with potential to create or decrease NNIS habitat would be the same across Alternatives, approximately 100 acres over the next decade.

Effects from Land Ownership Adjustment

Land exchanges can result in the loss or gain of NNIS infestations on the Forest. Biological evaluations of the areas involved during the process include assessing the ecological values of the involved land tracts. Decisions on the land exchange take into account the biological evaluation and ecological value of the tracts involved.

Whether land acquisition will increase the potential for NNIS on the Forest depends on past uses of the property. Areas affected by disturbance (e.g., timber harvest, agricultural use) will likely have NNIS already present. If so, the land will likely be allowed to revegetate via ecological succession under Forest Service management. NNIS that require high amounts of sunlight are likely to be replaced by native species over time (Meiners, et al). Conversely, shade-tolerant species, such as garlic mustard, are likely to continue to spread if already present.

Analysis of Alternatives

Land ownership adjustments with potential to create or decrease NNIS habitat would be the same across alternatives. Acreages estimates for this activity will depend on budget and land availability. Projections total as many as 40,000 acres of acquisition, and 400 acres of exchange over the next decade.

Effects from Threatened and Endangered Species (TES) Management

Ground disturbing activities during TES management or reintroduction can increase NNIS by providing new areas for establishment or spread. Conversely, protection of TES areas, including reduced ground disturbance, can decrease NNIS potential.

Analysis of Alternatives

Acreages impacted or protected by TES would be the same across alternatives.

Effects from Soil and Watershed Management

Over the short term, an increase of NNIS would likely occur in watershed improvement areas due to ground disturbance. Likewise, since these areas often are already highly disturbed, NNIS populations that will expand and spread during construction tend to be already established. Conversely, the decrease in bare soil with watershed restoration (decrease in erosion, acid mine drainage and flooding activities) overtime could decrease NNIS establishment and spread.

Analysis of Alternatives

The acreage affected by watershed and soil management activities would the same across all alternatives, 622 acres per decade.

Summary

The management activities with the potential to create NNIS plant habitat are summarized, by alternative, in Figure 3 - 50 and Figure 3 - 51. Table 3 - 41 shows the total acres, by alternative, of management activities that have the potential to increase NNIS invasion or spread within project areas. Those activities identified as potentially increasing or decreasing NNIS potential were not quantifiable and therefore are not included in the summary. The numbers reflected below give a mechanism to compare differences among alternatives and their potential impact on NNIS on the Forest by comparing those activities that differ across alternative. The driving forces in this comparison are prescribed burning for hazardous fuel removal and vegetation management (burning and timber harvesting.)

Table 3 - 41. Management activities that may create potential NNIS habitat (in acres) by alternative.

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt. F
Roads and Facilities	523	872	1286	1259	1258	1288	1139
Recreation and Facilities	364	364	325	362	325	325	285
Fire Management	71,551	66,101	42,589	37,715	31,703	32,099	33,777
Vegetation and Habitat	17,114	36,620	71,138	76,514	82,669	81,846	77,254
Energy and Minerals	1,441	1,441	1,441	1,441	1,441	1,441	1,441
Special Uses	100	100	100	100	100	100	100
Soil and Watershed	622	622	622	622	622	622	622
Total	**91,715**	**106,220**	**117,501**	**118,013**	**118,118**	**117,721**	**114,618**

Alternatives C through F would have similar potential for NNIS spread, but slightly higher than Alternatives A and B because the highest acreage of soil disturbance and/or vegetation removal would be incorporated into Alternatives C through F. Alternative A would present the lowest potential.

Cumulative Effects for Habitat Indicator 9

NNIS will continue to spread onto NFS lands from adjacent and intermingled lands of private and other agency ownerships. Likewise, NNIS from NFS land will continue to spread to adjacent non-National Forest Service lands. Activities outside the Forest that could increase NNIS include:

- Forestry activities (timber harvesting and related activities)
- Agriculture use (farming and grazing)
- Recreation activities and construction of trails
- Road use and construction
- Commercial and private construction activities (home and commercial building, parking lots)
- Stream channelization
- Refuse facilities construction and use
- Mineral developments (coal mining, strip mining, oil and gas drilling).

While some of these activities are similar to those that occur on the Forest, some are activities not seen on NFS land. Also, while similar activities may occur on the Wayne as well as private lands, often the amount and methods can vary. An example is differing road densities on NFS land in contrast to other ownerships.

The 2006 Forest Plan contains Forest-wide objectives (7.2a and 7.2b) that encourage working with adjacent land owners to identify areas of NNIS infestation and to coordinate treatment and monitoring of NNIS.

Habitat Indicator 10: Amount of NFS lands allocated to management areas that allow timber harvesting

Timber harvesting is a management tool used to regenerate oak, hickory, other hardwoods, and pine species and to alter the structure of one or more forest stands. Depending on the methods used, timber harvesting mimics some of the conditions created by natural disturbances such as small wind events, floods, ice storms, and tornadoes. Natural succession and disturbances are allowed to occur on portions of the WNF. On other portions of NFS land, timber harvesting may be used to ensure adequate habitat is available for species of viability or conservation concern or for species of public interest, such as wild turkey or ruffed grouse, and to improve and maintain forest health.

Timber harvesting is broken into two broad harvest method categories: even-aged and uneven-aged management.

- Even-aged management produces a mosaic of different-aged forest stands. Locations of different-aged stands change continually through time as mature stands are harvested, middle-aged stands grow to maturity, and young stands grow to older age classes. 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. Even-aged management includes thinning as well as the clearcut, shelterwood regeneration, and two-age methods.

  Thinning – Some trees in a stand are removed to reduce the density of trees on the site and to encourage healthier and larger individual trees.

  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 seed and create forest floor light conditions favorable for seedling development.

Two-aged – Regenerates a timber stand and maintains two age classes.

- An uneven-aged stand has trees of three or more distinct age classes, either mixed throughout the stand or in small groups. Uneven-aged management includes single-tree selection and group selection methods.

Single-tree Selection – The act of harvesting single trees or small clumps of trees to achieve and maintain a specific diameter distribution and create a new age-class of tree regeneration.

Group Selection – 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 two acres in size. It creates small openings in the canopy.

The forest communities on the WNF today generally grew from clearcut timber harvests over the last 200 years. A combination of land clearing for agriculture, mining, and charcoal production for iron furnaces meant the forested land was cleared one or more times after 1800.

Current Condition

Timber harvesting has been used on the Wayne to produce early successional habitat as well as to improve diversity of forest stand structure. Currently, uneven-aged management and thinning are the only timber harvest methods available for use to treat forest stands (refer to Amendments 11 and 13 of the 1988 Forest Plan).

Direct and Indirect Effects Common to All Alternatives

Some type of timber harvesting is incorporated into each alternative as a habitat management tool which will affect plant and animal habitat diversity. These effects will vary by site, timing, duration, intensity, and type of management activity. Activities associated with timber harvest that can also affect plant and animal habitat diversity include road reconstruction, temporary or permanent road construction, skid road and landing development, timber stand improvement, and herbicide application.

In general, the direct effects of timber harvest, tree felling, and equipment use, include disruption of nests and animal activities. There is potential for mortality, mainly among individual plants and small, relatively immobile animals such as amphibians, nestling birds, or mammalian young. Other animals, including adults of most species, would vacate an area during such disturbance. In addition to direct mortality, loss could occur during the breeding season if nests or young are abandoned due to the disturbance. The structural diversity of the forest stand and forage quality and quantity may be indirectly affected by timber harvesting.

Even-aged management would directly reduce the amount of mature and overmature forest. A forest stand generally requires about 60 to 80 years to attain mature characteristics, depending on whether it is pine or hardwood. Each newly regenerated stand, in time, reverts to mature woodland after passing through various stages of succession. Wildlife diversity also changes through time on each treated site as plant succession progresses.

While habitat for species requiring mature forest may be modified, habitat is created or enhanced for species that satisfy part or all of their life requirements in brushy-young forest. Even-aged management is beneficial for a variety of shrub and early forest species (e.g., yellow-breasted chat and ruffed grouse), and is a primary tool used to regenerate oak and hickory. Rich et al. (2004a) point out that certain Neotropical migratory birds with declining population trends benefit from the creation of early successional forest habitat. Furthermore, there are indications that certain forest interior Neotropical migratory birds use early successional forest habitat for feeding between the time the young fledge and the birds leave for their wintering grounds, including the cerulean warbler and worm-eating warbler (Vitz 2003). Even-aged management methods that retain trees in the harvest unit (e.g., clearcut with reserves, shelterwood, and two-age) can provide habitat for both early successional species, as well as some species typically associated with mature forest (Annand and Thompson, 1997; Rodewald and Yahner, 2000).

Uneven-aged management will reduce the number of trees per acre, temporarily resulting in a more open stand structure below the forest canopy. The canopy is temporarily changed from a dense, closed condition that provides almost 100 percent shade to a more open canopy through which some sunlight reaches the forest floor. Periodic removal of selected trees maintains vertical diversity in canopy structure.

Indirect effects of uneven-aged management include changes in light penetration to the forest floor and increased diversity of stand structure where the canopy was opened. Increased sunlight to the forest floor allows more vigorous growth of tree seedlings, shrub species, and herbaceous plants. This may be adverse for plants and animals that prefer shaded, open understories, but may benefit some animals that reproduce or feed in the understory or shrub layers. As an example, Kilgo et al. (1999) concluded that group-selection harvests provided food sources for songbirds during fall migration, including insectivorous species that apparently shift their diet preferences to fruit during the fall. Changes in stand structure may result in short-term changes in the mature forest avian community, especially if trees in the understory and shrub layer are removed (Rodewald and Smith, 1998). Stands that are treated with uneven-aged timber harvesting methods eventually grow back to a closed canopy, often with greater structural variation than before harvest.

Timber stand improvement includes crop tree release and grapevine control. Crop tree release involves the girdling or felling of smaller-sized trees (usually less than 6 inches dbh) to create enhanced growing conditions for specific trees, often mast-producing species. Crop tree release indirectly benefits future mast production and the species that depend on mast for food. It may also indirectly benefit species which utilize smaller snags for roosting or perching. Grapevine control includes the cutting of some grapevines that may be adversely affecting the growth of certain trees, especially mast-producing trees. Some vines are cut, while others are left in each stand to provide soft mast for wildlife.

Herbicide application to control competing species is confined to the stump or base of the tree bole, but drift could result in direct effects to nearby understory or shrub layer plants. These effects would be minimized because herbicide application would adhere to label directions and requirements. The indirect effects of herbicide application are a reduction in shade tolerant tree species and an increase in oak-hickory regeneration. Species which depend upon oak-hickory mast would benefit, but the benefits may not be seen for a few decades until the trees mature and begin producing acorns and nuts.

Permanent roads, temporary roads, skid roads and log landings are needed for timber harvesting activities. A larger road system is generally needed for areas treated with uneven-aged timber harvesting. Construction or reconstruction activities may result in the direct mortality of plants and less-mobile animals, and the loss of plant and animal habitat. Changes can occur in understory vegetation along the road and in adjacent forest stands because of increased sunlight. For example, species like blackberry and other fruit producing shrubs may flourish, thereby benefiting animal species which rely on these plants for food or cover. Certain native plant species, some of which are rare, can grow and even thrive in disturbed, open edge habitats along roadsides. Roads can indirectly provide a means for dispersal of non-native invasive plant species and increased herbivory by grazing wildlife (e.g., deer).

Timber harvesting and roads used to manage the forest stands can result in habitat fragmentation, or in other words, they can create a greater number of habitat patches that are smaller in size than the original contiguous tract of habitat. Even-aged management may fragment mature, contiguous forest until the stand once again reaches a successional stage that is no longer an ecological barrier to interior mature forest species (Rosenberg et al., 2003). The effects of habitat fragmentation vary by species or species group, however. Roads have been implicated as creating a barrier to species movement such as small mammals, which in turn affects the gene flow among populations (summary in Conrey and Mills, 2001). Data indicate that the relative abundance of forest interior Neotropical migratory birds is not reduced along narrow forest roads less than 24 feet in width. Rich et al. (1994b) inferred that most of these species do not react to narrow forest dividing corridors as they would forest fragmentation.

Even-aged management and roads create habitat edge, which can indirectly increase local plant and animal diversity. For example, Rodewald and Brittingham (2002) noted that flock size and species abundance in flocks of fall migrating birds were greatest in forest edges, possibly due to higher food availability (i.e., arthropods and fruit), vegetation structure, or microclimate conditions. However, habitat edge can reduce habitat quality and quantity for certain species, including Neotropical migratory forest interior songbirds. Edge-related effects of increased nest predation and nest parasitism have been implicated in reduced nesting success of some forest interior bird species. 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). As an example, nest parasitism by brown-headed cowbirds has been negatively correlated to the percentage of forest cover at the landscape scale, possibly because cowbird populations may be limited by availability of foraging areas than by host availability (Robinson et al., 1995). The WNF lies within a heavily forested landscape where 80 percent of all lands within the proclamation boundary are covered by forest (Landsat TM, 1994). Dettmers (1997) found that parasitism rates of forest breeding songbirds on the Wayne were lower than rates documented in the western parts of the Midwest.

Effects that Vary by Alternative

Fifteen management areas are integrated into the alternatives; eight of these management areas would contain prescriptions for timber harvest as a plant and animal habitat management tool. These management areas include: Diverse Continuous Forest (DCF), Diverse Continuous Forest with OHVs (DCFO), Forest and Shrubland Mosaic (FSM), Forest and Shrubland Mosaic with OHVs (FSMO), Grassland and Forest Mosaic (GFM), Historic Forest (HF), Historic Forest with OHVs (HFO), and River Corridors (RC).

All alternatives would allow for plant and animal habitat to be managed to some degree with timber harvesting (Figure 3 - 52). Alternatives A and B would allocate 87.8 percent of NFS land to management areas that prescribe timber harvesting for purposes of plant and animal habitat management. On the other end of the spectrum, Alternative F would allocate a greater amount of NFS land to management areas that favor natural succession and natural disturbance; therefore it would allocate the least amount of NFS land (71.4%) to management areas that prescribe timber harvesting for purposes of plant and animal habitat management. Alternatives C, D, E, and E Modified would allocate fewer acres of the Forest to management areas that allow timber harvesting for plant and animal habitat management than Alternatives A and B, but more acres than Alternative F.

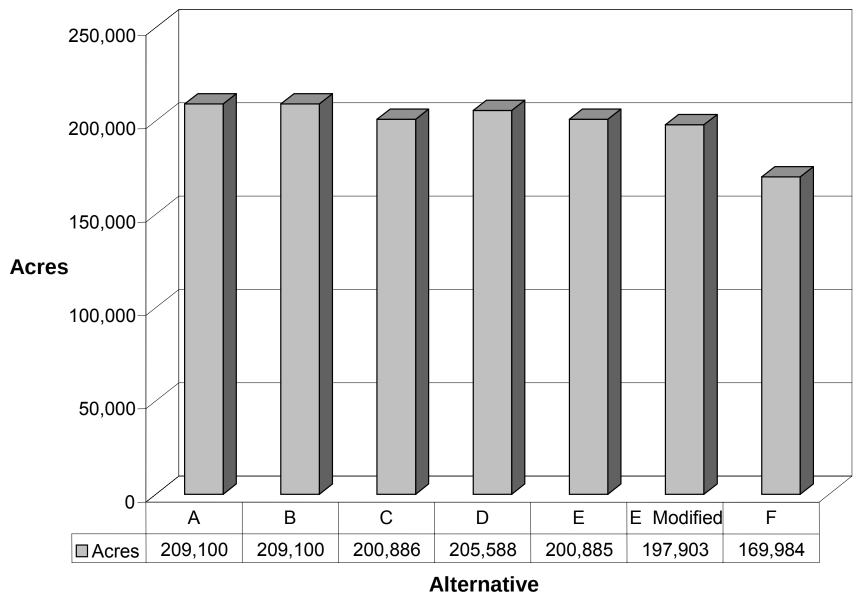


Figure 3 - 52. Acres of NFS land allocated to management areas that include timber harvest as part of plant and animal habitat management.

Cumulative Effects for Habitat Indicator 10

A historical overview of timber harvesting and forest change within the Wayne National Forest proclamation boundary, the cumulative effects analysis area, is provided in Appendix D of this DEIS. The cumulative effects of past timber management and removals have created the forests now present. The species composition, age class distribution, and product outputs of today are the results of past management activities that occurred during the last century.

The forests within the WNF proclamation boundary are managed in a variety of ways and by a variety of landowners, including the Ohio Division of Forestry, Ohio Division of Wildlife, MeadWestvaco Corporation and private landowners. Forests are managed to ensure forest health and to provide quality wildlife habitat in areas like Dean State Forest, Cooper Hollow Wildlife Area, Zaleski State Forest, and other

State-managed properties. A primary goal of MeadWestvaco Corporation is to supply fiber to its Chillicothe, Ohio mill in two forms – hardwood pulp and softwood pulp.

Approximately 80 percent of the lands within the WNF proclamation boundary are forested. Extrapolating the results of an Ohio-wide survey of private forest landowners (Birch, 1994) suggests that it is possible that some type of harvest activity could occur on up to 45 percent of the private forest land in the cumulative effects analysis area over the next decade. Timber harvesting on NFS land would affect only small amount of the forested land in the cumulative effects analysis area over the next decade: Alternative A (0.9%), Alternative B (2.1%), Alternative C (3.2%), Alternative D (3.1%), Alternative E (2.9%), Alternative E Modified (2.8%), and Alternative F (2.6%). The cumulative effects of managing forest habitat on NFS land to improve plant and animal habitat are outlined in the cumulative effects section for Habitat Indicators 1 through 6. The economic effects of timber harvesting on the WNF is described in Appendix K of this Final EIS.

Issue Indicator 11: Amount of NFS lands allocated to prescribed fire and mechanical fuels reduction

Prescribed fire is a management tool used to restore or improve plant and animal habitat, return the land to historic conditions, and reduce hazardous fuels. Periodic, low intensity fire is one tool that will maintain quality habitat for grassland-obligate species by reducing the encroachment of woody vegetation (Ewing, 2003b). It will reduce canopy and midstory canopy cover in oak barrens where plant species need open canopy conditions (Bender, 2000). Officials in the Great Smoky Mountains National Park have successfully used prescribed fire to enhance rare plant populations; the prescribed fire decreases leaf litter and duff, stimulates flowering, or reduces individual diseased plants (Rock, 2000). Blackberry, blueberry, persimmon, flowering dogwood and chokeberry are examples of soft mast (i.e., an important nutritional source for many animals) that has been shown to increase two to five years after prescribed fire (Weaver, 2000). Fire will also enhance the success of oak regeneration on drier sites (Van Lear et al., 2000; Dolan and Parker, 2004).

In the central hardwood forest, the climate warmed and became drier 5,000 to 8,000 years ago, and frequency of fire increased. Native American peoples utilized fire to clear forest from around their camps, clear brush for improved hunting, and for better visibility to protect against enemy attacks (Fralish, 2004). Fire was a disturbance process that historically occurred in oak-dominated ecosystems in Ohio (Hutchinson et al., 2003; Sutherland et al., 2003). For example, fire scar analysis of Vinton County, Ohio, oaks that originated in the mid-1800s, after European settlement but prior to fire suppression efforts, suggested that fires occurred when the tree cambium was dormant, from August to mid-April, but most fires occurred during March and April (Sutherland, 1997). The fire scars indicated that annual fires were unusual and low intensity fires occurred at this site every 3 to 4 years. It was unusual for a more than 12 years to pass between fires. Major fires occurred about every 7 to 8 years at this study site.

Fire is incorporated into the seven alternatives as a management tool to help control non-native invasive species, maintain or improve herbaceous and shrubland habitat, regenerate oak and hickory, and to reduce hazardous fuels.

Affected Environment

Over 90 years of fire suppression has resulted in changed ecological conditions, less forest cover in fire-tolerant species (oaks and hickories), and increasing presence of fire-intolerant and shade tolerant species (maples, yellow popular, etc.). Additionally, heavy leaf litter, downed timber, and denser undergrowth are resulting in fuel loads three to five times heavier than historical norms.

Forest managers now recognize that a “natural” fire regime, a general definition of the role fire would play across a landscape in the absence of modern human mechanical intervention, would include an influence similar to Native American burning. Five natural (historical) fire regimes are classified based on the average number of years between fires (fire frequency) combined with the severity (amount of replacement) of fire on the dominant overstory vegetation. The classification system includes the following five fire regimes:

I – 0 to 35 year frequency with low (surface fires most common) to mixed severity (less than 75% of the dominant overstory vegetation replaced)

II – 0 to 35 year frequency with high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced)

III – 35 to 100+ year frequency and mixed severity (less than 75% of the dominant overstory vegetation replaced)

IV – 35 to 100+ year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced)

V – 200+ year frequency and high (stand replacement) severity.

Fire Regime Condition Classes (FRCC) are used by Federal land management agencies, particularly the Forest Service, as a qualitative measure to describe the degree of departure from historically normal ranges. The current condition of key ecosystem components, such as species composition, structural stage, canopy closure, and fuel loadings define these three classes:

Condition Class 1 – Within the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency, severity, and pattern; and other associated disturbances.

Condition Class 2 – Moderate departure from the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency severity, and pattern; and other associated disturbances.

Condition Class 3 – High departure from the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency, severity and pattern, and other associated disturbances.

Most of the Wayne National Forest is in Condition Class 2 and Condition Class 3. This indicates a moderate to high level of alteration. Fuel types have changed since the year 1800, with the most recent change occurring over the last 80 years with the suppression of nearly all fires. Vegetation mapping and descriptions of historical natural communities reveal that the forest land was generally characterized by open woods comprised of fire-adapted trees with herbaceous and grassy understories (Fuel Model 2, fine herbaceous fuels, litter and dead downed wood from the shrub and timber overstory). These evolved to dense closed oak canopies (Fuel Model 9, leaf litter with a minimum fuel loading of approximately 4 tons/acre) as fire was excluded.

Historically, frequent fires burned at low intensities through grass/herb fuels. The current Fuel Model 9 on the Forest is estimated to be around 10 to 12 tons/acre. This is based on data generated from control fuel plots installed on the Ironton District in 2003 and on the experience of WNF fire personnel. Increased fuels contribute to higher-intensity wildfires, often with potentially catastrophic effects to timber, homes, and wildlife.

The net effect of the alteration of historic fire return-intervals has increased fuel accumulations above historic levels over large, continuous areas. Apart from the ecological consequences, the possible impacts of this, coupled with the increase of the wildland/urban interface, include the following threats:

- Increased risk of large, severe fires
- Increased risk of serious injury or loss of life to firefighters and the general public
- Increased risk of health effects due to smoke and visibility impairment
- Increased risk of property loss and damage to landscapes that have economic value to people
- Increased fire suppression costs.

Reintroduction of fire is proposed for a number of ecological reasons and to reduce the probability of adverse impacts of wildland fire on public land and adjacent private land and structures. The area where public forest land and private homes and communities come together is commonly referred to as the Wildland Urban Interface (WUI). Nearly the entire Wayne National Forest can be classified as WUI, containing at-risk communities. Development pressure in the WUI is increasing, making management of wildland fire risk on the Wayne a higher priority.

Community developments occur throughout the entire land-holdings of the WNF, as NFS ownership is currently just over 28 percent of the area within the proclamation boundary. Homes and farms interspersed with the Forest would benefit directly from fuel reduction projects on NFS land.

Late-winter through early-spring (i.e., the dormant season) is the primary prescribed fire period on the Wayne, although late-fall offers some opportunity for burning. The Forest Service has used prescribed fire to treat 608 acres of NFS land since 1998 (Figure 3 - 53). These prescribed fires were conducted to improve terrestrial plant and animal habitat and to reduce hazardous fuels. These prescribed fires have occurred on the Athens Unit and the Ironton Ranger District.

The Forest Service's Northeast Forest Experiment Station has conducted prescribed fire research in southeastern Ohio, and some research plots are located on NFS land (Sutherland et al., 2003). The plots are burned at varying frequencies to study the effects of fire to oak regeneration and to forest plant and animal resources.

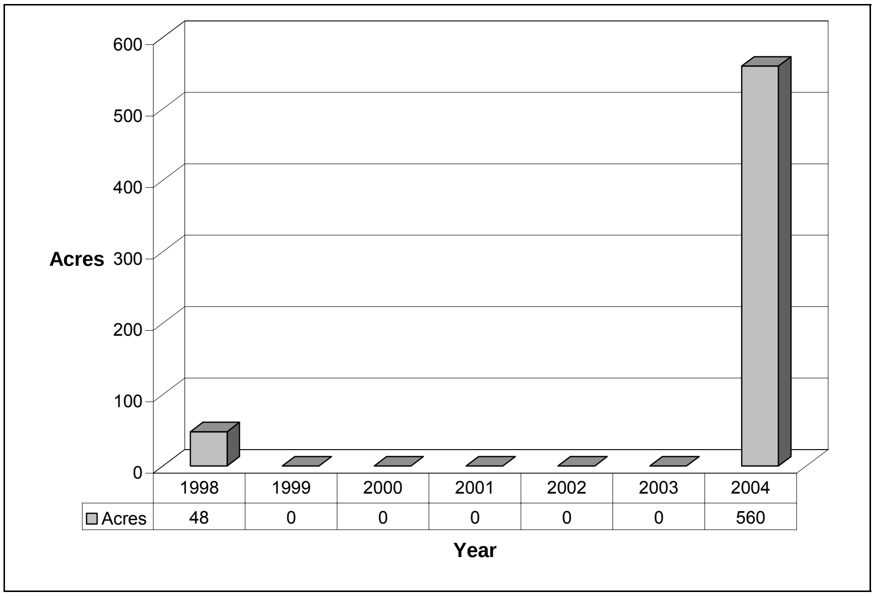


Figure 3 - 53. Acres of NFS lands treated with prescribed fire, 1998-2004.

Direct and Indirect Effects Common to All Alternatives

Fire played a role in the development and maintenance of the oak-hickory forests in the central hardwoods region in the past. However, some researchers (e.g., Kalisz and Powell, 2000) caution that the complexity of ecosystems make fire-effects difficult to understand and predict. Ongoing research studies in southeastern Ohio and the central hardwoods region have provided the following information about the direct and indirect effects of prescribed fire on plant and animal habitat diversity.

Direct Effects

Flames may cause direct injury or death to herbaceous or woody vegetation depending upon when during the year the fire is conducted, the intensity of the fire, and the structural characters of the vegetation (e.g., thickness of tree bark) (Hutchinson and Sutherland, 2000). Some to all of the unconsolidated leaf litter and fine woody material on the forest floor may be consumed within the burn area. As temperature at the forest floor surface increases temporarily, mortality of organisms living in the litter-humus interface may occur (Boerner, 2000). And, less mobile, ground-dwelling animals may be injured or killed.

Any fire, wildland or prescribed, creates smoke. Emissions created by prescribed fire are now subject to Federal Clean Air Act requirements, including standards for regulation of regional haze and the recent revisions to the National Ambient Air Quality Standards (NAAQS) on particulate matter. Additionally, the Ohio Department of Natural Resources/Division of Forestry and the Ohio Environmental Protection Agency require permits and waivers for open burning.

A burn plan is completed before each project burn and must contain provisions for proper smoke transport and dispersal. Direction of smoke, dispersion indices, and transport winds are essential in planning these operations.

Indirect Effects

According to Boerner (2000), transfer of heat to the unburned humus and upper soil layers may induce mortality of soil organisms, especially where concentrations of woody debris continue to smolder. Data suggest that soil animals (e.g., springtails, mites) are more likely to be affected if they are within the litter rather than the mineral soil, but these animals appear to be able to repopulate an area after periodic prescribed fire. Fires conducted annually on the same site may reduce the abundance of these organisms. While few data exist, the same pattern appears to be true for the microbial community (e.g., fungi, bacteria); recolonization of burned areas occurs, but microbial abundance is lower where lengthy smoldering occurred.

Hutchinson and Sutherland (2000) reported that long-term studies of forest communities subjected to prescribed fire show the understory 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. Light availability to the understory may increase slightly during the growing season, soil nutrients and pH may increase from litter ash, and soil moisture may decrease due to increased evaporation.

Prescribed fire may reduce the amount of leaf litter and shrubs in the understory over the short term, leading to a short-term loss of suitable habitat for ground nesting bird species such as the ovenbird and worm-eating warbler or shrub nesters like the hooded warbler. This, in turn, may lead to decreased abundance of these species, a change in bird species composition, and the potential for lowered reproductive success over the short-term (Aquilani et al., 2000; Artman et al., 2001).

Prescribed fire may enhance the abundance and diversity of hard mast (e.g., acorns) and soft mast (e.g., blackberry, persimmon, and flowering dogwood) (Weaver, 2000). These foods are important to many birds and mammals, including the black bear. Prescribed fire, used to discourage the growth of some woody vegetation in grassland and prairie habitats, will encourage production and flowering of some native grasses and forbs.

Construction of firelines, either by hand or by machine, may affect plant and animal habitat diversity. Leaf blowers and rakes are used to manually remove the litter layer from the ground to create a barrier that helps contain the fire. Removal of the litter likely displaces insects and other invertebrates to adjacent areas but should have no long-term effect on the understory vegetation. Mechanized equipment is used to construct firelines in certain cases, primarily on old roads where trees have grown up or in areas where firefighter safety demands a larger firebreak. While care is taken to uproot only trees and remove the litter layer, at times upper soil layers may be removed and placed off-site. In addition to displacing organisms, revegetation of such sites may take longer relative to areas where non-mechanized construction of firelines occurred.

Prescribed fires are considered low intensity fires, and thus, short-term and small-scale increases in surface runoff to streams could occur with consumption of ground vegetation. Until revegetation occurs, transport of sediment and nutrients to nearby streams could increase. Nutrients in the litter, vegetation, and soil can be redistributed by leaching of the ash layer and soil. Surface erosion, or solution transport, can then carry them into a stream. Within a short time, elevated nutrient levels subside as revegetation occurs. While the effects of nutrient concentration on aquatic habitat are not well known, levels appear to be below toxic thresholds for aquatic animals (Swanston, 1991). Sediment entering stream courses could settle out onto stream substrates or could remain suspended in the water column, both of which could ultimately affect aquatic productivity or diversity if the source of sediment persists. Forest-wide standards and guidelines incorporated into all six alternatives would minimize the potential for sediment transport to stream channels by ensuring the use of filterstrips when mineral soil may be exposed during fireline construction. Guidance is also provided on using streams as natural firebreaks rather than constructing firelines and for installing erosion control measures on firelines where necessary to control potential soil erosion. In addition, there is guidance that encourages mosaic pattern burning, where mesic areas and riparian areas experience only spotty burning. In such instances, more ground vegetation remains, providing more filtering capacity for sediment and nutrients.

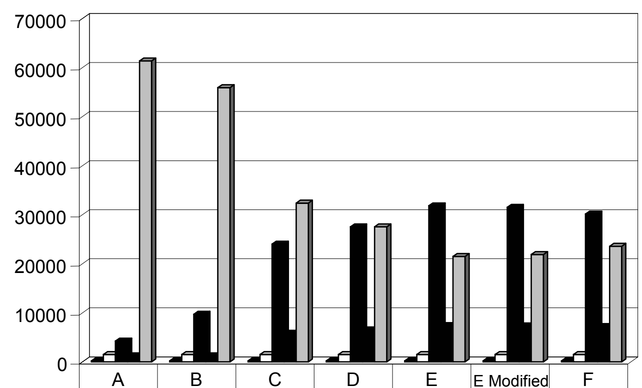
Smoke generated from prescribed fire may indirectly be of concern to:

- Obscured vision on highways, railroads, airports and commercial waterways
- Public health, particularly for residents near fire operations or where smoke may drift
- Firefighter safety and health

- Nuisance issues, such as odor and soiling effects of smoke
- Visibility protection for wildlands and parks.

Effects that Vary by Alternative

All alternatives incorporate prescribed fire as a management tool. Appropriate prescribed fire days are limited each year and to certain times of the year to minimize potential adverse effects to plants and animals. For these reasons, every alternative sets an annual upper limit of 6,982 acres that may be treated with prescribed fire. However, the alternatives vary in the amount of prescribed fire that would be used to manage various resources.



	A	B	C	D	E	E Modified	F
NNIS	200	200	200	200	200	200	200
Herbaceous-Grassy Habitat	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Oak-Hickory Regeneration (One Burn)	4,259	9,709	24,021	27,518	31,807	31,511	30,159
Oak-Hickory Regeneration (Two Burns)	1253	1253	5852	6541	7402	7352	7189
Hazardous Fuels	61,355	55,905	32,394	27,520	21,508	21,904	23,582

Figure 3 - 54. Acres of NFS lands projected to be treated with prescribed fire during the first decade of the planning period.

Habitat and Vegetation Management

Land managers and researchers are studying how non-native invasive plant species react to various control measures, including prescribed fire. Growth of some non-native invasive plant species may become more vigorous after fire. In some cases, however, if used in conjunction with other management tools, prescribed fire may be useful in controlling some non-native invasive plants species (Bennett, 2003). A minimal level of prescribed fire (i.e., 200 acres/decade) is included in the first decade projections for treatment of non-native invasive species.

Certain plant species of viability concern respond favorably with fire, such as the yellow gentian (Larson, 2003), Carolina thistle (McCartney and Swiezynski, 2003), and juniper sedge (McCartney and Goodwin, 2003).

Similarly, some common plants and animals benefit from prescribed fire in permanent forest openings or other herbaceous-grassy habitats. For these reasons, a minimal amount of prescribed fire (1,500 acres/decade) is projected in each alternative to improve herbaceous-grassy habitat.

The acreage of NFS lands projected to be treated with prescribed fire to encourage the regeneration of oak and hickory species, and to some degree pine species, will vary among the alternatives. Alternatives A and B include the least amount of prescribed fire for this purpose, while alternatives C through F incorporate more prescribed fire. Alternatives C through F contain the HF and/or HFO management areas, and the prescription for these management areas calls for prescribed fire to help reduce shade tolerant tree species in the understory. Forest communities in these two management areas would likely be treated with prescribed fire twice in the first decade to mimic typical fire regimes that occurred prior to fire suppression efforts in the early 1900s. The density of the understory and shrub layers is likely to be lower in areas treated with two prescribed burns in one decade than in those treated with just one. Habitat for ground dwelling or shrub nesting species may be reduced with such changes to the understory and shrub layer (Artman et al., 2001).

Fuels Reduction

The Healthy Forest Restoration Act, passed by Congress in December of 2003, promotes treatments to reduce fuel loading on lands in or adjacent to the WUI of at-risk communities and other at-risk Federal lands. The term "at-risk communities" implies that homes and other developments are in very close proximity to wildlands and the untreated fuels that exist outside of historical ranges of FRCC 1. The WNF seeks to work in collaboration with communities to set priorities and, as appropriate, develop Community Wildfire Protection Plans. Through programs such as Firewise, an initiative of the Forest Service sponsored by the National Association of State Foresters, homeowners and residents of WUI communities are instructed to fireproof their dwellings and other improvements. Private citizens can also employ many tactics used by the Forest Service to reduce fuel loads.

The public can access *Firewise* programs through the Website: www.firewise.org. Information is also delivered via television, radio, newspapers, and other media. Fire personnel also visit communities and distribute literature telling residents how to protect themselves. The following are examples of tactics that can be used to reduce risks from wildland fire:

- Defensible space around homes and structures
- Shaded fuel breaks
- Fuels reduction beyond defensible space

- Removal of slash, including piling and burning, mulching, grinding, etc.
- Prescribed fire
- Home maintenance and design to help reduce structural exposure and resistance to fire.

Mechanical reduction of hazardous fuels by large fuel removal, bush-hogging, and lop and scatter methods would remain the same regardless of alternatives. Dozer line construction would be slightly less due to minor road and skid trail construction through the 10-year planning cycle for Alternatives C through F. These roads and trails could then be used for potential fire lines for any prescribed fire action. Dozer line construction throughout all alternatives would be minimal and reclaimed to Forest standards. Though mechanical treatment by any means other than removal will impact potential fire behavior, the fuel loading would remain the same.

Figure 3 - 44 shows the predicted acreage of NFS land that may be affected by prescribed burn and mechanical fuels reduction treatments by alternative. Treatments in any one year may be higher or lower than the average.

Table 3 - 42. Predicted fuels reduction activities for the first decade (shown in acres unless otherwise noted).

Management Activity	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt. F
Prescribed Fire for Oak Regeneration *	6,764	12,214	35,725	40,599	46,611	46,215	44,537
Maintenance of Permanent Forest Openings and other Herbaceous Habitats (Mechanical)	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Maintenance of Permanent Forest Openings and other Herbaceous Habitats (Prescribed Fire)	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Control of Non-Native Invasive Species-Prescribed Fire	200	200	200	200	200	200	200
Reduction of Hazardous Fuels - Prescribed Fire	61,355	55,905	32,394	27,520	21,508	21,904	23,582
Reduction of Hazardous Fuels - Mechanical	10,181	10,181	10,181	10,181	10,181	10,181	10,181
Dozer Line Construction	15	15	14	14	14	14	14

* A portion of these prescribed fire projects include acres that are burned twice in one decade.

Alternative A

This alternative, the "no-action" alternative which represents the current Forest Plan, calls for the highest amount of fuel reduction prescribed fire target over the 10-year planning period. It also projects the least amount of fire for vegetative management. Thus, to move the forest's fuel load towards Condition Class 1, especially in areas that are most critical in the WUI, fuel reduction efforts would need to focus primarily on strategic targets, especially high-hazard areas. The burning provided for in this alternative, although beneficial for wildlife and botanical needs, would be funded and carried out primarily to protect communities and any Federal properties at risk. Also, fireline construction using dozers would be a bit more likely in this alternative than in Alternatives C through F.

Alternative B

This alternative would provide for nearly double the amount of vegetative management found in Alternative A. Still it would be only a modest change from the 1988 Forest Plan. Therefore, the amount of hazardous fuel reduction targeted would be second highest among the six alternatives. The amount of burning to protect at-risk communities would still be very high. Moving forest acreage towards Condition Class 1 would still depend greatly on funding for fuel reduction. Fireline construction using a dozer would be slightly higher in Alternative B than in Alternatives C through F.

Alternative C

Compared to the "no-action" alternative, funding for reduction of hazardous fuels to protect at-risk communities would be nearly halved in this alternative. However, more burning would occur for silvicultural treatments, and the associated benefit of fuel reduction would still be realized, just more economically. Because more hazardous fuels would be treated through vegetation management, funding from strictly hazard fuel reduction accounts could focus on the most critical WUI areas.

Alternative D

This alternative calls for only half the burning purely for hazard fuel reduction as would the no-action alternative. However, a significant number of acres would be burned for vegetative management. Accordingly, fuel reduction funds for social needs would have to target fewer acres.

Alternative E

This alternative would target the fewest acres for purely hazard fuel reduction, but it projects the most acreage for vegetative management burning. Alternative E (and Alternative E Modified) would include the most acreage in the Historic Forest Management Area, possibly moving the Wayne into Condition Class 1 and toward the historic range of variability. This alternative would not focus on the WUI as much as the previous alternatives, and the target acreage in the WUI for purely hazard fuel reduction needs is smallest of any alternative. It would force Forest managers to identify criteria to evaluate degrees of wildfire risk for individual communities.

Alternative E Modified

This alternative would target the fewest acres for purely hazard fuel reduction, but it projects the most acreage for vegetative management burning. Alternative E Modified (and Alternative E) would include the most acreage in the Historic Forest Management Area, possibly moving the Wayne into Condition Class 1 and toward the historic range of variability. This alternative would not focus on the WUI as much as the previous alternatives, and the target acreage in the WUI for purely hazard fuel reduction needs would be the smallest of any alternative. It would force Forest managers to identify criteria to evaluate degrees of wildfire risk for individual communities.

Alternative F

This alternative proposes burning the third fewest number of acres strictly for fuel reduction. It also calls for the third highest amount of burned acres under various vegetative management treatments. With fuel reduction acres on the lower end of the scale, these treatments would need to focus on the communities most at-risk. Though fuels would be reduced by vegetation management burning, coincidental fuel reduction for the most at-risk WUI areas could be minimal.

Smoke and particulate matter should be the same throughout all alternatives, as the burned acreage remains the same whether the land is burned for biological or purely fuel reduction reasons.

Cumulative Effects for Habitat Indicator 11

Beneficial cumulative effects would result for the uses of prescribed fire to improve terrestrial plant and animal habitat and to control NNIS (i.e., about 1,700 acres of NFS land affected during the first decade), since little to no prescribed fire is used for these purposes on private and State lands within the WNF proclamation boundary. The cumulative effects of using prescribed fire in combination with other silvicultural methods to regenerate oak communities are addressed in the Cumulative Effects section for Habitat Indicators 1 through 6.

In terms of fuels reduction, the Forest Service, working in concert with communities at-risk, can minimize the potential for losses from wildland fires by reducing fuels in the WUI, but decades may be required to achieve these goals. Estimating the monetary losses for communities affected by wildland fire would be difficult. New homes, industrial projects, and farming operations in the future should adhere to modern methods of architecture and defensive space requirements to prevent losses from wildland fire.

Smoke from prescribed fires adds to air pollution from all other sources. As long as fires conform to prescription, however, smoke should not result in non-conformance with air quality standards, and public exposure to smoke should be minimal and sporadic. Project-level mitigation should ensure proper lofting, dilution, and transport of pollutants from populated areas. Any visibility concerns should be short-term and not a continuing problem for any area. Additionally, some wildlife species are sensitive to smoke, and proper smoke mitigation methods in such cases would be addressed at the project level.

Smoke has a cumulative effect on the health of firefighters participating in these operations, and further studies in this area are ongoing. Research also continues on the development of practical and effective dust/smoke masks for wildland firefighting. Beyond smoke, literally hundreds of compounds are emitted by fires, but they are found in very low concentrations. Compounds of concern would be:

- Carbon monoxide can cause serious health effects, such as dizziness, nausea, and impaired mental functions, but it becomes a matter of concern for people in close proximity to fire (including firefighters). Blood levels of carboxyhemoglobin tend to decline rapidly, to normal levels, after a brief smoke-free period.
- Benzo(a)pyrene, anthracene, benzene, and numerous other components found in smoke can cause headaches, dizziness, nausea, and breathing difficulties. They are of long-term concern because of cancer risks associated with repeated exposure to smoke.
- Acrolein and formaldehyde are eye and upper respiratory irritants to which some segments of the public and firefighters are especially sensitive.

Recreation Opportunities

Affected Environment

Introduction

National Forests provide over 191 million acres of public land within the United States. The Wayne National Forest, the second largest supplier of public recreation lands within the State of Ohio, and the largest in southeast Ohio, with approximately 238,000 acres. The WNF provides a variety of unique natural settings for outdoor recreation and includes a wide array of dispersed and developed recreation opportunities within those settings.

Opportunities that the Wayne is well positioned to provide include: camping, picnicking, swimming, boating/canoeing, fishing, hunting, driving for pleasure, off-highway (OHV) vehicle riding, horseback riding, mountain biking, hiking, wildlife viewing, nature study, gathering forest products, natural, cultural, and historic education and interpretation, etc.

In an effort to find the Forest's recreation niche, the WNF recently examined the variety of recreation opportunities it was currently providing and compared it to opportunities that other Federal, State, local, and private organizations in the southeast Ohio region were offering. As a result, the Wayne identified and selected two recreation opportunities that formed the key components of its recreation niche. They include: OHV trail riding and interpreting of heritage/cultural sites. These two activities are what the Wayne is best positioned to provide. This does not imply that the Forest would stop providing other recreational opportunities. However, by clearly identifying what unique forms of recreation the WNF is best suited to provide, we can ensure that the opportunities which give the forest identity and value are sustained.

Discussion related to OHV opportunities is found in the Recreational OHV Use section of this Final EIS. Heritage and cultural interpretation is discussed in the Heritage section of this document.

Market Area

Market areas are established for National Forests to better evaluate public demand for recreation opportunities. In the Recreation Feasibility Study completed for the WNF in 2003, researchers defined the Forest's market area as within two-hours drive (approximately 100-mile radius) of the recreation site. A two-hour driving distance from one of the units of WNF includes much of Ohio and parts of West Virginia and Kentucky. The four urban areas that lie within this circumference and that were examined in the Recreation Feasibility Study are Columbus, Cincinnati, and Cleveland, Ohio, and Charleston, West Virginia (SRG, 2002).

Opportunities for outdoor recreation are not limited to the National Forest within the market area. Other lands such as Army Corp of Engineers, State forests, parks, and wildlife management areas, private industries and organizations, and municipalities also serve to connect and expand the range of recreation opportunities.

The Ohio Department of Natural Resources (ODNR), the largest supplier of public recreation lands in the State, manages approximately 387,000 acres of State parks and forests distributed throughout Ohio. A majority of those lands are available for public recreation (SRG, 2002). Many of the State parks offer highly developed overnight lodging facilities, water-based recreation opportunities such as swimming, fishing, boating, and water skiing, including dispersed recreation. In contrast, many recreation opportunities offered on a majority of private industry and organization lands are dispersed forms of recreation such as hunting, nature-viewing, hiking, and other non-motorized trail use.

Recreation Supply

Recreation Opportunity Spectrum (ROS)

Recreation opportunities can be analyzed according to the types of recreation experiences available. The Recreation Opportunity Spectrum (ROS) is used as a framework for establishing recreation setting and capacity for each of the Forest's management areas. ROS classes represent a spectrum of settings that provides visitors with an array of experiences. These experiences range from a high probability of solitude and recreational challenge to a very social experience where recreational challenge is relatively minor. The differing acreage available for the various ROS experiences can be used to compare the proposed alternatives. (See the Glossary for a description of each ROS objective.)

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. ROS is also used is to describe a set of recreation management objectives or desired future recreation settings, which are referred to as ROS class objectives. (See the Glossary for a description of ROS class objective.)

To help set the stage for discussion of the existing (inventoried) and desired future (proposed objective) ROS opportunities, it is important to examine the 1988 Forest Plan's ROS projections.

Implementing management activities prescribed in the 1988 Plan would not produce Primitive (P) or Urban (U) ROS acres. However, approximately 4,000 acres of Rural (R), 26,800 acres of Semi-primitive Non-motorized, 68,800 of Roaded Natural Non-motorized (RNNM), 77,200 acres of Roaded Natural (RN) and 4,000 acres of Rural (R) settings are projected. RNNM areas were areas with moderate to high road density but where motorized forms of recreation were not allowed (Management Areas 2.2 and 3.3). When the 1988 Forest Plan was being developed (1988), the Forest was trying to define areas for OHV recreation. RNNM areas were established to help the public understand where OHVs were and were not allowed (even if an area contained high a number of roads).

The 2004 ROS inventory combined RNNM with RN areas for two reasons:

- A clear OHV management footprint is now clearly defined on the forest and is generally understood by the public so there is no longer a need to set aside RNNM areas and
- Travel routes in RNNM and RN areas have been essentially managed the same – roads within both ROS areas have been closed

to motorized use if there was not a need to keep them open. This is not likely to change in the Revised Forest Plan.

The 2004 ROS inventory identified three ROS settings on the WNF. They range from those that provide visitors with opportunities for solitude in an environment with limited evidence of human impacts to intensely social settings in highly developed environments. These ROS settings include: Roaded Natural, Rural, and Urban. Neither Primitive nor Semi-primitive Non-motorized characteristics were then found on the Forest. Table 3 - 43 compares the 1988 ROS inventory and the 2004 (existing) ROS inventory acreage.

Table 3 - 43. Comparison of 1988 Forest Plan ROS projections and 2004 ROS inventory.

ROS Objectives	1988 ROS Inventory Est. Acres	2004 ROS Inventory Est. Acres	2004 ROS % of Total Forest Acres
Primitive	0	0	0
Semi-primitive Non-motorized	26,800	0	0
Semi-primitive Motorized	0	0	0
Roaded Natural Non-motorized	68,800	0	0
Roaded Natural	77,200	144,470	61
Rural	4,000	91,881	38
Urban	0	1,702	1
Total	176,800	238,053	100 %

Source: WNF ROS Inventory from GIS, 2004 and Forest Plan DEIS, 1988

Compared to the 1988 ROS inventory, the existing inventory shows a shift in acres and percentages toward more developed ROS objectives. The Forest trend continues to show no acres for Primitive and SPNM, while the RNNM areas have shifted toward RN. Additionally, an estimated 91,881 acres of RN has shifted toward the Rural ROS objective while approximately 1,702 acres have shifted toward the Urban ROS objective. Some reasons for the shift toward the more developed ROS objectives may be the acquisition of lands that contained more developments such as roads and/or the ROS inventory criteria used for the 1988 Forest Plan may have differed slightly from the 2004 ROS inventory. Thus, the result of this analysis does support the public’s claim for the need for more Primitive or SPNM areas.

Also in 2004, the WNF evaluated its land to determine if any area met the national criteria for Roadless/Wilderness areas. (See Appendix C for a complete discussion of the Forest’s Roadless/Wilderness evaluation and results). Roadless/Wilderness areas have similar characteristics found in Primitive and SPNM ROS objectives. However, no areas on the Forest were found to meet roadless or wilderness definitions.

Developed Recreation

The Forest provides for a mix of developed recreation facilities such as campgrounds, picnic areas, beaches, boat launches, interpretive sites, and observation sites. Table 3 - 44 displays the total number of developed recreation sites available on each Ranger District.

Table 3 - 44. Summary of developed recreation sites on the WNF.

Ranger Districts	Total # of Tent Camp Units	# Group Camp Units	# RV Camp Units	# of Single Picnic sites	# of Family Picnic sites	Picnic Shelters	Swim Sites	Boat Launch	Canoe Launch	Observation Sites	Interpretive Sites
Athens	74	3	45	6	4	5	0	2	3	0	2
Ironton	81	1	46	3	3	3	1	2	0	1	1
Totals	**155**	**4**	**91**	**9**	**7**	**8**	**1**	**4**	**3**	**1**	**3**

Source: WNF District Offices and Infra Database

Lake Vesuvius and Leith Run recreation areas were developed to be all-inclusive recreation destinations. These highly accessible recreation areas typically receive the highest concentrated recreation use on the Forest, especially during the summer recreation season. Both recreation areas are predominantly operated by concessionaires.

Smaller, less developed campgrounds can be found throughout the Athens District, primarily on the Marietta Unit along the Covered Bridge Scenic Byway (State Highway 26).

Dispersed Recreation

As developed campgrounds fill up on weekends during the summer, visitors are displaced, often to dispersed recreation areas. Many other visitors choose a dispersed setting for their desired activities or experiences. They include areas of concentrated use to semi-primitive areas relatively void of human sounds or influences. The general emphasis for dispersed recreation sites on the Forest is to maintain a natural appearance. Some specific dispersed activities include driving for pleasure, OHV riding, horseback riding, hiking, wildlife viewing, nature study, gathering forest products, hunting, canoeing, fishing, etc.

Dispersed recreation sites contribute approximately 295,778 or 30 percent of the Forest's total Persons at one Time (PAOTs). This value, however, does not include the number of visitors that may participate in such activities as hunting, fishing, gathering forest products, wildlife viewing, pleasure driving, or other dispersed recreation activities.

Trail riding, especially off-highway vehicle riding, is becoming one of the more popular dispersed recreation activities on the Wayne. Of the 349 miles of trails on the Forest, approximately 288 miles of trails were developed to accommodate multiple user groups. These trails are designated as OHV/mountain bike/hiking, equestrian/mountain bike/hiking, equestrian/hiking, or mountain bike/hiking. Table 3 - 45 displays the miles of trail available by each trail use type.

Table 3 - 45. Miles of WNF trails by administrative units.

Units	Hiking	Equestrian	Mountain Bike	ATV/OHM	Total Miles
Athens Totals	129.4[1]	19.4	70.0[2]	70.0	129.4[1]
Marietta Totals	90.7[1]	12.3	90.7[3]	0	90.7[1]
Ironton Totals	129.0[1]	42.7	46.0[2]	46.0	129.0[1]
Forest Totals	**349.1**	**74.4**	**206.7**	**116.0**	**349.1**

[1] Trail miles may be shared with mountain biking, ATV/OHM, and/or equestrian use.

[2] Trail miles shared with ATV/OHM use.

[3] Trail miles shared with hiking.

Source: WNF District Offices and Infra Database

Motorized Trails

See "Recreational OHV Use" section in this Final EIS.

Non-motorized Trails

Mountain bike and horseback riding accounted for less than five percent of trail use on the Wayne between 1998 and 2003. Trail use information related to hiking is unknown because the Forest does not charge fees for this activity. However, based upon the 2002 WNF Recreation Feasibility Study, the need for additional equestrian trails (19.4%), hiking trails (17.3%), and mountain biking trails (13.3%) were among the top six requests from local and statewide users. Additionally, one of the top issues discussed the March, 2003, Ohio Trails Partnership (OTP) Symposium was the need for Federal and State agencies as well as local governments to provide more non-motorized trail opportunities. OTP is a statewide consortium of equestrian, hiking, and mountain bike enthusiasts that promotes opportunities for non-motorized trail use.

Other Dispersed Recreation

According to ODNR's record of annual license sales, the demand for fishing and hunting licenses has gradually declined over the last decade. For the twelve counties surrounding the Wayne, fishing license sales experienced a drop of 23 percent, while hunting license sales dropped 5.8 percent between 1988 and 2000.

Recreation Demand

Recreation demand is a complex relationship between people's desires and preferences, availability of time, price, and availability of facilities. The evaluation of current and future demand for recreation on the WNF is based on recent surveys that identify and quantify:

- Estimated number of current recreation visits to the WNF.
- Current participation rates for recreation activities within the forest market area.
- Future recreation demand/trend based on projected population growth.

Current WNF Recreation Visits

The 2003 National Visitor Use Monitoring (NVUM) effort by the Forest Service has provided baselines for estimating current use of recreation sites on the Wayne. (See Table 3 - 46) These numbers account only for people visiting developed or dispersed sites for the purpose of engaging in a recreation activity. They do not include the millions of people that simply drive through the Forest.

Table 3 - 46. Annual WNF recreation use estimate.

Visit Type	# of Visits	80 % Confidence Interval
Recreation Site Visits[1]	598,626	15.9
National Forest Visits[2]	548,409	15.4

Source: WNF National Visitor Use Monitoring Report, 2003

[1] Recreation Site Visits – As visitors were visiting the WNF, some visited more than one recreation site while on the Forest. The total reflects these multiple site visits.

[2] National Forest Visits – Estimated number of visits to the WNF Day Use Developed Sites (DUDS), Overnight Use Developed Sites (OUDS), and General Forest Areas (GFA) in 2003.

Recreation use on the WNF for fiscal year 2003 at the 80 percent confidence level was 548,409 National Forest visits +/- 15.4 percent. There were 598,626 site visits, an average of 1.06 site visits per national forest visit. (Note**:** Several major recreation facilities and activities on the Forest were impacted by the draining and reconstruction of Lake Vesuvius and closure of its surrounding recreation areas for the past three recreation seasons.) These major forest areas were not open to the public during the survey year resulting in recreational use that was lower than usual. (NVUM, 2003)

The Forest sold approximately 43 mountain bike trail permits and 257 horse trail permits during the 2003 trail season, which accounts for one and two percent of total permit sales respectively. There is no charge for hiking on the Wayne, and therefore, visitor use information related to this activity is not available.

Recreation Activities' Participation Rates

Both long and short-term past trends point to continued growth in outdoor recreation across all segments of the population, some more than others. (Ken Cordell – Outdoor Recreation Participation Trends Website, Ch. 4, 2003) Many studies have shown that this upward trend can be directly or indirectly attributed to several factors. These factors may include but are not limited to growth in the national, regional, and local population; a shift in the population's age (i.e., Baby Boomers getting older with more free time to recreate); the greater need to spend quality time with family and/or get away from job-related demands and stress; and more people achieving higher levels of education which translates to jobs with higher income and more disposable income to spend on recreation activities.

Results of the 1994 National Survey on Recreation and the Environment (NSRE) show that 94.5 percent of Americans 16 years of age or older participated in at least one or more forms of outdoor recreation. That is almost 19 out of 20 people or approximately 189 million participants nationwide. (K. Cordell – Outdoor Recreation in the United States: Results Website, Ch. 2, 2003)

Table 3 - 47. Comparing local, State, regional, and national outdoor recreation trends by percentage of population.

Recreation Activities	Area Rec Users [g](2002)	Regional Midwest NSRE (1994/95)	National NSRE (2000)	National NSRE (1995)	National NSRE (1983)	% of National Change [f]83'-2000
Nature Viewing/Sightseeing	79	NA	38.2/108.6	54.1/113.4	21.2 / 81.3	+80.2% / +33.6%
Hiking	70	68.2	69.8	47.8	24.7	+ 182.6 %
Picnicking	64	52.2	118.3	98.3	84.8	+ 39.5 %
Swim/ Beach	59	53.4	94.8	78.1	56.5	+ 67.8 %
Visit Historical Site	53	43.9	46.3	44.1	NA	NA
Jogging	42	23.9	NA	26.2	NA	NA
Lodge	36	NA	NA	NA	NA	NA
Boating	35	31.8	76.7	58.1	49.5	+ 54.9%
Fishing	33	31.5	67.9	57.8	60.1	+ 12.9 %
Tent Camping	27	21.7a	25.8	28.0	17.7	+ 45.8 %
Tour Bike	24	31.4b	39.7c	3.2c	NA	NA
Off Road Vehicle	18	12.6	35.0	27.9	19.4	+ 80.4 %
Recreational Vehicle	14	NA	NA	8.6	NA	NA
Mountain Bike	13	NA	21.5	28.6	NA	NA
Hunt/Trap	12	11.3	20.9	18.6	21.2	- 1.4 %
Shooting	12	NA	NA	NA	NA	NA
Horseback Riding	10	6.8	23.1	14.3	15.9	+ 45.3 %
Backpacking	9	5.4	27.9	15.2	8.8	+ 217.1 %
Rock Climbing	5	3.3	NA	3.7	NA	NA

Source: Information in columns 1-3 came from SRG Wayne National Forest Recreation Feasibility Study; Information in columns 4-6 came from Ken Cordell's book – "Footprints on the Land", p. 218.

[a] Numbers in the tent category for regional and national data refer to developed camping, which may include campers in recreational vehicles.

[b] Numbers for tour biking regionally refer to all biking and may include mountain biking.

[c] Numbers for tour biking in NSRE 2000 refer to long distance biking.

[d] Numbers for tour biking in refer to all biking and may include mountain biking.

[e] Number for mountain biking in NSRE 94/95 refer to all biking and may include mountain biking.

[f] Percentage of change is from National NSRE 1983 to National NSRE 2000.

[g] Area recreation users represent the four urban areas surveyed in the SRG's 2002 WNF Recreation Feasibility Report.

According to the Forest's 2003 NVUM report, participation rates for three of the top seven outdoor recreation activities on WNF essentially supports the regional and national trends as shown in Table 3 - 47. They include: viewing nature and wildlife, OHV use, and hiking. The other top visitor activities were relaxing, picnicking, driving for pleasure, and fishing. (See Table 3 - 48) Forest visitors participating in many of these popular recreation activities favor doing them in the more natural and remote settings that can be found in Roaded Natural and Semi-primitive Non-motorized ROS objective. (Note: The results of the NVUM activity analysis DO NOT identify the types of activities visitors would like to have offered on the national forests. It also does not tell us about displaced forest visitors – those who no longer visit the Forest because the activities they desire are not offered.)

Table 3 - 48. WNF activity participation and primary activity.

Activity	% Participating	% as Primary Activity
Developed Camping	4.8	1.2
Primitive Camping	5.7	0.3
Backpacking	3.7	2.9
Resort Use	0.2	0
Picnicking	14.4	6.0
Viewing Natural Features	68.0	0.4
Visiting Historic Sites	3.8	0
Nature Center Activities	3.3	0.1
Nature Study	6.5	0
Relaxing	62.3	5.0
Fishing	21.7	18.5
Hunting	5.2	4.7
OHV Use	54.9	50.9
Driving for Pleasure	14.4	3.8
Snowmobiling	0	0
Motorized Water Activities	0.1	0.1
Other Motorized Activity	0.2	0
Hiking / Walking	20.4	5.1
Horseback Riding	1.2	1.0
Bicycling	1.2	0.8
Non-motorized Water	0.4	0
Downhill Skiing	0	0
Cross-country Skiing	0	0
Other Non-motorized	1.9	0.7
Gathering Forest Products	2.9	0
Viewing Wildlife	68.2	<.1

Source: WNF National Visitor Use Monitoring Report, 2003

Note: The "Primary Activity" column totals more than 100% because some visitors chose more than one primary activity.

Projected Population Growth

Population trends for southeast Ohio and the 12 counties surrounding the WNF for the previous decade (1990-2000) show mixed results. Hocking, Vinton, and Noble counties sustained both the most annual increases and the highest percentage change for population increase. (See Table 3 - 49) In contrast, Monroe and Scioto Counties had a population decline for the same period. However, the overall population for the 12-county area showed a slight increase of 15,595 persons, which is below the State average growth rate of 4.6 percent (SRG, 2002).

Table 3 - 49. Population trends for the 12 counties surrounding the WNF.

Athens Area	Total Population & Percent Change			
County	**1990**	**2000**	**1990-2000 Pop. Change**	**1990-2000 % Change**
Athens	59,549	62,223	2,674	4.50%
Hocking	25,533	28,241	2,708	10.61%
Morgan	14,194	14,897	703	5.00%
Perry	31,557	34,078	2,521	8.00%
Vinton	11,098	12,806	1,708	15.40%
Total	141,931	152,245	10,314	7.27%
Marietta Area	**Total Population & Percent Change**			
County	**1990**	**2000**	**1990-2000 Pop. Change**	**1990-2000 % Change**
Monroe	15,497	15,180	-317	-2.05%
Noble	11,336	14,058	2,722	24.01%
Washington	62,254	63,251	997	1.60%
Total	89,057	92,489	3,402	3.82%
Ironton Area	**Total Population & Percent Change**			
County	**1990**	**2000**	**1990-2000 Pop. Change**	**1990-2000 % Change**
Gallia	30,954	31,069	115	0.37%
Lawrence	61,834	62,319	485	0.78%
Scioto	80,327	79,195	-1,132	-1.41%
Jackson	30,230	32,641	2,411	7.98%
Total	203,345	205,224	1,879	.92%

Source: WNF Recreation Feasibility Study, 2002

Recreation Trends

Developed Recreation

Developed recreation is expected to receive a 16 percent increase in visitor growth by the next decade. Based on the 2002 WNF Recreation Feasibility Study, camping received the third highest number of responses asking the Forest to consider expanding. Not only are campers demanding more campsites, those using developed campgrounds are demanding campsite amenities, such as improved RV pads, electricity, and sewer hookups (NOI Comment Analysis 2002 and SRG 2002). Users have also expressed the need for more parking areas, interpretative facilities, and informative brochures, maps, and signs (SRG 2002). Historically, camping facilities located near large bodies of water or scenic vistas are favored over any other sites.

Visitors participating in developed recreation activities generally prefer developed facilities in natural settings, which may be found in Urban and Rural ROS objectives.

Dispersed Recreation

The demand for dispersed forms of recreation on the Forest is equivalent to or higher than that of developed recreation, depending on the activity. Dispersed recreation is expected to receive a 10 percent increase in visitor growth by the next decade. According to the latest national, regional, and local recreation studies, demand for such activities as wildlife/nature viewing, hiking, OHV riding, horseback riding, mountain bike riding, primitive camping, visiting historic and other interpretive sites, and driving for pleasure will continue to increase.

Visitors participating in many of these dispersed recreation activities generally prefer more natural settings that can be found in Roaded Natural, Semi-primitive, and Primitive ROS classes.

Environmental Consequences

Analysis Area

The analysis area includes all WNF land. This area represents Forest land where recreation resources exist, as well as land where those resources could receive impacts from management activities.

Effects Common to All Alternatives

Recreation Opportunity Spectrum (ROS)

To repeat, ROS is generally 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. (See the Glossary for a description of each ROS class objective.)

The Forest desires to provide a wide range of quality outdoor recreation opportunities that responds to public needs/demands, fulfills its recreation niche, and stays within the capabilities of the land. This desire is reflected across all proposed alternatives, including the “no action” alternative.

The general themes developed for Alternatives A through F emphasize various resource management objectives. Each alternative prescribes a different set of management activities and land allocations to meet those objectives. These land management prescriptions provide the parameters needed for redefining the current ROS distribution and the level of recreation facility development.

For each alternative, management activities would strive to meet its assigned ROS objectives. Generally, these activities may move an area toward a lesser developed ROS objective, but not a more developed objective. For example, an area classified as RN may move toward SPNM, but not toward the Rural ROS.

Table 3 - 50. ROS setting objectives by alternatives (Acres and % of Forest).

ROS Objective	2004 ROS Inventory Acres (%)	ROS Acreage Allocation and Percent of Forest Inventory by Alternatives Acres / %						
		Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt. F
Semi-primitive Non-motorized	0	18,470 (8%)	9,603 (4%)	24,445 (10%)	9,589 (4%)	14,292 (6%)	17,274 (7%)	27,122 (11%)
Roaded Natural	144,470 (61%)	217,744 (91%)	226,611 (95%)	209,530 (88%)	224,386 (94%)	219,683 (92%)	216,701 (91%)	206,853 (87%)
Rural	91,881 (38%)	1,839 (1%)	1,839 (1%)	4,078 (2%)	4,078 (2%)	4,078 (2%)	4,078 (2%)	4,078 (2%)
Urban	1,702 (1%)	0 / 0 %	0 / 0 %	0 / 0 %	0 / 0 %	0 / 0 %	0 / 0 %	0 / 0 %

Source: WNF ROS Inventory, 2004

No areas on the WNF can be classified as ROS Primitive as it is currently defined (See ROS User's Guide). Table 3 - 50 show all alternatives shifting acres of existing Urban (U) and Rural (R) ROS settings toward the ROS objectives Roaded Natural (RN) and Semi-primitive Non-motorized (SPNM). Although the acre change varies for each ROS setting (except the Urban setting), these changes are relatively small across all alternatives. No alternatives would have an Urban ROS objective. The ROS acreage allocation for Alternative E Modified changed slightly from Alternative E. Roaded Natural acres decreased by one percent while SPNM acres increased by one percent in Alternative E Modified from Alternative E. All other ROS acres remain unchanged. These changes were directly resulted from the shift in the boundaries and subsequently the acres (2,982 acres) of the Forest and Shrubland Mosaic to the Future Old Forest Management Area.

Approximately 98 percent of the Forest's existing Rural ROS acres would move toward the RN ROS objective. The RN ROS objective has the highest ROS percentage across all alternatives. Though the existing ROS inventory did not result in any SPNM areas, this ROS objective would see an increase across all alternatives, with the highest increase under Alternative F (27,122 acres). To be able to move an area toward or retain SPNM "remote" character, the Forest's existing low-service roads would have to be closed to motorized use, new roads would not remain open for general public use, and SPNM recreation activities such as hiking, backpacking, horseback riding, mountain biking, wildlife viewing, and primitive camping would be emphasized.

The Rural and SPNM ROS were specifically assigned to Forest areas to be managed with a recreation emphasis. The Rural ROS objective was assigned to management areas containing highly developed recreation sites, such as the Lake Vesuvius and Leith Run recreation areas. Conversely, management areas with the SPNM ROS objective emphasize recreation activities and opportunities in more natural remote settings, such as the Future Old Forest (FOF) and the Timbre Ridge Lake (TRL) Management Areas.

Finally, ROS acres, as well as other recreation factors, were used to determine the Forest’s maximum reasonable capacity of across the range of alternatives. The results from the assessment show no alternatives to likely exceed the Forest’s recreation capacity.

Table 3 - 51. Forest Acres Allocated for Developed and Dispersed Recreation, Carrying Capacity, and Constructed Recreation Facilities by Alternatives.

Management Activity	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt. F
Land Allocated for Developed Recreation Development (acres)	1,839	1,839	4,078	4,078	4,078	4,078	4,078
Land Allocated for Dispersed Recreation Development (acres)	236,214	236,214	233,975	233,975	233,975	233,975	233,975
Reasonable Maximum Carrying Capacity (Recreation Visitor Days)	1,026,328	1,050,889	1,011,591	1,052,742	1,039,714	1,039,714	1,004,176
Number of Recreation Facilities Constructed (i.e. Campgrounds)	1 to 5	1 to 5	1 to 5	1 to 5	1 to 5	1 to 5	1 to 5

Source: WNF GIS and recreation project file, 2004

Developed Recreation

Developed areas, such as campgrounds, picnic sites, and swim beaches are dedicated to and managed primarily for high visitor interaction and usually include constructed facilities. All alternatives emphasize offering developed sites with varying levels of development – from highly accessible recreation facilities with modern amenities such as electricity and showers to less developed sites with natural surfaces and little or no facilities.

Regardless of alternatives, all sites would be maintained to meet health and safety standards, protect natural resources, increase accessibility, and be cost effective to operate and maintain. Emphasis would also be placed on reducing the Forest’s deferred maintenance backlog, upgrading existing facilities, and altering or decommissioning less valued sites before considering new development. Generally, improvements are made for site and resource protection, however, visitor comfort and convenience would also be considered. Any facility upgrade or new construction would be developed at a level appropriate for the desired ROS setting. Each alternative proposes only a moderate increase in new facility development due the reality of limited budgets.

Dispersed Recreation

All alternatives provide areas for visitors to enjoy various forms of dispersed recreation. Dispersed sites support recreation activities that are generally found in the undeveloped areas of the Forest such as hunting, nature study, hiking, and primitive camping. These activities require little or no visitor interaction or constructed facilities with the exception of designated trails. Management activities generally can affect dispersed recreation more than developed recreation because developed recreation areas are dedicated primarily to recreation use, while dispersed recreation areas are shared with other and sometimes competing resource benefits, such as wildlife habitat improvement or mineral development.

One of the more popular dispersed recreation pursuits on the Wayne is trail riding, particularly motorized trails. Effects of the alternatives on motorized trail use will be discussed in detail under the Recreational OHV Use section of this chapter. The following paragraphs will focus on effects of alternatives on non-motorized trails and other dispersed recreation activities.

Based upon comments received from public scoping and local recreation surveys, the demand for additional miles of non-motorized trails was clearly evident. The 1988 Forest Plan projections for new equestrian and hiking trails have not been met. Mountain bike use was not addressed and therefore no miles were planned for this activity in the 1998 Plan. The sport was relatively new when the 1988 Plan was written. If Alternative A (continuance of the 1988 plan) is selected, it would include a mileage range of 15 to 30 new miles of new mountain bike trail construction. Moreover, all alternatives would have the same mileage range for this trail type. (See Table 3 - 52 for range of miles of new trail construction.)

The lack of adequate miles of ATV/OHM, equestrian, mountain bike and hiking trails would be addressed by any, all, or a combination of:

- Constructing additional new trails
- Sharing compatible uses on existing trails
- Converting existing low use level roads or user-developed trails to system trails
- Relocating trails off existing roads.

Where possible, trails would be connected to provide for longer continuous trails. Additionally, some camping areas may be constructed to accommodate the demands associated with popular trail activities, such as ATV/OHM and horseback riding. Similar to develop recreation developments, the level or miles of new trail construction will be proportionate to the availability of funds and resources.

Table 3 - 52. New Non-motorized Trail Density, New Construction Miles, and Cross-country Travel by Alternatives.

Management Activity	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt F.
New Hiking Trail Construction (mileage range)	5 to 14	5 to 14	5 to 30	5 to 30	5 to 30	5 to 30	5 to 30
New Non-motorized Trail Constr. (Density Range - miles/sq.mi)	1.5 to 4.5	1.5 to 4.5	Up to 2.5	Up to 2.5	Up to 2.5	Up to 2.5	Up to 2.5
New Equestrian Trail Constr. (mileage range)	5 to 30	5 to 30	5 to 50	5 to 50	5 to 50	5 to 50	5 to 50
New Mtn. Bike Trail Constr. (mileage range)	15 to 30	15 to 30	15 to 30	15 to 30	15 to 30	15 to 30	15 to 30
Equestrian Cross-country Use	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited
Mtn. Bike Cross-country Use	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited
Hiking Cross-country Use	Allowed	Allowed	Allowed	Allowed	Allowed	Allowed	Allowed

Source: WNF Recreation Project File, 2004

Also common to all alternatives is the desire to reduce the amount of cross-country travel from such uses as ATV/OHM, horseback, and mountain bike riding. Limiting these activities to designated trails minimizes adverse effects to soils, water quality, aquatic wildlife habitat, vegetation, and aesthetics. Unmanaged user-developed trails and concentrated use area (CUAs) would be assessed for their impacts to resources and usability. User-developed trails and sites found to be environmentally sound and economically viable may be managed to standard and incorporated into the Forest's existing system of trails and recreation sites. All other user-developed trails and CUAs would be closed and rehabilitated as funding permits. Due to the relatively low impact of hiking on the natural resources, this activity is permitted in most areas of the Forest, except where signed "closed to foot travel". This would apply to all alternatives, including the "no action" alternative.

Opportunities for other dispersed recreation such as fishing, canoeing/boating, camping, backpacking, viewing wildlife, and visiting historic sites would remain relatively the same as what is currently provided.

With respect to hunting, all alternatives would feature an increase in general big game (deer and turkey) and small game (rabbit, squirrel, grouse, and quail) habitat over 1988 Forest Plan direction. Management activities in Alternative B (160,488 acres) would see the greatest increase in big and small game habitat in the Forest Shrubland Mosaic (FSM) Management Areas (with OHV and without OHVs). Besides Alternative A, Alternative C has the smallest increase in big and small game habitat with 22,946 acres in the FSM and FSMOHV management areas. Alternatives D, E, E Modified, and F round out the acreage but would provide between 35,000 and 58,000 acres of big and small game habitat. Alternative B would provide the best opportunity hunting for big and small game species.

Direct and Indirect Effects – Recreation Opportunity Spectrum (ROS)

This section discusses the different direct and indirect effects among the range of alternatives as it relates to ROS allocation and the variety of developed and dispersed recreation opportunities. The changes discussed in this section may not be immediately evident and may take 10 or 20 years before noticeable results may be observed.

Alternatives A and B

Alternative A represents 1988 Forest Plan management objectives and would provide a baseline for evaluating other alternatives. This alternative focuses more on providing mature forested landscape with little or no provision for early successional habitat. Alternative A provides relatively little area for expansion of highly developed recreation. Approximately 1,839 acres (less than 1%) of the Forest is allocated for Rural ROS and none for Urban ROS. Alternative A would move all existing Urban ROS acres and most of the existing Rural ROS acres toward RN and SPNM ROS. This translates to Alternative A being able to provide a larger area for those visitors seeking a remote natural setting or backcountry experience and less positive for those seeking a more developed setting and motorized access. This alternative would provide the third highest acreage for a SPNM experience. Only Alternatives C or F would offer more.

Conversely, Alternative B would emphasize a mosaic of early successional forest landscape. Alternative B is similar to Alternative A in that the acres allocated for the Rural ROS objective would be the same (1,839 acres). However, Alternative B would offer slightly less acres for Semi-primitive Non-motorized (-8,867 acres) and equally more Roaded Natural (+8,867 acres) settings than Alternative A. As a result, visitors would have less area to enjoy a primitive or backcountry experience.

Alternatives C and F

Alternatives C through F are same with respect to the number of acres they would allocate for the Urban (no acres) and Rural ROS objectives (4,078 acres). The acres of Rural ROS called for in each of these alternatives are essentially double what would be provided under Alternatives A or B. Though relatively small when compared to the total Forest land base, these ROS acres would offer the most potential for expanding and improving highly developed recreation sites. New recreation facilities would be constructed primarily in response to demonstrated public need, however. Existing sites could be enhanced and reconstructed to standard. The Forest would strive to continue to offer a broad range of developed day and overnight use sites within this area. New developed recreation sites to support associated dispersed recreation opportunities would be considered. Sites at varying development levels would be provided. Some existing sites could be upgraded to a higher development level if a need was demonstrated.

Alternatives C and F would allocate approximately 24,445 acres and 27,122 acres respectively toward the SPNM objective in three separate sections of the Future Old Forest (FOF) Management Area plus 796 acres in the Timbre Ridge Lake (TRL) Management Area. No vegetation management except for that needed to protect public health and safety, or to protect private property, would occur. Opportunities to close low-service Forest roads in the FOF Management Areas would be given serious consideration. New roads in this area would not remain open for general public use. The Forest would manage these FOF areas toward a mature, natural appearing forest, thus providing visitors with areas where they can experience remoteness, solitude, and high level of challenge. Non-motorized recreation activities such as hunting, fishing, boating, hiking, mountain biking, horseback riding, and wildlife viewing would be common. Recreation sites that encourage the study and enjoyment of nature and scenery, interpret unique historical or biological communities, or promote the use of the National Scenic North Country Trail would be given priority. Recreation sites at lower development levels would have precedence, but sites at higher development levels would also be considered if there is a high public demand. All recreation sites would be constructed or reconstructed to compliment the natural setting and meet the SPNM ROS objective.

Alternatives C and F also would provide essentially the same RN ROS acres (approximately 209,530 and 206,853 acres, respectively). Visitors recreating in the RN areas would continue to experience some sense of remoteness, independence, and closeness to nature but not at the same level as found in SPNM areas. Visitors would typically find more evidence of human activity, motorized use, and facility development in RN areas. Recreation site development would continue on an as needed basis but at a higher development level than what may be found in SPNM areas.

Alternatives D, E, and E Modified

Like Alternatives C and F, Alternatives D and E and E Modified would provide the same acreage allocation for Urban and Rural ROS. Unlike Alternatives C and F, Alternatives D, E, and E Modified would increase the number of RN acres and proportionately decreases the number of SPNM acres. (See Table 3 - 50) Actually, Alternative D is closer to Alternative B, while Alternative E and E Modified is more nearly resembles Alternative A with respect to the number of acres they would allocate for RN and SPNM. Thus, the net recreation effects of RN and SPNM allocation for Alternatives B and D are similar while Alternatives A and E and E Modified are similar. (See Alternatives A and B in this section for a description of recreation effects.)

Developed Recreation

Alternatives A through F

The lands around the Forest's highly developed recreation areas such as Lake Vesuvius, Leith Run/Capitol Christmas Tree Complex, Burr Oak Cove Campground, and Lamping Homestead were included to allow more opportunities for future expansion. These areas are all within the Developed Recreation Management Area (DR) which would be managed mainly for a variety of developed and some dispersed non-motorized recreation opportunities. Vegetation management would occur only to protect or enhance the recreational facilities and natural settings.

There are no considerable differences across the range of alternatives in the type of recreation opportunities and experiences the Forest would offer. Each alternative proposes only moderate increases in new developed recreation facilities. The number and level of new facility development would directly depend upon public demand, availability of funding, and the ROS objective. The only noticeable difference among the alternatives is the acre allocation for future developed recreation expansion. Alternatives A and B would provide approximately 1,839 acres each, while Alternatives C, D, E, E Modified, and F would provide approximately 4,078 acres each.

All alternatives will emphasize reducing the number of low use recreation sites and facilities and maintaining or upgrading existing facilities to meet public health, safety, and accessibility standards, to provide site and resource protection, as well as meet visitor expectations.

Dispersed Recreation

Alternatives A and B

When compared to motorized trail use on the Forest, non-motorized trail use appears small. However, the demand for more non-motorized trails is increasing among this group of users. Alternatives A and B projections for new equestrian trail construction range from 5 to 30 miles, while new hiking trail construction would be between 5 and 14 miles by the end of the next decade. These projections were derived from the 1988 Forest Plan. The 1988 Plan also provided a trail density of 1.5 to 4.5 miles/sq. mile for equestrian and hiking trails. Thus, the result would be the potential for up to 95 total miles (sum of existing and new trails) of trails for each trail activity. (See Table 3 - 52)

The mileage range and density for non-motorized trail use within Alternatives A and B would be within the acceptable limits of the land due to the relatively large land base available for non-motorized trail construction.

Management activities in Alternative A would provide no real increase in big or small game habitat, while Alternative B would provide the greatest habitat increase of any alternatives with 160,488 acres. The emphasis of Alternative B is providing a mosaic of early successional habitat patches of various sizes interspersed throughout a predominately forested landscape. The Forest would contain mixed hardwood forest communities over 100 years old, permanent herbaceous forest openings, ponds and wetlands to enhance wildlife and visual diversity. Trees greater than 120 years old may occur throughout the area as individuals or groups. Game species associated with shrub and seedling/sapling forest habitats such as deer, turkey, and rabbits would flourish. Game species associated with more mature hardwood forests like squirrel and grouse would thrive. Under Alternative B, there would be no increase in acres of grassland from current levels, but early successional habitat would be greater than in the other alternatives. Thus, compared with other alternatives, Alternative B would generally offer hunters the greatest opportunity for hunting big and small game species.

Alternatives C through F

Alternatives C, D, E, E Modified, or F would provide the same total trail density, but within each alternative, the mileage range among the different trail types would vary slightly.

Alternatives C, D, E, E Modified, or F would provide 20 more miles of new equestrian trails and 16 more miles of new hiking trails than either Alternatives A or B. Mountain bike trails miles would remain the same across all alternatives.

Compared to motorized trails, noticeably fewer miles of new trail would be constructed for equestrian, hiking, and mountain bike use due to current and historic use from these activities. For Alternatives C through F, the proposed range of new trail construction for each trail activity would be:

- Equestrian (5 to 50 miles)
- Mountain biking (5 to 30 miles)

- Hiking (5 to 30 miles).

The trail density would be set at 2.5 miles/sq. mile for each trail activity across Alternatives A through F.

The mileage range and density for non-motorized trail use is well within the acceptable limits of the land due to the relatively large area available for non-motorized recreation opportunities. Furthermore, the miles of new trails proposed coupled with the mileage of existing trails should fulfill the need of this user group in the next decade.

The miles of new trail construction, whether motorized or non-motorized, will be directly dependent upon the availability of contiguous and suitable land, internal and external funding (i.e., appropriations, recreation fees, and grants), and partnership and volunteer contributions, as well as other environmental, social, and political factors.

Second only to Alternative A, Alternative C would increase big and small game habitat the least, with 22,946 acres in the FSM and FSM/O Management Areas. Alternatives D, E, E Modified, and F round out the acreage but would provide increases ranging from 35,000 and 58,000 acres of big and small game habitat. Alternatives C through F would moderately increase big and small game hunting opportunities.

Cumulative Effects

To adequately discuss the cumulative effects to the Forest's recreation program, activities on adjacent non-Federal lands must be taken into account. Unlike many of the nation's larger national forests, in which the land base is mostly contiguous, the WNF is significantly fragmented by private and State land. Thus, any activities on adjacent lands will very likely affect the recreation opportunities, settings, and experiences found on the Forest.

The private lands surrounding the Wayne are gradually losing their preferred settings and access for nature-based recreation. This trend can be traced to agricultural, mineral, and urban/suburban development. Furthermore, as more private lands are posted to prevent public access or are leased to hunting clubs, public lands may be among the few remaining areas where recreationists can pursue certain kinds of outdoor activity. Additionally, the WNF is one of the few large public land bases in Ohio that visitors may visit to experience solitude, closeness to nature, and semi-primitive settings. The Forest also provides a sense of place and beauty for local residents as they identify with and enjoy its natural landscapes and historic features. Because of these and other factors, the WNF is considered an important national treasure and is highly valued for the recreational opportunities it provides. If the Forest retains this character, visitor use and recreation demands will almost certainly increase over the next decade and beyond.

Providing outdoor recreation opportunities in Ohio requires involvement and collaboration between Federal, State, and local governments, as well as from private recreation associations, clubs, and businesses. Individually, each entity fulfills a unique niche. Together, they play an important role in providing a wide spectrum of recreation opportunities for the public.

Federal agencies such as the Forest Service generally manage for outdoor recreation opportunities that require large land bases, for example, hiking, backpacking, trail riding, hunting, primitive camping, etc. National Forest System lands are well suited to support long trails, recreation sites with few amenities, sites with scenic vistas, and backcountry recreation. The State also provides recreation opportunities that require large land bases, but invests heavily in water-based recreation and lodges. Local governments tend to focus on providing highly developed indoor and outdoor facilities, such as community centers and parks and hardened hike/bike trails. The private sector largely focuses on theme parks or providing recreation support facilities, such as specialty shops, bed & breakfast inns, and restaurants.

Because each entity offers its own unique recreation opportunities and settings, they complement each other by giving visitors an array of recreation opportunities from which to choose. Thus, the WNF will continue to attract a select group of visitors that desires to recreate in a large natural setting with some sense of remoteness and solitude and/or a high level of challenge.

Many communities are beginning to see the benefits of visitors coming to the Forest and are encouraging tourism centered on the WNF to stimulate their economies. This is evident from the growing interest of local businesses, trail associations/club, and community leaders in having the Forest's trail system linked to their town or place of business.

Recreation supply and demand will invariably shift with time. As demand exceeds supply, conflicts among user groups will become greater, the visitor's recreation experience will be reduced, illegal trail use will escalate, and impacts to natural and visual resources will rise.

The Wayne's capability to fulfill the public's recreation expectations is limited by a number of factors. Much of the Forest has been affected by human activities in one form or the other. Additionally, the Forest's scattered land ownership pattern, the difficulty in reducing the high density of public roads, and the increasing competition from Forest users for the same lands are just some of the factors that may limit the Forest's ability to provide for large Primitive/Semi-primitive areas, thus making it difficult for visitors to "get away" and seek solitude.

These and other limiting factors suggest the appropriate recreation niche for the Forest. Based on this niche the Forest can direct its budget, resources, and efforts toward providing a set of recreation opportunities that best fulfills its particular role. Other Federal, State, and local agencies and private organizations can then concentrate on providing other types of recreational opportunities. This approach would help the Forest devote resources to the recreation opportunities for which it is best suited, provide better customer service, and ensure a higher level of user satisfaction. Such a strategy would also allow the Forest to find and develop strong working partnerships to help meet the growing recreation demands of its constituents.

Summary

All alternatives would provide a range of recreation opportunities, settings, and experiences, and would meet the public's recreation needs in differing ways.

Alternative F would provide the greatest opportunity for future Semi-primitive recreation in the Future Old Forest and Timbre Ridge Lake management areas while also providing high opportunities for developed recreation expansion by enlarging the Developed Recreation Management Area. The second highest opportunity for SPNM recreation would come under Alternative C followed by Alternatives A, E, E Modified, B, and D, respectively.

Alternatives A or B would each allocate the same acreage for developed recreation. Alternatives C through F would allocate more than twice the acreage to developed recreation as Alternatives A or B. Additionally, fewer miles of horseback riding and hiking trails would be constructed in Alternatives A and B compared to Alternatives C through F.

With respect to hunting opportunities, Alternative A would provide no real increase in new big or small game habitat, while Alternative B would offer the greatest potential to increase big and small game habitat (except for quail) of any alternative. Alternatives C through F would provide a moderate increase in big and small game hunting opportunities.

Recreational OHV Use

Public opinion about recreational off-highway vehicle (OHV) use on the Wayne National Forest spans a broad spectrum – from an insistence that OHV riding be prohibited on the Forest to a strong desire that the Forest Service maximize its opportunities to construct more OHV trails or routes.

The Forest Service has determined that OHV riding is a legitimate use on NFS lands, and the WNF has a well established system of designated all-terrain vehicle (ATV) and off-highway motorcycle (OHM) trails. Currently, the Forest has no designated trail system for four-wheel drive (4WD) and similar high-clearance vehicles.

This discussion of resource effects takes into account the environmental impacts on the WNF related to OHV use on proposed designated trails and cross-country travel. Discussions of these effects are included in the various resource sections of this Final EIS. They are also part of project-level analysis.

This section discusses direct and indirect social effects such as, use trends and demands, use conflicts and compatibility, and illegal trail activity, as well as the fiscal effects of constructing and maintaining new motorized trails on the Forest. Discussions of cumulative social effects consider the opportunities for OHV use on other land ownerships within and near the Forest's proclamation boundary and/or within the State of Ohio. Discussions of cumulative fiscal effects consider the opportunities for obtaining outside sources of funding through partnerships, grants, and volunteers to help offset costs associated with ATV/OHM trail construction and maintenance.

For the purpose of this analysis, the following definitions for the various types of recreational motorized vehicles are given to provide clarification during the discussion of the affected environment and environmental effects.

- Off-highway vehicle (OHV) – Includes ATVs, OHMs, 4WDs, SUVs, dune buggies, mini-bikes, go-carts, Gators®, and similar high-clearance vehicles designed to travel off maintained roads.
- All-terrain vehicle (ATV) – Motorized flotation-tired vehicle, with three to six low-pressure tires, generally 50 inches wide or less, straddled by the rider, and designed to travel off maintained roads.
- Off-highway motorcycle (OHM) – Motorcycle designed generally for use off maintained roads and commonly referred to as a "dirt bike" or designed for use off or on maintained roads such as a "dual sport bike".
- Four-wheel Drive (4WD) – Licensed high-clearance all-wheel drive vehicles capable of on or off-highway travel.

- Sport utility vehicle (SUV) – Licensed two or all-wheel drive, high-clearance vehicles capable of on or off-highway travel.

OHV INDICATOR 1 – Miles of new motorized trail construction

The first indicator addresses the demand for additional designated ATV and OHM trails on the WNF. The effects of the alternatives on new motorized trails are based on the maximum miles of additional designated ATV/OHM trails each alternative could potentially provide. All alternatives, including the "no-action" alternative, would provide for motorized trail use and opportunities to construct new trails.

OHV INDICATOR 2 – Construction and maintenance cost of providing more OHV opportunities on the Forest

The second indicator addresses the financial costs of constructing and maintaining existing as well as new trails on the WNF. The effects of the alternatives on the cost of constructing and maintaining new motorized trails are based on the maximum miles of additional designated ATV/OHM trails each alternative could potentially provide. All alternatives, including the "no-action" alternative, would provide for the construction of new motorized trails.

Affected Environment

Introduction

The Wayne's motorized trail system is a highly popular attraction for ATV and OHM enthusiasts. It is one of a few areas in Ohio or the Midwest region where riders may come to enjoy their sport. Motorized trail riders from as far as Indiana, Michigan, Pennsylvania, West Virginia, and Kentucky come annually to ride. For this reason, the WNF has identified providing motorized trail opportunities as one of the key elements that form its recreation niche.

However, as will be discussed, the OHV use is likely to continue increasing. Thus, managing OHV use will continue to be an issue and a challenge for the WNF, just as it has become a national issue for the Forest Service. Unmanaged recreation, especially the undesirable impacts from unmanaged OHV use, has been identified by the Chief of the Forest Service as one of the key threats facing the national forests and grasslands. Concerns have been expressed over the amount of unplanned roads and trails, erosion, lack of quality OHV recreation opportunities, degradation of water quality, and destruction of habitat from unmanaged OHV activity.

Market Area

Market areas are established for national forests to better evaluate public demand for recreation opportunities. In the Recreation Feasibility Study completed for the WNF in 2003, researchers defined the Forest's market area as within two-hours drive (approximately 100-mile radius) of the recreation site. A two-hour driving distance from one of the units of WNF includes much of Ohio and parts of West Virginia and Kentucky. The four urban areas that lie within this circumference and that were examined in the Recreation Feasibility Study are Columbus, Cincinnati, and Cleveland, Ohio, and Charleston, West Virginia (SRG, 2002).

Opportunities for outdoor recreation are not limited to the national forest within the market area. Other lands such as Army Corp of Engineers, State forests, parks, and wildlife management areas, private industries and organizations, and local municipalities also serve to connect and expand the range of recreation opportunities.

The Ohio Department of Natural Resources (ODNR), the largest supplier of public recreation lands in the State, manages approximately 387,000 acres of State parks and forests distributed throughout Ohio. A majority of those lands are available for public recreation (SRG, 2002). Many of the State parks offer highly developed overnight lodging facilities, water-based recreation opportunities such as swimming, fishing, boating, and water skiing, including dispersed recreation. In contrast, many recreation opportunities offered on a majority of private industry and organization lands are dispersed forms of recreation such as hunting, nature-viewing, hiking, and other non-motorized trail use.

Recreation Supply

The Midwest region contains only a handful of large areas designated for motorized recreation. Some of these areas include the Hatfield-McCoy Trail (WV), the Allegheny National Forest (PA), Huron Manistee National Forest (MI), and the Daniel Boone National Forest (KY). Of the six motorized trail systems in Ohio, three are found on the WNF. The 1988 Forest Plan designated two management areas (2.3 and 3.2 MA) for motorized OHV recreation. Within these management areas, the Forest Service has constructed approximately 116 miles of OHV trails, compared to 43 miles managed by the State of Ohio. This situation creates a high demand for the Wayne's motorized trail system both now and into the future.

OHMs and ATVs 50 inches wide or less are permitted on designated motorized trails only. With the exception of dual sport motorcycles, all street legal or licensed 4WDs and SUVs are limited to open roads only (maintenance level [ML] 2 roads or higher). Cross-country travel by motorized vehicles is prohibited on the Forest.

Recreation Demand/Trend

Two decades of national recreation studies have shown off-road driving to be one of the fastest growing outdoor activities. During a 17-year period (1983-2000), this sport has increased by 80.4 percent. A second indicator of the increasing trend of motorized vehicle use can be seen in State registration figures. From 1998 to November 2002, the registration of ATVs has almost doubled. (See Table 3 - 53)

Table 3 - 53. ATV and OHM registrations statewide in Ohio for the last five calendar years.

Type of Registrations	CY1998	CY1999	CY2000	CY2001	CY2002[3]
ATV in-state[1]	7,014	8,712	11,839	12,518	13,350
OHM in state[1]	2,495	2,201	2,141	2,341	2,629
ATV Non-resident[2]	N/A	N/A	136	97	128
OHM Non-resident[2]	N/A	N/A	31	21	51

Source: Ohio's Bureau of Motor Vehicles

[1] Ohio's in-State registrations are good for 3-year periods of time.

[2] 30-day non-resident placards (permits). Ohio began to issue these in February, 2000; therefore, CY-2000 non-resident is only for 11 months.

[3] CY-2002 includes Jan 1, 2002 through Nov 30, 2002.

State and national OHV sales from 1995 through 2001 also support the increasing trend for this type of motorized sport. (Table 3 - 54) Ohio has maintained a ranking of 5th in the nation for retail sales of motorcycles from 1995 to 2001, but moved from 12th in the nation in sales of ATVs to 5th in this same time period.

Table 3 - 54. Off-highway Vehicle State and National Trends in Retail Sales.

Ohio New Retail Sales	Dual-Sport Motorcycles	ATVs	Total
1995	3,964	9,495	13,459
2001	10,045	28,901	38,946
% of Change	**153.4%**	**204.4%**	**189.4%**
US New Retail Sales	**Dual-Sport Motorcycles**	**ATVs**	**Total**
1995	90,679	277,787	368,466
2001	270,209	729,054	999,263
% of Change	**198%**	**162.5%**	**171.2%**

Source: Motorcycle Industry Council

Similar to national and regional trends, motorized trail use on the Wayne is increasing annually. This is reflected by the increasing number of OHV sales, State all-purpose vehicle (APV) registrations, and the number of recreation visits and revenues collected from motorized trail permit sales on the Forest. OHV riding accounts for more than 90 percent of trail permits sold on the Forest.

In 2003, over 16,800 motorized trail permits were sold on the Forest through the Fee Demo Program. Forest trail permit sales for 2004 are expected to meet or exceed 2003 sales.

Environmental Effects

Analysis Area

The analysis area includes WNF lands within the OHV management areas. They are: Diverse Continuous Forest with OHV (DCFO), Forest and Shrubland Mosaic Forest with OHV (FSMO), and Historic Forest with OHV (HFO). These areas represent Forest land where recreational motorized trail riding is permitted, as well as adjacent lands where management activities may impact that sport.

Effects Common to All Alternatives

General Resource Protection Measures

Adverse effects from motorized vehicle use would be mitigated by implementing appropriate Forest-wide standards and guides, Best Management Practice (BMP) techniques, or through proper trail design. Additionally, by applying effective education and enforcement programs, the Forest would help increase public understanding and compliance of its OHV policies, thus reducing impacts to natural resources.

OHV Use Policy to be Applied Across All Alternatives

No alternatives would permit OHV use off designated motorized trails or routes. Additionally, these recreational vehicles are not permitted on Forest system roads, except where roads serve as trail connectors. These road crossings would be appropriately signed to allow such use. Trails are designed for OHMs and ATVs 50 inches wide or less. Trails are open for use only from mid-April through mid-December.

Construction of new motorized trails and associated facilities would be limited to only the Diverse Continuous Forest with OHV, the Forest and Shrubland Mosaic with OHV, and Historic Forest with OHV management areas. All of these management areas were assigned the Roaded Natural (RN) ROS objective. (See Recreational Opportunities and Settings section for a description of this ROS objective.)

All alternatives allow some non-motorized uses on motorized trails, such as mountain biking and hiking, though these user groups typically do not like to share trails with OHV riders. Horseback riding is not permitted on the motorized trail system for safety and compatibility reasons.

Opportunities to provide designated 4WD roads or trails would be limited across all alternatives. Any proposal to close low-maintenance system roads and designate them for high-clearance vehicle use would be considered on a case-by-case basis. However, no routes or areas on the Forest have been designated for 4WD or high-clearance vehicle use.

Social Effects

A positive effect from motorized recreation is that it provides pleasure to a large segment of the population. Some of these visitors may include people with a physical disability or the elderly who may perhaps not be able to enjoy the outdoors otherwise. Motorized vehicles also provide visitors easy access to remote areas of the Forest; allow them to experience more of the Forest by covering more area; provide them an opportunity to build close family ties; and provide deer hunters with a convenient way to transport game out of the woods.

Motorized recreation also contributes to a community's economic welfare. On the Wayne, local vendors benefit by selling Forest trail permits. Not only do they receive revenue from the direct sale of trail permits, they also gain additional business from the sale of food, gas, and supplies to visitors. Additional revenues are generated from visitors lodging and eating at local hotels and restaurants.

However, negative social effects may also result from motorized recreation. A principal effect is the displacement of some non-motorized users seeking solitude such as hikers, mountain bikers, backpackers, primitive campers, bird watchers, and even some hunters. This is generally attributed to factors as loud noise, exhaust emissions, and the high rate of speed from these recreational motor vehicles.

To help absorb displaced non-motorized users, the Wayne limited motorized trail use to a few management areas that cover approximately 19 percent of the Forest. The remaining 81 percent is open to non-motorized recreation use.

Also, accelerated motorized recreation use could strain the Forest's limited law enforcement program. Heavily used areas require more routine patrol, and create an uneven distribution of law enforcement officers (LEO) across the Forest. Less used recreation areas would lack the enforcement oversight they deserve, and therefore, may experience more vandalism or visitor non-compliance.

This effect would be mitigated through the use of more Forest protection officers (FPO) and developing partnerships with State and local law enforcement to assist in patrolling the Forest's motorized trail system.

Natural Resource Effects

This section briefly discusses the general effects of natural resources from motorized recreation use. A detailed discussion of effects would be found under each applicable resource section of this Final EIS or during site-specific project level analysis.

The degree of natural resource impacts from motorized trail use is proportionate to the level and intensity of use and/or to the level at which the trail was constructed and maintained. In other words, the more use a trail receives and the harder a trail is ridden, the higher the probability of negative effects on resources from use if the trail was poorly designed, constructed, and maintained.

Regardless of which alternative is selected, some illegal OHV use can be expected to occur. Though the Forest currently provides a system of designated trails for motorized use, illegal off-trail riding continues. Illegal off-trail riding has created many user-developed routes on the Forest. Some contributing factors for this illegal activity are:

- Trail demand is greater than the current supply
- Existing trails do not provide the challenge some riders are seeking
- Lack of Law Enforcement Officers to patrol trails
- No established trail patrol program to educate/inform riders of Forest OHV policies and to routinely monitor or patrol trails
- Lack of adequate signing or marking of existing designated trails.

Though many user-developed routes may be found on the Forest, they are not condoned. However, some user-developed trails could be considered for system trail designation if they are well located and could be easily incorporated into the existing designated trail system. Many user-developed trails are causing adverse effects to natural resources and pose a risk to rider safety. When user-developed trails are identified and cannot be reasonably incorporated into the existing designated trail system, they will be closed and rehabilitated. Certainly, the miles of user-developed trails the Forest could incorporate or rehabilitate/close in a given year is dependent on its budgetary and personnel capabilities.

Without routine trail monitoring, maintenance, and/or rehabilitation, adverse effects to soils, water quality, aquatic habitat, wildlife habitat, vegetation, and scenic resources would inevitably occur.

INDICATOR 1 – Miles of New Motorized Trail Construction

Direct and Indirect Effects

This section discusses the different direct and indirect effects among the range of alternatives as it relates to the development of new ATV and OHM trails. It is important to note that the changes discussed in this section may not be immediately evident and may take 10 or more years before noticeable results may be observed.

The demand for a longer motorized trail system will continue to be voiced by the Forest’s largest group of trail users – its OHV constituents. If the

Wayne provided the miles of motorized trails needed to meet public demand, this group maintains, the expansion would reduce trail overcrowding, lower maintenance costs, minimize illegal off-trail activity and resource impacts, while increasing rider safety and enjoyment.

All alternatives would provide for additional ATV and OHM trails. Table 3 - 55 displays the projected mileage range for new OHV trail construction and Forest total when completed.

Table 3 - 55. New Motorized Trail Density, New Construction Miles, and Cross-country Travel by Alternatives.

Management Activity	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt F.
New OHV Trail Construction (Density Range - miles/sq.mi)	3.2 to 6.4	3.2 to 6.4	2.0 to 3.5	2.0 to 3.9	2.0 to 3.5	2.4 to 3.5	2.0 to 3.0
New OHV Trail Construction (mileage range)	109 to 184	109 to 184	21 to 124	21 to 154	21 to 124	50 to 124	21 to 91
Total OHV Mileage Range (existing + planned)	225 to 300	225 to 300	137 to 240	137 to 270	137 to 240	137 to 240	137 to 207
OHV Cross-country Use	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited

Source: WNF Recreation Project File, 2004

Unlike non-motorized trails which could be developed over most of the Forest, motorized trail development is confined only to the management areas open to OHV use. For this reason, trail density is applied differently for motorized trails when compared to non-motorized trails. Density for motorized trails is applied within the OHV management areas while non-motorized trails are applied on a site-specific basis.

Alternatives A and B

Alternatives A and B each propose to construct between 109 and 184 miles of new OHV trails. These new miles added to the existing 116 miles would give the Forest a minimum of 225 miles and a potential maximum of 300 miles of designated motorized trails. This is equivalent to a density of 3.2 to 6.4 miles per square miles when completed. This is the projected total in the 1988 Forest Plan (Alternative A).

The WNF could meet public demand if the 300-mile maximum was constructed. However, that amount would likely exceed the land's acceptable limit for trail construction.

Alternatives C, E, and E Modified

The existing designated trail system was mapped along with any potentially new trails (within environmental and management area constraints) to determine the land's maximum acceptable trail density. The result of the mapping and trail assessment showed the existing density at approximately 1.0 mile/sq. mile. This total, coupled with the additional miles of new trails that could be potentially developed, produced a new trail density at approximately 2.0 miles/sq. mile.

This figure, however, does not take into account any low-level system roads or user-developed trails that could be converted to system trails. If these factors were considered, the density would be moderately higher.

Alternatives C and E propose to construct between 21 and 124 new miles of trails. If added to the existing 116 miles, it would give the Forest a minimum of 137 miles and a potential maximum of 240 miles of designated motorized trails. This is equivalent to a density of 2.0 to 3.5 miles per square miles when completed. Alternative E Modified proposes to construct between 50 up to 124 new miles of trails. If added to the existing 116 miles, it would give the Forest a minimum of 166 miles and a potential maximum of 240 miles of designated motorized trails. This is equivalent to a density of 2.4 to 3.5 miles per square miles when completed. The 240 miles is the maximum threshold at which the land is thought to be capable of sustaining OHV use within the Forest's OHV management areas.

Alternatives C through F would provide 60 miles less of new trails than Alternatives A or B, if the maximum miles were constructed.

The Forest may fall short in meeting public expectation and demand if Alternatives C, E, or E Modified is selected. Nonetheless, the trail density would remain within the land's maximum acceptable limit for trail construction.

Alternative D

In an effort to provide a reasonable range of new motorized trail construction miles across the alternatives, the Forest generated different mileage thresholds (maximums) for Alternatives D and F.

Alternative D would construct between 21 and 154 new miles of trails. If added to the existing 116 miles, it would give the Forest a minimum of 137 miles and a potential maximum of 270 miles of designated motorized trails. This is equivalent to a density of 2.0 to 3.9 miles per square miles when completed. Alternative D would provide 30 miles or 10 percent less of new trails than Alternatives A or B; 30 miles more than Alternatives C or E; and 63 miles more than Alternative F.

Alternative F

Under Alternative F, between 21 and 91 new miles of trails could be constructed. If added to the existing 116 miles, it would give the Forest a minimum of 137 miles and a potential maximum of 207 miles of designated motorized trails. This is equivalent to a density of 2.0 to 3.0 miles per square miles when completed. Alternative F would provide the least new miles of trail than any other alternative – approximately 93 miles or 31 percent less than Alternatives A or B; 63 miles less than Alternative D; and 33 miles less than Alternatives C or E .

Mileage estimates for Alternative F were derived from motorized trail mileage outputs from the 1994 Trail Master Plan developed by trail advocates. To obtain a more accurate picture of the proposed trail density at the time the Trail Master Plan was being developed, the Forest used the total projected miles of new motorized trail construction in the Trail Master Plan and calculated with the 1993 WNF acres allocated for that use. This density was used proportionately to adjust the new projected miles based on 2004 acres within the OHV management areas.

Cumulative Effects

Cumulative effects for OHV trails include what other suppliers in the vicinity (within 2 to 3 hours drive) of the WNF are currently providing and what they are planning to provide within the next decade (10 - 15 years). Table 3 - 56 displays the existing, planned, and total projected OHV trail miles of area motorized trail providers.

Table 3 - 56. Existing, planned, and total projected OHV trail mileage of local motorized trail providers.

Area Motorized Trail Providers	Existing Trails	Planned Trails	Total Projected
Hatfield McCoy Trail System (WV)	500 miles	Up to 1500 miles	Up to 2000 miles
Daniel Boone N.F. (KY)	150 miles	Up to 173 miles	Up to 323 miles
Dept. of Natural Resources (OH)	43 miles	Unknown *	43 miles
TOTAL	**693 miles**	**Up to 1,673 miles**	**2,323 potential miles**

Source: Hatfield McCoy and ODNR website and Daniel Boone National Forest Revised Forest Plan's Record of Decision, August 2004

* At the time of this analysis, ODNR had not determined whether to construct new motorized trails on State land. A decision is pending.

If future demands follow existing trends, the Forest would be in a better position to meet demands if Alternative A or B were selected, assuming that additional lands were acquired within the OHV management areas to construct the maximum 184 miles of new trails. It is further assumed that other motorized trail providers would continue to construct and complete the miles they planned.

INDICATOR 2 – Construction and maintenance cost of providing more OHV opportunities on the Forest

One of the main factors limiting the Wayne's ability to provide additional motorized recreation opportunities is the lack of adequate funds to construct new trails and maintain existing trails to standard. Much of the Forest's 116-mile OHV trail system was constructed in the early 1990s was funded from appropriations specially earmarked by Congress. Since then, a majority of the Forest's trail appropriations were designated for trail maintenance.

Currently, it costs the Forest an average of $22,000 to construct a mile of motorized trail and $3,500 annually to maintain it. It should be noted that these are baseline costs used for alternative comparison. They do not include the cost of NEPA analysis or construction/maintenance costs associated with trail facilities such as bridges, restroom facilities, parking areas, camping areas, and signs. These and other variables (environmental, topography, weather, etc.) may affect overall project cost.

Direct and Indirect Effects

The following section discusses the direct and indirect effects of the alternatives in relation to the financial costs of constructing and maintaining additional motorized trails. Due to the variables addressed in the previous section, only costs associated with constructing and maintaining the trail tread are discussed.

Table 3 - 57. Estimated construction and caintenance costs of new OHV miles by alternative.

Management Activity	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt F.
Cost of New OHV Trail Construction ($22,000/mile)	$4,048,000	$4,048,000	$2,728,000	$3,388,000	$2,728,000	$2,728,000	$2,002,000
Cost of Maintaining New OHV Trails ($3,500/mile)	$664,000	$664,000	$434,000	$539,000	$434,000	$434,000	$318,500
Total	**$4,712,000**	**$4,712,000**	**$3,162,000**	**$3,927,000**	**$3,162,000**	**$3,162,000**	**$2,320,500**

Source: WNF Recreation Project File, 2004

Alternatives A and B

Up to 184 miles of new OHV trails could be constructed under either Alternatives A or B. Using the 2004 cost estimate ($22,000/mile), construction of the maximum trails miles would cost $4,048,000, the highest cost of any of the alternatives.

Maintaining a fully expanded trail system would cost $664,000 annually, the highest cost of any of the alternatives. This cost is calculated using 2004 values, i.e., $3,500/mile.

Also, costs for construction and maintenance can be expected to increase 3 percent annually.

Alternatives C, E, and E Modified

Alternatives C, E, and E Modified would both call for up to 124 miles of new OHV trail construct. Using the 2004 cost estimate ($22,000/mile), construction of the maximum miles of trails would cost $2,728,000. This would be $1,320,000 less than Alternative A or B, $660,000 less than Alternative D, but $726,000 more than Alternative F.

Maintaining a fully expanded trail system would cost $434,000 annually, $230,000 less than Alternatives A or B, $105,000 less than Alternative D, and $115,500 more than Alternative F. These costs are calculated using 2004 values, i.e., $3,500/mile.

Also, costs for construction and maintenance can be expected to increase 3 percent annually.

Alternative D

Up to 154 miles of new OHV trails could be constructed under Alternative D. Using the 2004 cost estimate value ($22,000/mile), construction of the maximum trail miles would cost $3,388,000. This is $660,000 less than Alternatives A or B, but $660,000 more than Alternatives C, E, or E Modified, and $1,386,000 more than Alternative F.

Maintaining a fully expanded trail system would cost $539,000 annually, $125,000 less than Alternatives A or B, but $105,000 more than Alternative D and $220,500 more than Alternative F. These costs are calculated using 2004 values, i.e., $3,500/mile.

Also, costs for construction and maintenance can be expected to increase 3 percent annually.

Alternative F

Up to 91 miles of new OHV trails could be constructed under Alternative F. Using the 2004 cost estimate value ($22,000/mile), construction of the maximum trail miles would cost $2,002,000. This is $2,046,000 less than Alternatives A or B, $726,000 less than Alternatives C or E, and $1,386,000 less than Alternative D.

Maintaining a fully expanded trail system would cost $318,500, the lowest maintenance cost of any of the alternatives. This is $345,500 less than Alternatives A or B, $115,500 less than Alternatives C, E, or E Modified, and $220,500 less than Alternative D. These costs are calculated using 2004 values, i.e., $3,500/mile.

Also, costs for construction and maintenance can be expected to increase 3 percent annually.

Cumulative Effects

The cumulative effects of all alternatives as they relate to the cost of constructing and maintaining OHV trails include other sources of funding or assistance the Forest could generate or receive.

The Forest receives between $300,000 and $400,000 from Congress annually for trails.

This falls short of what is needed to maintain trails to standard or construct new trails. Thus, the Forest depends heavily on alternate sources of funding, such as Fee Demo (FD) revenues, Recreational Trail Program (RTP) Grants, and in-kind assistance from local trail partners and volunteers to help leverage the Forest's annual trail budget.

Since its 1998 inception, the Forest's Fee Demo program has collected over $700,000 from the sale of trail permits. Much of these funds have been directed toward trail maintenance. Additionally, the Forest has received a considerable amount of grant funding from the Recreational Trail Program. To date, approximately $571,000 has been awarded to the Forest for motorized trail work. A large portion of this money has been directed toward reducing the trail maintenance backlog.

Summary

Alternatives A or B would have the potential to provide the most new miles of motorized trails than any of the alternatives and would, thus, best meet user demand. However, the additional miles proposed in these two alternatives may exceed the reasonable carrying capacity of the current land base designated for motorized recreation use.

Though Alternatives C, E, or E Modified would provide fewer new miles of motorized trails than Alternative A or B, it would not exceed the reasonable carrying capacity of the current land base designated for motorized recreation use. The additional trail miles under Alternatives C or E may not meet user expectations or demand.

Alternative D would provide 30 fewer miles of new trails than Alternative A or B but 30 more miles than Alternatives C,E, or E Modified. Total trail miles proposed under Alternative D would exceed the reasonable carrying capacity of the current land base designated for motorized recreation use. The additional trail miles under Alternative D may not meet user expectations or demand.

Alternative F would provide the least miles of new motorized trail of any alternatives. Total trail miles proposed for Alternative F would not exceed the reasonable carrying capacity of the current land base designated for motorized recreation use. However, the additional trail miles under Alternative F may not meet user expectations or demand.

Alternatives A and B each propose the most miles of new trail construction and, therefore, would each also have the highest associated construction and maintenance costs of any of the alternatives. Conversely, Alternative F proposes the least miles of new trail construction and would have the least associated construction and maintenance costs. All other alternatives would have costs that fall between Alternatives A and F. However, regardless which alternative is chosen, because of the relatively high cost of constructing and maintaining a mile of motorized trail, coupled with the limited funds in the Forest's annual budget for trail maintenance, the Forest Service would not be able to construct or maintain the additional trails needed to meet projections without receiving additional funding and/or assistance from outside sources.

Scenic Quality

Visitors are generally attracted to the Forest not only for the many recreational opportunities it offers, but also to enjoy the natural scenic beauty of its landscape. Managing scenic resources may also help enhance the local community's tourism and economic development, as well as strengthens its sense of pride and place.

The Wayne's scenic resources are affected when management activities alter the natural appearance of the landscape. To help define the acceptable degree of deviations caused by management activities in the landscape, the WNF has assigned Scenic Integrity Objectives (SIOs) to all its lands.

Scenic Quality Indicator 1 – Scenic Integrity Objective Distribution Among Alternatives

This indicator is an objective measurement of the Forest's landscape and is used to compare the relative importance each alternative would place on scenery. An area's scenic integrity is its 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".

Affected Environment

Existing Landscape Character Description

Most of the land that is now the WNF had once been cleared for timber or agricultural purposes or mined for coal and other minerals. With the onset of the Great Depression in the 1930s, much of this land was abandoned; a good deal of it was to suffer severe erosion. In 1934, the Ohio legislature passed a bill enabling the Federal government to purchase the land in Southeast Ohio that now forms the Wayne National Forest.

Today, Southeast Ohio is a land of visual contrast. There are areas of significant natural beauty and cultural history. The highly dissected landscape is highlighted by rolling, forested hills, striking rock bluffs and shelters, and caves of sandstone and shale. A network of winding streams and rivers runs through deep valleys. Artificial lakes are remnants of past strip mining. The natural-appearing landscape, covered predominantly by an oak-hickory forest with scattered pines, is interspersed with private farms and pastureland that gives it a rural feel. Cultural features such as historic barns, log structures, iron furnaces, covered bridges, and mineral developments also contribute to the landscape character. These contrast with areas of significant environmental abuse, such as abandoned mines, acid seeps, roadside trash dumps, and the effects of illegal motor vehicle use.

The vast majority of the WNF supports a deciduous forest canopy; however, some temporary openings have been created by timber harvests, mineral development, or natural events such as ice storms or insect infestations. Such openings can appear visually out of place in a heavily forested setting, particularly in the first year following their creation. But, they do contribute spatial diversity and opportunities for viewing a progression of successional vegetation stages.

Existing Scenic Quality

The scenic resources of the Forest are currently managed in accordance with the Wayne's 1988 Land and Resources Management Plan. Scenic resources are managed according to Visual Quality Objectives (VQOs) determined by the Visual Management System (VMS). VQOs define different levels of acceptable alteration of scenic resources. The Forest identified four of five possible objectives in the 1988 Forest Plan. They include Preservation, Retention, Partial Retention, and Modification. (See Glossary for description of Visual Quality Objectives.)

The Forest Service analyzed and generated the existing scenic condition acreage data (see Table 3 - 58). Analysis revealed that most WNF lands have surpassed the requirements for the Modification VQO or met the Partial Retention VQO, which indicates the overall scenic resources of the Wayne are in good or excellent condition. This was due to the relatively few timber harvesting or prescribed burning activities that have occurred on the Forest in the previous decade.

Many of the Retention areas on the Forest can be found on the west side of the Ironton Unit along the State Highway 93 corridor and Lake Vesuvius Recreation Area, on the northeast section of the Athens Unit around the Burr Oak Lake Recreation Area, and the southeast section of the Marietta

Unit along the west edge of Ohio River around the town of Newport, Ohio.

The Partial Retention and Modification areas are generally distributed throughout the remaining areas on the Forest.

Table 3 - 58. Existing scenic condition acres and percent of the Forest under 1988 Forest Plan direction (VQO).

Visual Quality Objectives	Forest Acres	% of Forest
Retention (R)	119,395	50%
Partial Retention (PR)	115,718	49%
Modification (M)	2,940	1%
Total	**238,053**	**100%**

Source: WNF Project File

Though timber harvesting or prescribed burning may have occurred infrequently on the Forest during the previous decade, there have been other management activities or natural occurrences that have had an impact on the landscape. These activities or events include oil and gas exploration and development, road and trail construction, wildlife habitat improvement, minor insect infestations, and an ice storm. Management activities and insect infestations had relatively minor impacts on the Forest landscape, especially major natural disturbances.

An example of a large natural disturbance is the large ice storm of February 2003 that somewhat altered the generally closed-canopy forest aspect on the Ironton District. The storm affected, to varying degrees, an estimated 40,000-acre swath of trees across the district (east to west), nearly twice that amount on adjacent private land.

Because of the Forest's fragmented land base, the casual observer may be unable to distinguish whether scenery-altering activities have occurred on private land or NFS land. Activities such as land clearing for agricultural, urban, and mineral development on private land have caused noticeable changes in the landscape.

VMS/SMS Crosswalk

All WNF lands have been re-inventoried to comply with the new Scenery Management System (SMS), which replaced the VMS in 1995. For Forest Plan revision purposes, Scenic Integrity Objectives (SIOs) were established for each management area using the Scenery Management System. (See Table 3 - 60 for results of the Forest's SMS inventory)

SMS provides an overall framework for the orderly inventory, analysis, and management of scenery. SMS responds to the deficiencies of, builds on, and validates original VMS inventories. Additionally, SMS provides more accurate scenery-related information and better reflects the social and ecological changes that have occurred since the previous Forest Plan revision.

The system applies to all land administrated by the Forest and to all management activities, including timber harvesting, road and trail construction, stream improvements, wildlife habitat improvement, mineral developments, utility line construction, recreation developments, and fire management.

The crosswalk between Visual Quality Objectives (Visual Management System) and Scenic Integrity Objectives (Scenery Management System) is shown in Table 3 - 59. For a detailed discussion of the cross-walk between the VMS and SMS system, refer to Agricultural Handbook 701, Landscape Aesthetics–A Handbook for Scenery Management.

Table 3 - 59. Cross-walk of VMS and SMS Objectives.

Visual Quality Objective (VQO)	Appearance To Casual Observer	Scenic Integrity Objective (SIO)
Preservation (P)	Unaltered	Very High (VH)
Retention (R)	Appears Unaltered	High (H)
Partial Retention (PR)	Slightly Altered	Moderate (M)
Modification (M)	Moderately Altered	Low (L)
Maximum Modification (MM)	Heavily Altered	Very Low (VL)

Source: Landscape Aesthetics, A Handbook for Scenery Management, Agricultural Handbook 701.

SIOs define the different levels of acceptable alteration to scenic resources to help the Forest achieve desired scenic conditions. These objectives range from Very High (unaltered) to Very Low (heavily altered) as displayed in Table 3 - 59.

Environmental Consequences

Effects Common to All Alternatives

All alternatives would manage for a range of diverse landscapes and natural-appearing settings. The range of Forest landscapes would include areas with high scenic integrity displaying little or no evidence of management activities, to landscapes with lower scenic integrity where evidence of management activities are dominant. Regardless of the alternative selected, standards and guidelines would be developed to minimize the effects of management activities on scenic resources. For instance, in each alternative, flowering trees and shrubs (dogwood, redbud, etc.) would be left in regeneration harvest areas. These and other management activities would not reduce the scenic integrity below the assigned scenic objective for a given area. All alternatives would strive to create a natural-appearing landscape on the Wayne.

Direct and Indirect Effects

INDICATOR 1 – SIO Distribution Among Alternatives.

Scenic integrity objectives were assigned to each inventoried scenic classes in accordance with the proposed management areas and alternatives characteristic themes. (See Glossary for a description of scenic class.) For instance, a High SIO would generally be assigned to a Concern Level 1 or 2 areas or travel corridors, where scenery is an important part of the visitor's experience, such as the North Country National Scenic Trail. Management activities within these areas would not be readily apparent.

All lands on the Wayne were assigned one of three objectives for scenic integrity. They include the High, Moderate, and Low SIO. Very High and Very Low SIOs are not part of the scenery objectives in this analysis.) See Glossary for description of Scenic Integrity Objectives.) Table 3 - 60 displays the acre and Forest percentage distribution of SIOs for each alternative.

Table 3 - 60. Scenic Integrity Objective by alternative (Acres and % of Forest).

Scenic Integrity Objectives	Alt. A (acres / %)	Alt. B (acres / %)	Alt. C (acres / %)	Alt. D (acres / %)	Alt. E (acres / %)	Alt. E Modified (acres / %)	Alt. F (acres / %)
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 Project File and Landscape Aesthetics, A Handbook for Scenery Management, Agricultural Handbook 701.

Alternatives A and B

Alternatives A and B are similar in that the number of acres or percent of the Forest allocated to High (27%), Medium (70%), and Low (3 %) scenic integrity objectives are same and they both propose less intensive vegetation management. Under Alternative A, management activities would continue under 1988 Forest Plan direction. The Forest landscape would progressively move toward a more mature forest setting compared to what is seen today. No even-aged and minimal un-even aged vegetation management would occur in Alternative A. Conversely, Alternative B would allow for both even-aged and uneven-aged vegetation management, though less intense when compared to Alternatives C, D, E, E Modified, and F. Alternative B would place more emphasis on providing more early-successional habitat and setting. More small (2 to 30 acres) openings and younger stands of trees would be apparent under Alternative B, though still not as prevalent as could be found under Alternatives C through F.

Other human-induced activities, such as mineral development, road and trail construction, recreation area expansion, prescribed burning, and utility corridor and other special-use related facilities improvement would be readily evident in the Forest landscape. These activities may or may not emulate ecological processes, but all would be mitigated to protect or enhance scenic resources.

Eight percent of the Forest would be managed for semi-primitive non-motorized recreation opportunities under Alternative A, while Alternative B would offer half as much for SPNM recreation (4%). The level of scenic quality over the next decade for either Alternative A or B would remain the same or moderately increase.

Alternatives C through E Modified

Alternatives C, D, E, and E Modified are similar in that the number of acres or percent of the Forest allocated to High (29-30%), Medium (67-68%), and Low (3 %) scenic integrity objectives are the same and all propose more intensive vegetation management than Alternatives A or B. The Forest landscape would contain extensive tracts of mature all-aged forest with a generally closed, but uneven forest canopy. A mosaic of different-aged forest patches would be well-distributed across the Forest landscape.

Three times as many acres of uneven-aged harvest are proposed in Alternatives C through E Modified than under Alternatives A or B. Half as as many acres of even-aged harvest would occur in Alternative B.

Effects from all other management activities would be similar to those found under Alternatives A and B. These activities may or may not emulate ecological processes, but all would be mitigated to protect or enhance scenic resources.

Alternative C would provide 10 percent of the Forest for semi-primitive non-motorized recreation, while Alternatives D, E, and E Modified would offer 4 and 6 percent respectively, for SPNM recreation. Though more openings in the Forest landscape would be evident, by implementing the appropriate mitigation measures, the level of scenic quality over the next two decades for Alternatives C, D, E, or E Modified should not diminish.

Alternative F

Compared to all other alternatives, Alternative F would allocate the highest percentage of the Forest to the High (33%) scenic integrity objective with the Moderate SIO at 64 percent and the Low SIO is at 3 percent. The greatest concentration of the High SIO would be found in the Future Old Forest (FOF) and Future Old Forest with Mineral Activity (FOFMA) Management Areas. The FOF Management Area would contain most of the semi-primitive non-motorized recreation opportunities while both FOF and FOFMA is where visitors may experience more park-like stands of large, old trees.

The ratio (5:1) of uneven-aged to even-aged regeneration harvests is similar to Alternatives C through E but is managed at a less intensive level. A majority of the uneven-aged harvest areas are distributed across the Diverse Continuous Forest (DCF), Diverse Continuous Forest with OHV (DCFO), Historic Forest (HF), and Historic Forest with OHV (HFO) Management Areas while the even-aged harvest areas are primarily concentrated in the Forest and Shrubland Mosaic (FSM) Management Area. These areas are where most of the Moderate and Low SIOs are found.

Direct and Indirect Effects

Scenery Indicator 2 – Forest Landscape Description by Alternatives.

Alternative A

This alternative would continue management under the 1988 Forest Plan as amended. It would emphasize providing a continuous canopy forest containing mature mixed hardwoods of various ages. Approximately 84 percent of the Forest would be managed using the uneven-aged regeneration method. No early successional habitat (i.e., no even-aged timber harvest) would occur, except through new land acquisition or natural disturbances (i.e., insect infestations, ice storms, tornados, etc.).

The Forest would gradually transition from a predominantly oak-hickory forest type to more shade tolerant species, such as red maple and beech. Visitors would not begin to see a notable change in the Forest landscape for another 75 to 100 years. This alternative would use a mix of vegetation management tools including commercial timber harvests, prescribed fire, and pesticides (herbicides, insecticides, etc.) to help maintain and restore the mixed oak ecosystem. As the forest matures, some large oaks and hickories will eventually die out and create natural openings in the forest canopy.

Approximately 8 percent of the Forest would be managed to mimic a park-like stand of large, old trees with little understory vegetation in the Future Old Forest Management Area. Grasslands would not be a component of the Forest under this alternative.

Alternative B

The Forest would be managed to provide a mosaic of early successional habitat patches of various sizes interspersed throughout a predominately forested landscape. The Forest would also contain scattered mid- and late-successional forest communities, as well as permanent forest openings containing herbaceous vegetation. Species associated with shrub and seedling/sapling forest habitats would flourish and contribute to overall landscape biological diversity and conservation needs. This mosaic of successional habitat would make up approximately 67 percent of the Forest's vegetative component and would be maintained with extensive use of even-aged silvicultural management systems. In addition, there would be an increase in prescribed burning and pre-commercial thinning.

Compared to Alternative A, which proposes no even-aged regeneration, Alternative B would provide for the highest acres of even-aged regeneration methods. This would favor oaks as well as other fire tolerant and shade intolerant species. The mix of forest communities would generally consist of oaks and hickories in the uplands and on xeric sites (south aspect slopes) and yellow poplar, beech, maples, oaks, hickories, and other mesic species favoring moist sites (north aspect slopes and coves). Native pine communities containing white, shortleaf, pitch, and/or Virginia pine would also occur in portions of this area.

Vegetation management by even-aged regeneration methods would in the first five years would create openings 5 to 30 acres in size. Ten to 15 years after the regeneration cut, visitors would not be able to see through these areas. Foot travel through these harvest areas would be most difficult. In the following 50 years, as more shade tolerant or faster growing tree species begin to compete for space, these areas would revert to more open mixed hardwood forests with moderate vegetation cover in the understory.

A small portion of the Forest (17%) would be managed to maintain a mature forest canopy with a moderately open understory. As in Alternative A, eight percent of the Forest would be managed for old forest communities and no areas would be managed to provide large blocks of grassland.

Alternative C

This alternative emphasizes restoring and maintaining the mixed oak ecosystem through uneven-aged silvicultural systems, commercial thinnings, and prescribed burning. Much of the Forest (67%) would be managed to provide extensive tracts of mature all-aged forest with a generally closed, but uneven forest canopy. Managing a majority of the Forest with uneven-aged techniques may tend to move the Wayne away from its current and historic character of oak-hickory to more of a maple-beech dominated forest. However, this change would be gradual and not noticeable for another 75 to 100 years or more. Visitors would see similar forest conditions as found in Alternative A, except to a lesser degree because less uneven-aged management would occur. Alternative C proposes 2½ times the acres of uneven-aged harvests as Alternative A, the highest of any alternative.

A portion of each district would also provide a mosaic of well-dispersed, different-aged forest habitat using even-aged regeneration methods (10%). Views of the Forest would commonly include a greater diversity in vertical structure with an increased presence of ground and shrub-like vegetation.

Alternative C would provide for a slight increase (10%) in the old, large forest component (FOF Management Area) than compared to Alternatives A or B.

Another goal of Alternative C would be to provide an area for visitors to experience what the Forest was like prior to European settlement. This was predominantly a forest containing a nearly continuous oak-hickory forest canopy with a lower mixture of related central hardwoods and scattered pine. Under Alternative C, approximately eight percent of the Forest would be allocated to be managed as “Historic Forest”.

Approximately two percent of the Forest would be managed to provide grassland habitat for species dependant on that ecosystem.

Alternative D

Forest conditions would be similar to what would be found under Alternative C, except less of the Forest (47%) would be managed to provide extensive tracts of mature all-aged forest with a generally closed, but uneven forest canopy. A higher portion (18%) of the Forest would provide a mosaic of well-dispersed, different-aged early-successional forest habitat than compared to Alternative C.

Nearly twice as much area (14%) of the Forest would be managed for the “Historic Forest” mixed oak ecosystem than under Alternative C. The amount of land allocated for grasslands would same as under Alternative C , while land managed for old forest ecosystems would be the same as under Alternative A (8%).

Alternatives E and E Modified

Forest conditions would be similar to what would be found under Alternatives C or D, except less of the Forest (32 %) would be managed to provide extensive tracts of mature all-aged forest with a generally closed, but uneven forest canopy. A higher portion (24%) of the Forest would provide a mosaic of well-dispersed, different-aged early-successional forest habitat than compared to Alternatives C or D.

More areas of the Forest (20%) would be managed for the “Historic Forest” mixed oak ecosystem than under Alternatives C or D. The amount of land allocated for grassland and old forest ecosystems would be the same as provided by Alternative C.

Alternative F

Forest conditions would be similar to what can be found in Alternative E, except more of the Forest (23%) would be managed for large, old trees in the Future Old Forest and Future Old Forest with Mineral Activity

Management Areas. Views of the forest would have a natural, park-like appearance with less ground or shrub vegetation in the understory and scattered standing dead and fallen trees.

Same as Alternative C, 20 percent of the WNF would be managed for “Historic Forest” mixed oak ecosystem and 2 percent for native grasslands.

Cumulative Effects

The cumulative effects of the alternatives on scenic resources do not only include land within the Forest’s administrative boundaries, but also encompasses adjacent private and State lands.

In areas of interspersed ownership within National Forest System land, there is potential for combined effects from activities on NFS and other land ownerships. Due to the WNF’s mosaic and complex ownership patterns, management activities occurring on non-NFS lands that do not blend into the landscape can have an adverse affect on the Forest’s scenic resources. While most public land management agencies and commercial forest management corporations follow their own set of guidelines for managing scenic resources, no mandatory scenic quality guidelines that apply to private lands. Recognizing that timber harvests may be higher on non-NFS land, their potential negative cumulative effects may be compounded when combined with the effects that would result from Alternatives C, D, E, E Modified, or F, which propose more vegetation management/timber harvests.

Additionally, continued clearing of forested private lands for agricultural or residential development would have a negative affect on the scenic quality of adjacent WNF landscapes. However, if structures or other developments are designed to blend into the landscape, the scenic effect can be minimal.

The 2006 Forest Plan would implement SIOs consistent with the theme and emphasis of the selected alternative. Meeting the SIOs would not only help enhance the Forest’s scenic landscape, but also help attract more visitors to the area and benefit the local tourism industry.

Summary

Alternatives A and B would assign the High SIO to the least land area (63,693 acres), while Alternative F would assign the High SIO to the most acres (79,337). Most of these high SIO areas would be found in the Future Old Forest, Future Old Forest with Mineral Activity, Developed Recreation, Timbre Ridge Lake, and Special Areas Management Areas. Most of these areas have the highest concentration of land allocated for developed recreation or semi-primitive recreation opportunities. Concern

Level 1 and 2 areas – developed recreation sites, the North Country Trail, or highly traveled corridors – also would be given the highest consideration for scenic quality.

Management activities proposed under Alternatives A (no action) would provide the same results in the Forest landscape as the existing scenic condition. Alternatives B through F propose more vegetation management and prescribed burn activities than the 1988 Forest Plan. All other management activities (i.e., mineral activity, watershed restoration, etc.) would essentially remain the same across all action alternatives. Management activities with potential to cause visual deviations from a natural-appearing landscape would be mitigated by varying their size, shape, texture, location, and frequency. Many of these activities would cause minor, short-term visual impacts. Most openings created by regeneration harvests would be designed to resemble small natural disturbances. The long-term impacts to the Forest landscape from these activities would not likely be significant because the management intensity is low and widely distributed across the Forest. Urban/suburban development and agricultural activities on private lands adjacent to the Forest would more likely have a greater impact on the WNF landscape.

Lands

Affected Environment

Background

Discussions between the State Forester of Ohio and the Chief of the Forest Service regarding the possibility of establishing a national forest in Ohio began in 1919. The Forest Service noted that there was a considerable area of “rough” land near the Ohio River that would fit the criteria set forth under the Weeks Act. After initial reconnaissance, the State and the Forest Service agreed that, because Ohio had such a small amount of available “idle and waste lands”, such lands should be designated State Forests and Parks.

No further consideration of a Federal Purchase Unit occurred until the early part of President Franklin Roosevelt’s Administration. The decline in several southeastern Ohio natural resource-based industries, combined with the Great Depression, caused many people to migrate out of the region. People were abandoning the land in record numbers, leaving much of it cutover, mined out, and eroding. Many farms offered at auction for non-payment of taxes had no buyers. By 1933, more than 30 percent of the land in southeastern Ohio was tax delinquent.

In 1933, Federal legislation was proposed to relieve economic distress, create the Civilian Conservation Corps workforce, and increase the nation's forest resources. For the first time, Ohio indicated an interest in joining the National Forest system. Legislation, introduced in 1934 as the State Consent Bill, called for allowing the Federal Government to acquire certain lands in Ohio as a means to ensure "immediate preservation of the public peace, safety, and health of the inhabitants of the State of Ohio" (O.R.C. Section 1503.32). It further stated that enactment was necessary because the Federal Government had appropriated funds that year to purchase "submarginal land" to establish National Forests and was ready to consider Ohio lands. The bill established a process for designating lands available for Federal purchase. The bill became law in December of 1934, called the Ohio State Consent Act (O.R.C. Section 1503.32).

Field examination was conducted during 1934 of five proposed purchase units in southern Ohio, totaling 1,464,000 acres, including: Muskingum Unit, 282,000 acres; Hocking Valley Unit, 355,000 acres; McArthur Unit, 285,000 acres; Little Scioto Unit, 287,000 acres; and Symmes Creek Unit 255,000 acres.

The Purchase Unit boundaries were approved in 1935, and the headquarters office for the Ohio Purchase Units was established in Columbus. A Forest Service nursery was established near Chillicothe (no longer active) to produce trees for reforestation. The Civilian Conservation Corps (CCC) provided jobs for the unemployed and the manpower to begin reforesting hillsides and controlling erosion. These workers also constructed fire lookout towers across Ohio and strung telephone lines between them to relay messages for wildfire control.

In 1949, the five Ohio Purchase Units were consolidated into a single National Forest unit, together with the Purchase Units in Indiana. This consolidation was aimed at reducing the cost of administering the two systems. The consolidated units were known as the Wayne-Hoosier Purchase Units (Wayne of Ohio and Hoosier of Indiana). Bedford, Indiana, was headquarters for both units.

Over the next 20-years, acquisition of land to increase the size of the Forest within the five prescribed Purchase Units was a major emphasis. Restoration, including stabilizing erosion, rehabilitating damaged land, and controlling wildfires was another major emphasis.

In 1970, after several years of study, analysis, and legal process, the Wayne National Forest boundary was adjusted, and the number of Purchase Units was reduced from five to three – Athens, Marietta, and Ironton. The adjustments resulted in a reduction of the area within the proclamation boundary from 1,411,969 acres to 830,836 acres (as calculated by the Government Land Office). At that time, the Forest owned a total of 140,250 acres within the Units. The revision was made to include some watersheds more completely, and to exclude areas where a National Forest program was no longer possible due to residential, commercial, or industrial expansion.

In 1993 the WNF was established as a separate administrative unit, with headquarters in Athens, Ohio. The 1993 Congressional Appropriations Bill directed the establishment of a Forest Supervisor's Office for the Wayne in Ohio. Some reasons for this included the need for increased customer service in Ohio and differing resource issues on the two forests.

Since the Consent Act was signed by the State of Ohio in 1934, the Forest Service has acquired 238,053 acres (as of May 9, 2003) of 853,153 acres within the proclamation boundary that comprises the WNF's current purchase area (acreages from WNF database). (Table 3 - 61).

Table 3 - 61. National Forest acreage in the 12 WNF counties, 2003

County	WNF Acres	Proclamation Acres	Total Acres in County	WNF as % of County
Athens	18,721	83,860	325,327	5.8%
Gallia	17,907	112,405	301,543	6%
Hocking	25,741	61,293	270,974	9.5%
Jackson	1,650	7,562	269,632	0.6%
Lawrence	70,765	163,314	292,375	24.2%
Monroe	24,424	143,951	292,441	8.4%
Morgan	3,354	7,803	269,725	1.2%
Noble	715	5,626	258,738	0.3%
Perry	22,336	79,710	263,841	8.5%
Scioto	11,707	33,359	394,358	3%
Vinton	1,901	27,397	265,526	0.7%
Washington	38,832	127,251	409,125	9.5%
Total	**238,053**	**853,531**	**3,613,605**	**6.6%**

Environmental Consequences

Cumulative Effects - Common to All Alternatives

The alternatives do not vary in terms of Forest's land acquisition and land ownership adjustment program. It is difficult to assess the environmental effects of public versus private land ownership. Most of the land acquired for the WNF is undeveloped forested land. There is no way to know how the uses of this land might change in the future, if it were to remain in private ownership. In general, it can be assumed that more development would occur on privately owned than on publicly owned land. These effects would be similar under all alternatives.

Starting in 2005, Federal funds will be used by the State to purchase conservation easements under the Forest Legacy Program (FLP), authorized under the Cooperative Forestry Assistance Act. The 12 counties within the Forest's proclamation boundary are included entirely in the 31-county Forest Legacy Area, identified in the Assessment of Need draft (June 15, 2004). It is not a goal of the Forest to purchase lands with FLP conservation easements. However, with cooperation from the State, private landowners and the Forest Service, conservation easements adjacent to National Forest System land could contribute to the general conservation goals of the Forest.

The goal of consolidating the WNF land base would be the same under all alternatives. Acquiring in-holdings, adjacent properties, and lands comprising essential blocks of key ownerships would promote more efficient administration, provide greater recreation opportunities, and provide larger blocks of plant and animal habitat. The need to acquire right-of-ways for road and trail access is reduced with a consolidated land pattern.

The social and economic effects of National Forest System ownership are of interest to many residents. These effects are discussed in the social and economic section of this chapter.

Minerals and Geology

Background

For over a century and a half, mineral production has been very important to the people of Ohio, providing jobs and products that sustain a higher standard of living. This economic contribution is felt statewide as well as locally. Also, the U.S. economy depends heavily on non-renewable mineral resources.

Ohio's oil and gas industry dates back to the mid-1800s, with production in 1860 from the first commercial oil well in Washington County. The first production of natural gas followed in 1884. Since then, Ohio has ranked in the top half of all states that produce oil and gas. Ohio ranks fourth nationally in the total number of wells drilled (269,790 as of 2002), superseded only by Texas, Oklahoma, and Pennsylvania.

Coal is Ohio's most valuable single mineral resource, and the State now boasts a multi-billion dollar coal industry. Since 1800, a total of 3.63 billion tons of bituminous coal have been mined in Ohio.

Industrial minerals have been produced in Ohio since before recorded history. Native Americans exploited raw materials such as flint and clays long before the arrival of European settlers. Limestone, dolomite, sand, and gravel account for over 90 percent of Ohio's industrial mineral production. Various amounts of salt, sandstone, clay, shale, gypsum, and peat comprise the remainder. Ohio ranks 3rd nationally in the production of lime and 5th in the production of crushed stone.

The WNF is located in the heart of the State's oil, gas, and coal deposits. Industrial minerals such as sand, gravel, limestone, clay, shale, sandstone, and salt are also found within the Forest. The WNF is currently comprised of 239,497 acres of Federally owned surface (this includes acreage outside the proclamation boundary) of which about 40 percent (96,246 acres) is underlain by minerals fully owned by the Federal government. Reserved and/or outstanding mineral rights wholly or partially encumber the remaining 143,251 acres.

Minerals management differs significantly from the management of renewable Forest resources such as timber, wildlife, or recreational opportunities. First, management of mineral and energy resources on the Wayne is determined in part by the type of mineral ownership (Federal minerals, reserved minerals, outstanding minerals, or any combination thereof). Second, minerals are difficult to locate and inventory. Third, development of mineral resources depends greatly on local, national, and global markets. Such uncertainties complicate out-year planning.

Legal and Administrative Framework

With the adoption of the Mining and Minerals Policy Act of 1970, Congress set a national policy of developing an economically sound and stable domestic minerals industry through private enterprise. The act calls for the "orderly economic development of domestic mineral resources" to help satisfy the industrial, security, and environmental needs of the nation. Within this context, the Forest Service has an essential role in contributing to an adequate and stable supply of mineral and energy resources while continuing to sustain the land's productivity for other uses and its capacity to support biodiversity goals.

The government's policy was restated in the National Materials and Minerals Policy, Research, and Development Act of 1980 and the Energy Security Act of 1980. These statutes direct the Secretary of Agriculture to process applications for leases and permits to explore, drill, and develop resources on National Forest System land, notwithstanding the status of a National Forest's Land and Resource Management Plan.

Executive Order 13212 (May 18, 2001) states that agencies shall take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy.

Statutes, regulations, and executive orders guide Forest Service policy for the exploration and development of mineral resources on NFS land. Authority to manage the exploration and development of mineral and energy resources on NFS land is shared by the Secretaries of Agriculture and the Interior. The U.S. Dept. of the Interior (USDI) has primary responsibility for administration of general mining laws and mineral leasing, but certain leasing acts require the Secretary of Agriculture's consent. Leases may also be subject to conditions designed to ensure adequate utilization of lands for the purposes for which they were acquired or are being administered. The Forest Service has entered into interagency agreements with USDI agencies to establish cooperation and coordination in the management of Federally owned minerals within National Forests. The Forest Service is responsible for managing surface occupancy and use by those conducting mineral activities and to manage the disposal of certain mineral materials.

Mineral and energy resource management laws and regulations and associated authorities can be divided into two categories:

- Surface management authorities
- Mineral management authorities.

Major laws and regulations that authorize the Forest Service to manage surface resources in conjunction with mineral exploration and development include:

- Organic Administration Act of 1897
- Multiple-Use Sustainable-Yield Act of 1960
- Wilderness Act of 1964
- National Environmental Policy Act of 1969
- Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976
- National Forest System Land and Resource Management Planning Regulations (36 CFR 219)
- Forest Service Minerals Regulations (36 CFR 228)
- Forest Service Manual 2800.

General laws and regulations that specify the procedures and conditions under which exploration and development of mineral and energy resources on NFS land may be conducted include:

- General Mining Law of 1872 (does not apply to eastern National Forests)

- Act of March 4,1917 (Mineral Resources on Weeks Law Lands)
- Mineral Lands Leasing Act of 1920, as amended
- President's Reorganization Plan No. 3 of 1946
- Materials Act of 1947
- Mineral Leasing Act for Acquired Lands of 1947
- Multiple-Use Mining Act of 1955
- Geothermal Steam Act of 1970
- Mining and Minerals Policy Act of 1970
- Federal Coal Leasing Amendments Act of 1976
- Federal Land Policy and Management Act of 1976
- Surface Mining Control and Reclamation Act of 1977
- Energy Security Act of 1980
- National Materials and Minerals Policy, Research, and Development Act of 1980
- Federal Onshore Oil and Gas Leasing Reform Act of 1987
- Comprehensive National Energy Policy Act of 1992
- Energy Policy Act of 2005
- Forest Service Minerals Regulations (36 CFR 228, Subpart C – Disposal of Mineral Materials)
- Forest Service Manual 2800.

The authority for the administration of *reserved minerals* is 36 CFR 251.15 (1963 Secretary of Agriculture's rules and regulations that govern the exercise of mineral rights reserved in conveyances to the United States). Prior to 1963, the Secretary issued rules and regulations in 1911, 1937, and 1947 for National Forests. Companion rules and regulations were issued in 1938, 1939, and 1950 for National Grasslands. When the United States acquired surface ownership of NFS lands, the appropriate rules and regulations in effect at the time of the mineral reservation were incorporated in the deeds.

The Secretary's rules and regulations do not apply to *outstanding mineral* rights. However, the exercise of all reserved and outstanding mineral rights is subject to applicable Federal and State laws and regulations pertaining to mining, real property, and environmental protection, including the Surface Mining Control and Reclamation Act with regard to coal. In general, the Forest Service has no authority to deny the exercise of reserved or outstanding mineral rights. However, every effort must be made to mitigate or minimize the effects of mineral exploration and development on other resources.

Codified State laws and regulations that apply to mineral activities on the WNF include:

- Ohio Revised Code, Title (15) XV Conservation of Natural Resources. Notably Chapter 1509 (Oil & Gas), Chapter 1513 (Coal Surface Mining), Chapter 1514 (Other Surface Mining), and Chapter 1561 (Mines & Quarries).
- Ohio Administrative Code, Chapter 1501:9 (Oil & Gas), and Chapter 1501:13 (Coal).

Statutory and regulatory direction divides Federal mineral resources into three categories: locatable, leasable, and saleable.

Locatable Minerals

Locatable minerals are those (such as metallic minerals) regulated by the Bureau of Land Management (BLM) pursuant to the General Mining Law of 1872, which allows mining claims to be located on public domain lands but not on acquired lands. Since eastern National Forests (including the WNF) are made up of acquired lands only, the General Mining Law of 1872 does not apply to them. On eastern National Forests, all minerals (except saleable minerals) are leasable.

Leasable Minerals

With passage on the Mineral Leasing Act of 1920, Congress established a program to provide for the exploration and development of certain minerals[1] on Federal lands, including National Forests. This Act authorizes the Secretary of the Interior to issues leases for the disposal of these minerals. The Mineral Leasing Act for Acquired Lands of 1947 extends these mineral leasing provisions to acquired National Forest System land, but requires the consent of the Secretary of Agriculture prior to leasing. In the case of coal, the Surface Mining Control and Reclamation Act of 1977 (SMCRA), as amended, gives the Office of Surface Mining (OSM) the authority to regulate coal mining operations.

[1] Coal, phosphate, sodium, potassium, oil, oil shale, gilsonite, gas, and (in Louisiana and New Mexico) sulfur. Geothermal resources were added to the list of leasable minerals by the 1970 Geothermal Steam Act.

Saleable Minerals

Mineral materials, or "common variety" minerals[2], are commodities having a low value per ton. These include sand, gravel, crushed stone, riprap, clay, and fill dirt. The Mineral Materials Act of 1947 authorizes the disposal of these minerals through a sale system on U.S. public lands. Any sale of mineral materials must be made at no less than fair market value as determined by an appraisal. The act also provides for free use (not exceeding 5,000 cubic yards, or weight equivalent) of these materials by Federal or state agencies, municipalities, non-profit associations, or individuals as long as those materials are not for commercial, industrial, or resale purposes. Disposal of mineral materials is at the discretion of the authorized officer.

[2] The Multiple Use Act Mining Act of 1955 defines "common variety mineral materials" and distinguishes them from rare varieties (uncommon variety mineral material). Uncommon variety mineral materials may be locatable under the Mining Law of 1872 on public domain lands only.

Affected Environment

Mineral Ownership

Surface and Mineral ownership on the WNF is intermixed and complex.Table 3 - 62 shows the current surface/mineral ownership within the WNF proclamation boundary and about 1,000 acres beyond it.

Seventy-two percent of the land within the proclamation boundary of the Wayne National Forest is privately owned. Sixty percent of the Federally owned surface has privately owned minerals beneath it.

Table 3 - 62. Wayne National Forest surface/mineral ownership.

Ownership			Marietta Unit (acres)	Athens Unit (acres)	Ironton District (acres)	Forest Totals (acres)
Federal Surface	**Federal Minerals**	100% minerals Unencumbered	8,507	10,382	43,491	62,380
		100% minerals with deed lease[1]	8,760	8,069	17,037	33,866
		Total Federal Minerals	**17,267**	**18,451**	**60,528**	**96,246**
	Private Minerals[2]	Reserved Minerals	4,384	5,663	9,182	19,229
		Outstanding Minerals	7,622	12,468	11,000	31,090
		Combination[3]	34,725	36,565	21,642	92,932
		Total Private Minerals	**46,731**	**54,696**	**41,824**	**143,251**
Total Federal Surface			**63,998**	**73,147**	**102,352**	**239,497**
Private Surface	**Federal Minerals**		7	116	708	831
	Private Minerals		204,053	195,682	214,273	614,008
Total Private Surface			**204,060**	**195,798**	**214,981**	**614,839**
Total Acres within the WNF			**268,058**	**268,945**	**317,333**	**854,336**

[1] Most of these leases appear to be inactive and/or may have expired, but their legal status is currently unknown.

[2] Reserved, Outstanding, and Combination minerals may not all be 100% private minerals. Partial Federal interests may exist as well.

[3] Combination indicates a parcel with two or more outstanding, reserved or deed lease rights.

Minerals underlying National Forest System land may be Federally or privately owned or a combination of both. Federal minerals are those to which the rights have been acquired by the Federal government through purchase, exchange, or donation. Private minerals are divided into reserved and outstanding rights. Reserved minerals are mineral rights retained by the seller when the surface is sold. Outstanding minerals are mineral rights retained by a third party prior to transfer of the surface.

Sorting out mineral rights can be very complex and may involve the following situations:

- Different individuals, entities, or groups of individuals and/or entities may own different minerals or groups of minerals. For example, the Federal government may own the oil, but the gas could be reserved in private ownership while ownership of the coal remains outstanding in other private hands.
- Each mineral or combination of minerals could be held wholly or partially by different owners.
- The ownership of a particular mineral (oil for instance) could be split into separate producing horizons. Each horizon could have one individual owning 100 percent of the mineral in question. Groups of owners could hold any conceivable combinations of partial rights.
- Minerals can be reserved forever or just for a number of years (term reservation). If a private lease is in effect when the government acquires a mineral estate, the existing lease is called a "private-acquired lease". Private-acquired leases are unique. Even though the Federal government owns the minerals and assumes the role of lessor, it cannot legally apply any of its mineral regulations because the leases were not issued by the United States (via the Bureau of Land Management).
- If the government acquires a surface with a term mineral reservation but no lease is in effect, another awkward situation may arise. If, during the time of the mineral reservation, a lease is executed by the grantor, it becomes a term private lease that expires when the minerals revert back to the government. Section 2507 of the Comprehensive National Energy Policy Act of 1992 (CNEPA) amended the Mineral Leasing Act of 1920 to allow these expiring term private leases to be converted non-discretionally and non-competitively by the BLM to Federal leases under certain conditions (the operator must request the conversion, and there must be a producing well or one capable of producing in paying quantities).

Geology

The geologic setting is the foundation for a variety of ecological elements. Geologic materials and geologic processes control or influence a host of ecological factors such as:

- Slope aspect and steepness
- The aerial extent of landforms and associated vegetation
- Distribution and composition of soil parent material

- Structure and composition of vegetation
- Physical character of wetlands, riparian areas, and stream substrates
- Quantity and quality of stream water and ground water
- The natural disturbance regime.

Surface geologic processes are an important part of the natural disturbance regime in the Forest. These processes include:

- Erosion, transport, and deposition of sediments
- Mass wasting or landsliding
- Flooding
- Changes in stream channels and groundwater flow
- Sinkholes and other features.

These processes have always been part of the natural disturbance regime and affect the Forest in varying degrees every year.

The interaction of the surface geologic processes with the different geologic formations and geologic structures produced different landforms. The Wayne National Forest lies within the Kanawha section of the Appalachian Plateau province, which in Southeastern Ohio is characterized by deeply dissected unglaciated hills that are underlain by sedimentary rocks outcropping along narrow ridges in steep-sided, V-shaped valleys. Though Southeastern Ohio escaped glaciation, its physiography was very much influenced by the glacier meltwaters draining from the north and west.

The average relief of the area (the difference between the topographical highs and lows) is between 400 and 450 feet on some parts of the Forest but much less elsewhere. The skyline formed by the tops of the high points is relatively even across the Forest, true to its “plateau” designation.

Except for recent lacustrine (lake) and fluvial (river, stream) deposits and Pleistocene glacial deposits, all exposed rocks in Ohio are of the Paleozoic Era (440 to 185 million years before the present). These include, from the oldest to the youngest, Ordovician, Silurian, Devonian, Mississippian, Pennsylvanian, and Permian rocks. Paleozoic Cambrian rocks are not exposed in Ohio. The rock strata of the Mesozoic Era (Triassic, Jurassic, and Cretaceous), as well as all of the Tertiary rocks of the Cenozoic Era (Paleocene, Eocene, Oligocene, Miocene, and Pliocene) have been eroded away. The bedrock in central and western Ohio is composed predominantly of marine limestones and shales of Ordovician to Devonian age inclusively. In eastern Ohio the bedrock is mostly non-marine shales and sandstones (including coals) with lesser amounts of marine shales, sandstones, and limestones of Mississippian to Permian age. Pennsylvanian and Permian beds at many localities were deposited under more or less cyclic successions of alternating marine and non-marine environmental conditions called cyclothems.

In Ohio, the rock strata are arranged in a great, generally north-south trending, anticline called the Cincinnati Arch, which is divided in two branches. The Kankakee branch extends northwesterly into Indiana from the Cincinnati area, and the Findley branch extends north-northeasterly from Cincinnati toward Toledo and beyond. The rock strata dip (slope) east and southeast from the crest of the Findley branch toward the Appalachian geosyncline (a great trough-like basin) underlying the Appalachian Highlands. Some smaller north-south structures affect the geology of eastern and southeastern Ohio. These are the Parkersburg-Lorain syncline and the associated Cambridge Arch. As a result of all the foregoing structures, the oldest rocks in Ohio outcrop in the western part state and the youngest outcrop in the east and southeast along the Ohio River.

Geology of the Wayne National Forest

Bedrock outcrops on the Forest are composed of clay, shale, siltstone, sandstone, conglomerate, and limestone, mostly from Pennsylvanian and Permian systems. Some Mississippian rocks also occur on the surface. Coal seams are found interbedded in the Pennsylvanian and Permian formations. These rock units – as well as the thick sequence of sedimentary rocks of Devonian, Silurian, Ordovician and Cambrian Ages – overlie an igneous and metamorphic Pre-Cambrian complex.

Formations in the vicinity of the WNF generally strike in a northeast-southwest direction and dip gently to the southeast, averaging less than five degrees.

The correlation between the Appalachian Plateau and a subsurface feature called the Appalachian Basin accounts for the southeasterly dip of rock formations underlying the WNF. This basin was probably formed by slow subsidence during the Paleozoic era. The subsidence is believed to have been most rapid towards the center of the basin, which lies southeast of the Forest. Sedimentation into the basin kept up with the subsidence during most of the basin's formation, consequently, sedimentary rock units thicken as they dip towards the basin's center, resulting in an increased dip of older (deeper) rock units.

This dip represents the only known major structural feature within the Athens and Ironton Units. However, within the Marietta Unit the major structural feature is the north-south trending Burning Springs Anticline, which has smaller features on its flanks. No large faulting is known in the area, although small faults do occur. Despite the large number of wells drilled in the area, the stratigraphy of eastern Ohio remains poorly understood.

The known oil and/or gas producing zones in eastern Ohio include:

- "Goose Run Sand" within the Pennsylvanian Monongahela Group, Upper Sewickley Sandstone (SS)
- "1st Cow Run" within the Pennsylvanian Conemaugh Group, Cow Run SS
- "2nd Cow Run" within the Pennsylvanian Allegheny Group, Upper Freeport SS
- "Macksburg 500' " within the Pennsylvanian Allegheny Group, Clarion SS
- "Macksburg 700' " within the Pennsylvanian Pottsville Group, Homewood SS
- "Salt Sand" within the Pennsylvanian Pottsville Group, Massillon SS
- "Big Injun" within the Mississippian Cuyahoga Fm, Black Hand SS
- "Squaw Sand" within the Mississippian Cuyahoga Fm
- "Weir Sand" within the Mississippian Cuyahoga Fm, Buena Vista SS
- "Coffee Shale" within the Mississippian Sunbury Shale Fm
- "1st Berea" within the Mississippian Berea Sandstone Fm
- "Gantz" within the Devonian Ohio Shale Fm, Chagrin Shale
- "Gordon" within the Devonian Ohio Shale Fm, Chagrin Shale
- "Big Cinnamon" within the Devonian Ohio Shale Fm, Huron Shale
- Unnamed zone within the Devonian Oriskany Sandstone Fm
- Unnamed zone within the Silurian Salina Group, Bass Island Dolomite Fm
- "Newburg" within the Silurian Niagara Group, Lockport Dolomite Fm
- "Clinton" within the Silurian Albion Group, Grimsy SS
- "Medina" within the Silurian Albion Group, Whirlpool SS
- Unnamed zone within the Ordovician Trenton Limestone Fm
- Unnamed zone within the Ordovician Black River Limestone Fm
- "Gull River" within the Ordovician Black River Limestone Fm

- "St. Peter Sand" within the Ordovician Wells Creek Fm
- "Rose Run Sand" within the Ordovician Knox Dolomite Fm
- "Trempealeau" within the Cambrian Knox Dolomite Fm.

On the WNF, the three major oil and gas targets are the Berea Sandstone, the Ohio Shale, and the "Clinton"-Medina. A detailed discussion of these three targets can be found in Appendix B of the Record of Decision and Final EIS of the 1988 Forest Plan Amendment #8.

Continuous coal beds in eastern Ohio include:

- Pennsylvanian Monongahela Group, Pittsburgh No. 8
- Pennsylvanian Allegheny Group Upper Freeport No. 7 coal
- Pennsylvanian Allegheny Group Middle Kittanning No. 6 coal
- Pennsylvanian Allegheny Group Lower Kittanning No. 5 coal.

Additionally, there are as many as 15 discontinuous coal beds within the Pennsylvanian Conemaugh and Allegheny Groups.

Given the nature of the sedimentary formations outcropping or close to the surface, mineral materials (sand and gravel, dolomite, limestone, clay, etc.) are abundant on the Forest.

There are several fossiliferous marine members of the Pennsylvanian system. The marine fossils within these members consist of gastropods, corals, cephalopods, fusulinid protozoans, clams, brachiopods, bryozoans, and trilobites. These are all fairly common invertebrate fossils. A few formations have yielded fish fossils and scales as well. Plant fossils in the form of plant fragments, fern fronds, trunks, pyritized logs, stumps, spores, and roots, can be found in a variety of deposits including coal, clay, shale, sandstone, and limestone. Some formations have an abundance of plant fossils. Others only have traces, while the majority has none.

Mineral Resources

The Appalachian Basin, which includes Ohio counties covered by the WNF, gave birth to the world's oil industry and is one of the oldest commercially producing provinces in North America. Through 2003, Ohio wells have produced 1.1 billion barrels of oil and 7.92 billion Mcf of natural gas. Virtually all of the production comes from "stripper" wells and is pumped by independent producers, many of who are small family-owned businesses. Many wells, particularly in Southeastern Ohio, are completed in, and produce from, multiple reservoirs. Research completed by the Ohio Department of Natural Resources (ODNR), Divisions of Mineral Resources Management and Geological Survey, indicates that

Ohio has significant remaining producible oil and gas reserves (OOGA, 2002 and ODNR, 2003b).

Since 1800, a total of 3.65 billion tons of bituminous coal have been mined in Ohio. However, from 1970, when the production peaked at 55 million tons, the industry declined to a production of 22.5 million tons in 2000. Coal production in 2001 totaled 25.8 million tons, 48.6 percent of which was recovered from 102 surface mines with 51.4 percent from 10 underground mines. This was a 14.7 percent increase over the 2000 production figures. In 2002 coal production totaled 21 million tons an 18.6% decrease from 2001. Production in 2002 came from 95 surface mines (48.3%) and 9 underground mines (51.7%) The State Division of Geological Survey has estimated the 2003 production at 21.9 million tons.

Ohio has a long history of industrial mineral production. Industrial mineral production for 2002 totaled 137.1 million tons from 708 mining operations, a decrease of 0.9 percent from 2000. Estimated 2003 production figures were 137.1 million tons.

Mineral Development and Exploration of the Wayne National Forest

Oil and Gas Development

Most wells within the WNF are all classified as “stripper” wells, which produce small volumes of oil, gas, or both, with equally small volumes of brine as a waste product. The average stripper gas well in Ohio produces 7.4 Mcf per well each day, while the average stripper oil well produces less than one barrel of oil per day. Table 3 - 63 shows that $1,155,213 worth of oil was produced from private and Federal wells in 2002 on the WNF ($1,886,847 using 2004 oil values). The corresponding natural gas figures are $2,816,115 ($5,343,188 using 2004 gas values). These figures are based on oil and gas production for the 12 counties comprising the WNF and the percentage of NFS acres within each of these counties.

Table 3 - 63. 2002 oil and gas production (private and Federal minerals) on the WNF.

	Athens Unit	Marietta Unit	Ironton Unit	WNF Totals
2002 Oil Production (Bbl)	29,365	12,981	8,996	51,342
2002 Oil Values	$660,712	$292,081	$202,420	$1,155,213
July 2004 Oil Values	$1,079,163	$477,065	$330,619	$1,886,847
2002 Gas Production (Mcf)	208,306	377,383	240,152	825,841
2002 Gas Values	$710,322	$1,286,876	$818,917	$2,816,115
July 2004 Gas Values	$1,347,738	$2,441,669	$1,553,781	$5,343,188

Table 3 - 64 shows the royalties generated from Federally leased wells on the WNF from 1996 to 2003, and Table 3 - 65 shows the mineral revenue payments to Ohio counties made in the same period (25% of all mineral royalties received by the Federal government from lands acquired under the Weeks Act are given to the State).

Table 3 - 64. Royalty payments to counties from Federal oil and gas wells.

Unit/County	2003	2002	2001	2000	1999	1998	1997	1996
Athens								
Athens	$4,696	$3,448	$7,344	$5,036	$4,644	$6,020	$7,608	$9,192
Hocking	$6,052	$4,424	$9,548	$6,396	$5,864	$7,544	$9,480	$11,752
Morgan	$856	$632	$1,344	$920	$872	$1,132	$1,428	$1,768
Perry	$5,376	$3,884	$8,228	$5,532	$5,208	$6,724	$8,444	$10,452
Vinton	$480	$356	$756	$516	$488	$640	$804	$956
Athens Totals	**$17,460**	**$12,744**	**$27,220**	**$18,400**	**$17,076**	**$22,060**	**$27,764**	**$34,120**
Marietta								
Washington	$9,944	$7,312	$15,580	$10,692	$10,096	$13,076	$16,452	$20,216
Monroe	$6,260	$4,568	$9,728	$6,676	$6,304	$8,172	$10,256	$12,636
Noble	$176	$132	$252	$108	$100	$136	$168	$208
Marietta Totals	**$16,380**	**$12,012**	**$25,560**	**$17,476**	**$16,500**	**$21,024**	**$26,876**	**$33,060**
Ironton								
Lawrence	$17,676	$13,044	$27,796	$19,236	$18,024	$23,240	$27,624	$34,672
Gallia	$4,352	$3,212	$6,844	$4,696	$4,436	$5,756	$7,256	$9,048
Scioto	$2,984	$2,204	$4,668	$3,148	$2,964	$3,812	$4,756	$5,784
Jackson	$436	$324	$688	$472	$444	$584	$732.00	$904
Ironton Totals	**$25,448**	**$18,784**	**$39,996**	**$27,552**	**$25,868**	**$33,392**	**$40,368**	**$50,408**
TOTALS	**$59,288**	**$43,540**	**$92,776**	**$63,428**	**$59,444**	**$76,836**	**$95,008**	**$117,588**

Table 3 - 65. Mineral revenue payments to Ohio counties

Unit/County	**2003**	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**
Athens								
Athens	$1,174	$862	$1,836	$1,259	$1,161	$1,505	$1,902	$2,298
Hocking	$1,513	$1,106	$2,387	$1,599	$1,466	$1,886	$2,370	$2,938
Morgan	$214	$158	$336	$230	$218	$283	$357	$442
Perry	$1,344	$971	$2,057	$1,383	$1,302	$1,681	$2,111	$2,613
Vinton	$120	$89	$189	$129	$122	$160	$201	$239
Athens Totals	**$4,364**	**$3,186**	**$6,805**	**$4,600**	**$4,269**	**$5,515**	**$5,589**	**$8,530**
Marietta								
Washington	$2,486	$1,828	$3,895	$2,673	$2,524	$3,269	$4,113	$5,054
Monroe	$1,565	$1,142	$2,432	$1,669	$1,576	$2,043	$2,564	$3,159
Noble	$44	$33	$63	$27	$25	$34	$42	$52
Marietta Totals	**$4,095**	**$3,003**	**$6,390**	**$4,369**	**$4,125**	**$5,346**	**$6,719**	**$8,265**
Ironton								
Lawrence	$4,419	$3,261	$6,949	$4,809	$4,506	$5,810	$6,906	$8,668
Gallia	$1,088	$803	$1,711	$1,174	$1,109	$1,439	$1,814	$2,262
Scioto	$746	$551	$1,167	$787	$741	$953	$1,189	$1,446
Jackson	$109	$81	$172	$118	$111	$146	$183	$226
Ironton Totals	**$6,362**	**$4,696**	**$9,999**	**$6,888**	**$6,467**	**$8,348**	**$10,092**	**$12,602**
TOTALS	**$14,822**	**$10,885**	**$23,194**	**$15,857**	**$14,861**	**$19,209**	**$23,752**	**$29,397**

About 71 percent of the active leases of Federally owned minerals on the WNF are “private-acquired” leases, private lease agreements in effect when the Federal government acquired the mineral rights. These private leases constitute an outstanding contractual right that must be honored. Private-acquired leases are unique because even though the Federal Government owns the minerals and assumes the role of lessor, it cannot legally apply any of its mineral regulations since the leases were not issued by the United States (via the Bureau of Land Management). Instead, private-acquired leases are administered principally under their own lease terms, State law, and a normal lessee-lessor relationship.

Activity on Federal leases on the WNF since 1993 has been minimal. Only four new wells were drilled and six depleted producers were plugged. Oil and gas activities on outstanding and reserved mineral rights have averaged five wells drilled per year on the Forest. Over the last decade, oil and gas production in Ohio has declined steadily, from 8.3 million barrels of oil in 1993 to 5.65 million barrels in 2003, and from 136 million Mcf of gas to 94 million Mcf over the same period. The low number of new wells can be attributed to energy prices in the mid-1990s, which were some of the lowest experienced by industry in 35 years (See Table 3 - 66). However, current energy prices are strong and have elicited increased interest in drilling new wells on Federal leases on the WNF. Ten new Applications for Permit to Drill (APD) were submitted in 2003/2004.

Table 3 - 66. Average wellhead price of oil & gas, 1993 – 2004.

Year	Oil - $/Bbl	Gas - $/Mcf
1993	$17.26	$2.48
1994	$15.59	$2.45
1995	$16.61	$2.33
1996	$19.55	$2.63
1997	$17.68	$2.74
1998	$11.73	$2.24
1999	$16.20	$2.41
2000	$26.76	$4.06
2001	$21.84	$4.49
2002	$22.50	$3.41
2003	$27.64	$5.90
2004 (July)	$36.75	$6.47

Table 3 - 67 displays the different types of leases currently active on the WNF and the associated number of producing wells. The Forest also has many inactive leases not included in this table. Their status is unknown.

Table 3 - 67. Active leases and producing wells.

Lease Type	Marietta Unit Leases	Marietta Unit Wells	Athens Unit Leases	Athens Unit Wells	Ironton District Leases	Ironton District Wells	Forest Totals Leases	Forest Totals Wells
Federal lease Unrestricted Mgmt. Areas[1]	33	51	14	18	1	3	48	72
Federal lease NSO Mgmt. Areas[2 & 3]	7	21	0	0	1	1	8	22
Private acquired Unrestricted Mgmt. Areas	98	232	23	75	1	1	122	308
Private acquired NSO Mgmt. Areas	19	32	1	1	0	0	20	33
Total leases/wells on Federal minerals[4]	**157**	**336**	**38**	**94**	**3**	**5**	**198**	**435**
Federal acres leased[5]		11,215		6,696		2,545		20,456
Outstanding rights Unrestricted Mgmt. Areas	164	442	35	118	4	4	203	564
Outstanding rights NSO Mgmt. Areas	23	66	7	12	1	1	31	79
Reserved rights Unrestricted Mgmt. Areas	28	61	27	79	0	0	55	140
Reserved rights NSO Mgmt. Areas	14	16	4	12	0	0	18	28
Total leases/wells on Private Minerals	**229**	**585**	**73**	**221**	**5**	**5**	**307**	**811**
Totals Leases/Wells	**386**	**921**	**111**	**315**	**8**	**10**	**505**	**1246**

[1]Management Areas 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 6.1, 6.3, & 9.1

[2]No Surface Occupancy management areas, which includes 6.2, 7.1, 8.1, 8.2, & 9.2

[3]Existed prior to Amendment #8, which changed Mgmt. Area 6.2 to No Surface Occupancy

[4]Private acquired leases, though on Federal minerals, are not Federal leases.

[5]Acreage figures come from BLM's LR2000 database, and are somewhat lower than the acreage actually leased. This is due to possible database discrepancies coupled with the lag time involved to get private acquired lease packages from the FS to the BLM.

Literally hundreds of old, (early 1900s) abandoned oil and gas wells (so-called orphan wells) on the WNF have not been plugged or have been improperly plugged. These pose a significant potential threat to environmental health and human safety. The plugging of orphan wells on the WNF has traditionally been a cooperative effort between the State and the Forest Service and, in some cases, the Bureau of Land Management (BLM) for wells on Federal leases. However, orphan wells have been plugged at a very slow pace, as shown in Table 3 - 68.

Table 3 - 68. Orphan well plugging.

	Number of Orphan Wells Plugged			
Year	**Marietta Unit**	**Athens Unit**	**Ironton District**	**Totals**
2004	2	0	0	2
2003	0	0	0	0
2002	3	0	2	5
2001	3	0	0	3
2000	1	4	1	6
'93 to '99	0	0	0	0
1992	2	0	0	2
Totals	**11**	**4**	**3**	**18**

Coal Mining Operations

There are currently no Federal coal leases on the WNF, and there has been no demand for Federal coal resources for at least 15 years.

From 1990 to 1992, Avis Coal exercised its outstanding rights to strip-mine 220 acres on the WNF. The final bond release was in 1998.

A permit to strip mine coal on the Athens Unit was issued in 1998 under valid existing reserved rights. Approximately 80,000 tons of low-sulfur coal were removed, and reclamation was completed in the fall of 1999.

A Plan of Operations was recently approved for exploratory coal drilling in the Corning area of the Athens District involving outstanding mineral rights. On the Ironton District, one company holds valid existing rights to strip mine coal on approximately 1,200 acres of land.

Past coal mining operations have left many acres of abandoned mined lands, particularly on the Athens Unit and the Ironton District. To remedy this situation, the following has been accomplished in cooperation with many partners since 1997:

- Reclamation of 25 acres of gob piles
- Closure and reclamation of 21 subsidence areas
- Closure, or bat gating, of seven open mine portals
- Enhancement of three acres of wetland
- Restoration of two acres of stream using natural channel design concepts
- Construction and/or installation of various systems to treat acid mine drainage.

More details on the reclamation of old abandoned mines can be found in the Watershed section of Analysis of the Management Situation.

Mineral Materials

Over the last five years, there has been no mineral materials activity on the WNF. None were sold, no free-use permits were issued, and there was no in-service use of mineral materials for road maintenance, etc.

Geophysical Exploration

No recent geophysical exploration has been conducted on the Marietta Unit of the Forest, despite requests for two permits to do so in 2000 and one permit in 2002. There has been recent geophysical activity on private lands, however. On the Athens Unit, one permit was issued in 2002, resulting in 3.45 miles of line laid. Additionally, seven geophysical permits have been issued over the last 10 years. On the Ironton District, no geophysical exploration activities have been conducted recently.

Reasonably Foreseeable Development Scenario for Oil and Gas

Increased national demand for energy has driven up the price producers receive at the wellhead. Consequently there is increased interest in drilling wells on the Federally owned surface of the WNF. Based on a BLM survey of local oil and gas producers, a forecast of the total number of new wells and associated surface disturbance likely to occur on Federal surface over the next 10 years, regardless of mineral ownership (Federal, reserved or outstanding), is shown in Table 3 - 69 for the Forest's three administrative units.

Table 3 - 69. Forecasted Federal oil and gas operations over next 10 years.

Oil and Gas Activity	Athens Unit	Marietta Unit	Ironton Unit	Forest Wide
Number of new wells drilled	24	110	100	234
Miles of new access road needed	5	21	19	45
Total acres of surface disturbed by oil & gas drilling activity before reclamation	27	135	110	272
Total acres of surface needed to support drilled wells that are completed for production (excess disturbance reclaimed)	11	59	51	121
Number of depleted wells plugged	82	26	0	108
Total acres reclaimed by plugging depleted wells	45.1	14.3	0	59.4

Federally owned minerals constitute about 40 percent of the mineral ownership on the WNF. This represents the only class of mineral estate for which the Forest Service can decide whether to make the surface 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 leased on a timely basis upon request with only standard lease stipulations
- Drilling permits on Federal minerals are processed in timely fashion
- Oil and gas prices remain at or above current levels.

The entire text of the Reasonably Foreseeable Development Scenario (RFDS) for Oil and Gas can be found in Appendix G.

Minerals Indicator 1 – Leasable, Federally-Owned Minerals

Federal Leasable Minerals Management

The responsibility for managing Federal leasable mineral resources is shared by the Forest Service and the U.S. Department of the Interior's Bureau of Land Management. The BLM has a major role in issuing licenses, permits, and leases for Federal minerals and in supervising associated operations. In the case of coal, USDI's Office of Surface Mining has the authority to regulate coal mining operations. The Interior Department's agencies cooperate with the Forest Service to ensure that impacts upon surface resources are mitigated and that affected land is reclaimed.

Oil and Gas

For oil and gas, the Forest Plan makes two decisions:

- Availability of lands for future leasing [36 CFR 228.102(d)]
- The lease terms and stipulations to apply to tracts of Federally owned minerals that the Forest consents to lease. [36 CFR 228.102 (e)]

The first decision was made in Amendment #8 to the 1988 Forest Plan adopted in 1992, which made all Federally owned minerals on the Forest available for lease. None of the alternatives considered in detail would modify the availability decision.

Coal

The Surface Mining Control and Reclamation Act of 1977, as amended, prohibits surface (strip) mining of coal (subject to valid existing rights and certain exceptions) on any Federal lands within the boundaries of any National Forest east of the 100th meridian. There are currently no leases for Federally owned coal on the WNF.

Non-energy Minerals

Non-energy minerals, such as metallic minerals normally locatable on public domain lands under the Mining Law of 1872, may be leased only on the acquired lands of eastern National Forests. However, geological settings comprising sedimentary rocks, such as those found on the WNF, do not generally host such minerals. Therefore, leasing and development of such minerals on the Wayne is unlikely.

Federal Mineral Materials Management

Mineral materials are managed in accordance with 36 CFR 228, subpart C. Though limestone, dolomite, sand, and gravel account for over 90 percent of Ohio's industrial mineral production (137.1 million tons in 2002), and Ohio ranks 3rd nationally in the production of lime and 5th in the production of crushed stone, the demand for these mineral from the WNF has been non-existent for the last decade or so. That situation is expected to change little over the next decade.

Minerals Indicator 2 - Management of Private Mineral Rights on Federal Lands

An important difference in the administration of private mineral rights (reserved or outstanding rights) is that the exercise of those rights is not a privilege but a right owned by a private party. As such, the Forest Service has no role in leasing, and the BLM is not involved in the approval of an Application for Permit to Drill (APD) for privately owned oil and gas. Coal activities are regulated by OSM, through the Ohio Department of Natural Resources, in cooperation with the Forest Service.

Private mineral rights are administered so that their activities/operations are consistent with:

- Rights granted by deed
- Best management practices, to use only as much of the surface as necessary
- The Forest Plan's standards and guidelines
- In the case of reserved minerals, the appropriate Secretary of Agriculture's Rules and Regulations and Pertinent Federal and State regulations.

Environmental Consequences

Analysis Area

The area within the WNF proclamation boundary constitutes the area of analysis for the environmental effects relating to minerals issues. This look at the direct and indirect effects of implementing the 2006 Forest Plan will be limited to impacts affecting only National Forest System (NFS) land. The cumulative effects analysis, however, will include impacts off NFS land.

This section examines the impacts of implementing Forest-wide standards and guidelines and management area direction that pertain to non-mineral resources (wildlife, watershed, vegetation, recreation, etc.) but affect the exploration and development of minerals. Environmental impacts of mineral activities on other resources are analyzed within the respective sections of the affected resources.

Effects Common to All Alternatives

Direct and Indirect Effects

Direct effects immediately follow a specific action or activity and occur at the same place. Indirect effects are caused by a specific action or activity but typically occur later in time and farther in distance. Direct and indirect effects sometimes have been considered together and not identified separately. Effects relating to minerals issues were analyzed assuming reasonably foreseeable development activities (see RFDS in Appendix G).

Minerals Indicator 1 - Leasing of Federally owned mineral rights for oil and gas extraction

To protect the diverse resources of the WNF, certain constraints may be imposed on the exploration and development of mineral resources. These limitations – based on laws, regulations, and executive orders – modify standard lease rights and are made part of a new lease. They strengthen protection of identified resources and require mitigation of negative effects. All activities on Federal oil and gas leases are subject to these limitations. The different categories of limitations are listed below in descending order of control:

In **Statutorily Withdrawn** areas (such as wilderness areas), acts of Congress prevent the leasing of Federally owned minerals. The WNF contains no such areas.

To protect desired values, the **No Surface Occupancy** (NSO) stipulation prohibits use or occupancy of the land surface for oil and gas exploration and development. The Forest Plan applies NSO in two ways:

- NSO is applied to certain management areas (MA NSO).

- NSO is applied where specific conditions (e.g., steep slopes) or resources occur Forest-wide (FW NSO).

Even though an NSO stipulation prohibits surface occupation, the leased subsurface resources remain legally available if they can be accessed by other means.

Where NSO stipulations are imposed, they may affect all or only a portion of the lease, depending on the location of the lease and the values to be protected. Oil and gas activities could occur on portions of a lease not affected by the NSO designation (assuming access is not blocked by the NSO portion). Minerals underlying an NSO surface may be extracted by directional drilling if adjacent lands are available for leasing with surface occupancy or are privately owned. Directional drilling technology limits the distance a well can be located from its subsurface target, however. In some cases, directional drilling is neither technically nor economically feasible. Directionally drilled wells can be many times more expensive to drill and maintain, and their economic life is shorter than that of conventional wells.

An NSO designation on the WNF currently has the same effect as a “no leasing” designation because:

- Most of the operators are small, independent businesses with limited resources and cannot justify the cost of directional drilling or state-of-the-art mineral assessment and mapping technologies.
- Despite the large number (thousands) of wells drilled in southeastern Ohio, the stratigraphy remains poorly understood. To accurately and consistently predict targets, production rates, and the life expectancy of any well is virtually impossible.

Surface acreage with the MA NSO stipulation would vary by alternative, from a low of 20,086 acres to a high of 39,844 acres (See below). This represents 8 percent to 17 percent of WNF surface ownership, leaving 83 percent to 92 percent of the Forest’s surface ownership available for both private and Federal oil and gas development. To date, about 44 percent (104,955 acres) of the Forest is underlain by Federal oil and gas rights (100% or partial ownership). This figure will increase as reserved minerals revert to Federal ownership and if more mineral estate can be purchased. In the next 10 years, 9,204 acres of reserved minerals are due to revert to Federal ownership. Additionally, about 17,000 acres of reserved minerals held by producers will eventually revert to U.S. ownership when production ceases. Even assuming that all these reserved minerals revert, increasing Federal mineral ownership by perhaps 11 percent, no more than 55 percent of the WNF surface could be leased in the next 10 years.

Table 3 - 70 shows the acres of Federally owned minerals subject to the MA NSO stipulation by alternative.

As explained above, NSO currently equates to "no leasing" on the WNF. Therefore, the MA NSO designation would result in the loss of oil and gas production from 7 to 14 wells, depending on which alternative is chosen. This represents 3 percent to 6 percent of the total number of projected new oil and gas wells over the next 10 years (See Table 3 - 69) in the Affected Environment section. This will affect royalty revenues to the U.S. Treasury, which in turn will reduce payments to the counties involved. In addition, it will affect the local revenue from oil and gas production, and from activities related to exploration and development (drilling, road and pad building, etc).

Table 3 - 70. MA NSO that would affect oil/gas exploration and development.

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt. F
Acres of No Leasing	0	0	0	0	0	0	0
NSO acres Under Mgt Area FOF	18,470	9,603	23,649	8,793	13,496	16,478	26,326
NSO acres Under Mgt Areas CA, DR, RNA, SA, & TRL	10,483	10,483	13,518	13,518	13,518	13,518	13,518
Total acres of MA NSO	28,953	20,086	37,167	22,311	27,014	29,996	39,844
Percent of Forest surface ownership with MA NSO	12%	8%	16%	9%	11%	13%	17%
Federal oil/gas ownership (100% or partial) underlying MA NSO	14,269	10,668	18,237	12,091	14,077	15,160	18,544
Percent of Federal oil & gas ownership affected by MA NSO	14%	10%	17%	12%	13%	14%	18%

Surface acreage with the FW NSO stipulation would total 4,620 acres (2% of WNF surface ownership) and be underlain by about 2,100 acres (1%) of Federally owned minerals. These acreages would not vary by alternative. The FW NSO surface acres would include:

- Water features (ponds, etc.) – 891 acres (average of 0.6 acres per water feature)
- Indiana bat hibernaculum – 119 acres (represents ¼ mile buffer around one site)
- Slopes greater than 55 percent – 3,408 acres (average of 0.2 acres per area).
- Cultural resources of known significance – 200 acres (less than 1 acre per site).

Because FW NSO areas are relatively small, neither their size nor location are likely to affect an entire lease or preclude leasing altogether on the affected leases. Also, neither type of NSO affects the exploration and development of private mineral rights underlying them.

Table 3 - 71 shows the acreage of Federal minerals (100% or partial ownership) affected by the MA NSO and FW NSO stipulations. They are broken down by the percent of NSO affecting any particular parcel. Since the 0 to 20 percent range includes zero, the acreages in that row generally represent the Federal mineral estate not covered with NSO.

Table 3 - 71. Federal minerals (complete or partial ownership) affected by MA NSO and FW NSO.

Percent of NSO	Alt. A acres	Alt. B acres	Alt. C acres	Alt. D acres	Alt. E acres	Alt. E Modified acres	Alt. F acres
0-20	85,624	89,441	81,622	87,250	86,257	85,174	80,645
21-40	4,041	4,002	3,788	3,895	3,491	3,491	4,031
41-60	1,924	1,617	1,723	2,350	1,435	1,615	1,935
61-80	1,727	1,741	2,235	2,176	2,015	2,015	2,502
81-100	11,639	8,155	15,587	9,284	11,757	12,529	15,843

Table 3 - 72 shows the acreage of MA NSO and FW NSO, and the availability of Federal oil and gas for leasing.

Table 3 - 72. Effects of MA NSO and FW NSO on availability of Federal oil/gas.

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt. F
MA NSO acres	14,269	10,668	18,237	12,091	14,077	15,160	18,544
Percent of Federal oil & gas affected by MA NSO	14%	10%	17%	12%	13%	14%	18%
Percent of WNF surface	6%	5%	8%	5%	6%	6%	8%
FW NSO acres	2,100	2,100	2,100	2,100	2,100	2,100	2,100
Percent of Federal oil & gas affected by FW NSO	2%	2%	2%	2%	2%	2%	2%
Percent of WNF surface	1%	1%	1%	1%	1%	1%	1%
Acres of Federal oil & gas available for leasing	88,586	92,187	84,618	90,764	88,778	87,695	84,311
Percent of total Federal oil & gas	84%	88%	81%	86%	85%	84%	80%
Percent of WNF surface available for Federal O&G leasing	37%	39%	36%	38%	37%	37%	35%

Timing Limitation Stipulations (Seasonal Restrictions) prohibit surface use at specific times to protect certain resource values. Seasonal restrictions do not apply to the operation and maintenance of production facilities unless analysis demonstrates continued need for mitigation that less stringent, project-specific measures cannot accomplish.

Seasonal restrictions may increase exploration costs by narrowing the window available for drilling, especially in the present situation where drilling rigs are scarce and in high demand. Development costs also may rise if a well is not completed within time limits. Stopping a drilling operation and leaving equipment idle or moving equipment to another site and then moving it back also increases costs. When a drilling proposal is submitted, on-the-ground conditions may allow an exemption to, or require an extension of, timing limitations based on seasonal conditions or habitat use.

Under **Controlled Surface Use (CSU)** stipulations, occupancy and use are allowed unless restricted by another stipulation. Certain resource values may require special operational constraints, however. These stipulations identify standards that operators must meet to mitigate potential adverse effect to surface resources. Such stipulations usually permit year-round occupancy and accessibility to leased lands. Discovery and development of oil and gas resources proceed under restrictions that mitigate impacts to other resources.

CSU compliance could increase the cost of oil and gas activities by requiring use of expensive technology to meet mitigation requirements. It could also require an operator to drill off target, possibly resulting in less production. As mentioned above, the stratigraphy in southeastern Ohio remains poorly understood. Production zones underlying the WNF are not laterally uniform and tend to be sinuous and difficult to follow.

Lease Notifications provide more detailed information concerning limitations that already exist in law, lease terms, regulations, or operational orders and address special items the lessee should consider when planning operations. Lease Notifications attached to leases should not be confused with **Notices to Lessees**, which are issued by the Bureau of Land Management to implement onshore oil and gas orders. The effects of Lease Notifications are minimal since they do not impose new or additional restrictions.

The lease-specific oil and gas stipulations are found in Appendix H of the 2006 Forest Plan. They incorporate all of the above mentioned types of limitations (except the first one), and are based on the Forest-wide standards and guidelines and management area direction. These notifications/stipulations include:

- A special notification regarding all the standards and guidelines being incorporated into each lease in their entirety
- Five notifications regarding:
    - Cultural resources
    - Floodplains
    - TES species

    - Compliance with all relevant public laws and Federal regulations
    - Steep slopes and/or unstable soils

- Six NSO stipulations for the protection of the following Management Areas:
    - Future Old Forest
    - Research Natural Areas
    - Special Interest Areas
    - Candidate RNAs and SAs
    - Administrative sites, developed recreation areas, trails and associated trailheads
    - Timbre Ridge Lake
- Four NSO stipulations for the protection of the following resources:
    - Cultural areas of known significance
    - Slopes in excess of 55 percent
    - Areas of mass soil instability
    - Indiana bat hibernacula
- Seven Controlled Surface Use stipulations to protect:
    - Scenic integrity objectives
    - Known locations of Federally listed species
    - Areas of known regional sensitive species
    - Managed wildlife openings
    - Riparian areas
    - Portions of floodplains outside riparian areas
    - Slopes between 35 and 55 percent.

The potential effects of some aspects of fire management on oil and gas activities, such as prescribed burns, are routinely taken into account by incorporating mitigation measures in burn plans. This involves direct contact with all potentially affected operators/owners of wells/pipelines. Some company representatives now accompany fire crews in the field to monitor burns. Some elect to temporarily shut down their wells when prescribed burning takes place. This applies to both Federal and private oil and gas activities.

Minerals Indicator 2 - Management of National Forest System lands over privately owned mineral rights

An important difference in the administration of reserved or outstanding rights (ROR) 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 ROR minerals on National Forest System 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 negotiating the terms and conditions of an operations plan for outstanding minerals, the Forest Service may request voluntary adherence to any of the above-mentioned constraints to Federal oil and gas exploration and development.

For both reserved and outstanding minerals, certain constraints, such as those relating to threatened and endangered species and cultural resources, are not negotiable and will be enforced. On the other hand, the No Surface Occupancy designation will not apply to the exploration and development of reserved and outstanding mineral rights. The effects of any constraints applied to the exploration and development of private minerals will be the same as those described in the discussion of the management of Federally owned minerals.

With oil and gas prices on the rise, the exercise of private mineral rights on the WNF is also likely to increase. Since Reasonably Foreseeable Scenario projections of new oil and gas drilling activity were made without regard to mineral ownership, accurately assessing how many of those wells would be on private mineral rights is impossible. Currently, 35 percent of the wells on the WNF are drilled for Federal minerals, and 65 percent are drilled for private minerals, both outstanding and reserved. Given that situation, it can be expected over the next decade that about 65 percent of the 234 projected new wells (152 wells) will be drilled for private minerals. Private mineral activity often influences Federal mineral development. Private mineral developers may find trends for oil and gas production zones that appear to continue unto Federal minerals. If so, they may choose to initiate exploration projects or pursue drilling for Federal minerals as well.

The Surface Mining Control and Reclamation Act of 1977, as amended, prohibits surface (strip) mining of coal on Federal land within the boundaries of any National Forest east of the 100th meridian (Located in central Texas) subject to valid existing rights and certain exceptions. Therefore, deposits of coal on the WNF generally may be mined only by underground methods.

The Athens Unit has recently approved an operations plan for a coal exploration drilling program for private minerals in the Corning area. 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 test holes will be drilled in the Future Old Forest management area. If exploration results are encouraging, a prospecting permit to drill on about 95 acres for 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 Federal ownership 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 the Forest.

On the Ironton District, one company holds valid existing rights to strip mine coal on approximately 1,200 surface acres. The company plans to conduct exploratory drilling to determine the quality and quantity of coal with the possibility of strip-mining it in the future. However, legal problems make it uncertain if this company can proceed with the coal operations in the next 10 years. If they do, it will severely disturb approximately 1,200 acres.

Alternative A

Direct and Indirect Effects

Minerals Indicator 1 – Leasing of Federally owned mineral rights for oil and gas extraction

As mentioned above, only the Management Area NSO (MA NSO) varies by alternative. As indicated on Table 3 - 70, the number of surface acres affected by the MA NSO under Alternative A would total 28,953 acres, representing 12 percent of the WNF surface acreage. The acreage of Federal minerals (100% or partial) underlying the MA NSO areas totals 14,269 acres, representing 14 percent of the Federal oil and gas ownership on the Forest.

As can be seen on Table 3 - 71, selection of Alternative A could result in lost production and associated royalties from as many as 10 Federal oil and gas wells in the first decade of the 2006 Plan.

Under this alternative, 88,586 acres of Federal oil and gas (100% or partial) would be available for leasing. (See Table 3 - 72)

Minerals Indicator 2 – Management of National Forest System surface over privately owned mineral rights

Management of NFS land over privately owned mineral rights would not vary by alternative. The effects of managing privately owned mineral rights would be the same as those discussed under Issue 2 in Effects Common to all Alternatives.

Alternative B

Direct and Indirect Effects

Minerals Indicator 1 – Leasing of Federally owned mineral rights for oil and gas extraction

As indicated on Table 3 - 70, the number of surface acres affected by the MA NSO stipulation under Alternative B would total 20,086 acres, representing 8 percent of WNF surface acreage. The acreage of Federally owned mineral rights (100% or partial) underlying MA NSO areas would total 10,688 acres, representing 10 percent of Federal oil and gas ownership on the Forest.

As can be seen on Table 3 - 71, Alternative B could result in lost production and associated royalties from as many as seven Federal oil and gas wells in the first decade of the 2006 Plan.

Under this alternative, 92,187 acres of Federal oil and gas rights (100% or partial) would be available for leasing. (See Table 3 - 72)

Minerals Indicator 2 – Management of National Forest System lands over privately owned mineral rights

Management of NFS land over privately owned mineral rights would not vary by alternative. The effects of managing privately owned mineral rights would be the same as those discussed under Issue 2 in Effects Common to all Alternatives.

Alternative C

Direct and Indirect Effects

Minerals Indicator 1 – Leasing of Federally owned mineral rights for oil and gas extraction

As indicated on Table 3 - 70, the surface area affected by MA NSO under Alternative C would total 37,167 acres, representing 16 percent of WNF surface acreage. The acreage of Federal mineral rights (100% or partial) underlying the MA NSO areas would total 18,237 acres, representing 17 percent of Federal oil and gas rights on the Forest.

As shown by Table 3 - 73, implementing Alternative C could result in lost production and associated royalties from as many as 13 Federal oil and gas wells in the first decade of the 2006 Plan.

Under this alternative, 84,618 acres of Federal oil and gas rights (100% or partial) would be available for leasing. (See Table 3 - 70)

Minerals Indicator 2 – Management of National Forest System lands over privately owned mineral rights

Management of National Forest System land over privately owned mineral rights would not vary by alternative. The effects of managing privately owned mineral rights would be the same as those discussed under Issue 2 in Effects Common to all Alternatives.

Alternative D

Direct and Indirect Effects

Minerals Indicator 1 – Leasing of Federally owned mineral rights for oil and gas extraction

As indicated on Table 3 - 70, the number of surface acres affected by the MA NSO under Alternative D would total 22,311 acres, representing 9 percent of WNF surface acreage. The acreage of Federal mineral rights (100% or partial) underlying the MA NSO areas would total 12,091 acres, representing 12 percent of the Federal oil and gas mineral ownership on the Forest.

As can be seen on Table 3 - 73, implementing this alternative could result in lost production and associated royalties from as many as 7 Federal oil and gas wells in the first decade of the 2006 Plan.

Under Alternative D, 90,764 acres of Federally owned oil and gas mineral rights (100% or partial) would be available for leasing. (See Table 3 - 70)

Minerals Indicator 2 – Management of National Forest System lands over privately owned mineral rights

Management of National Forest System lands over privately owned mineral rights would not vary by alternative. The effects of managing privately owned mineral rights would be the same as those discussed under Issue 2 in Effects Common to all Alternatives.

Alternative E

Direct and Indirect Effects

Minerals Indicator 1 – Leasing of Federally owned mineral rights for oil and gas extraction

As indicated on Table 3 - 70, the number of surface acres affected by the MA NSO under Alternative E would total 27,014 acres, representing 11 percent of the WNF surface acreage. The acreage of Federally owned mineral rights (100% or partial) underlying MA NSO areas would total 14,077 acres, representing 13 percent of Federal oil and gas mineral rights ownership on the Forest.

As can be seen on Table 3 - 73, this alternative could result in lost production and associated royalties from as many as 9 Federal oil and gas wells in the first decade of the 2006 Plan.

Under this alternative, 88,778 acres of Federally owned oil and gas mineral rights (100% or partial) would be available for leasing. (Table 3 - 70)

Minerals Indicator 2 – Management of National Forest System lands over privately owned mineral rights

Management of National Forest System lands over privately owned mineral rights would not vary by alternative. The effects of managing privately owned mineral rights would be the same as those discussed under Issue 2 in Effects Common to all Alternatives.

Alternative E Modified

Direct and Indirect Effects

Minerals Indicator 1 – Leasing of Federally owned mineral rights for oil and gas extraction

As indicated on Table 3 - 68, the number of surface acres affected by the MA NSO under Alternative E would total 29,996 acres, representing 13 percent of the WNF surface acreage. The acreage of Federally owned mineral rights (100% or partial) underlying MA NSO areas would total 15,160 acres, representing 14 percent of Federal oil and gas mineral rights ownership on the Forest.

As can be seen on Table 3 - 71, this alternative could result in lost production and associated royalties from as many as 13 Federal oil and gas wells in the first decade of the 2006 Plan.

Under this alternative, 87,695 acres of Federally owned oil and gas mineral rights (100% or partial) would be available for leasing. (Table 3 - 70)

Minerals Indicator 2 – Management of National Forest System lands over privately owned mineral rights

Management of National Forest System lands over privately owned mineral rights would not vary by alternative. The effects of managing privately owned mineral rights would be the same as those discussed under Issue 2 in Effects Common to all Alternatives.

Alternative F

Direct and Indirect Effects

Minerals Indicator 1 – Leasing of Federally owned mineral rights for oil and gas extraction

As indicated on Table 3 - 68, the number of surface acres affected by the MA NSO under Alternative F would total 39,844 acres, representing 17 percent of WNF surface acreage. The acreage of Federally owned mineral rights (100% or partial) underlying the MA NSO area would totals 18,544 acres, representing 18 percent of Federally owned oil and gas mineral rights on the Forest.

As can be seen on Table 3 - 73, this alternative could result in lost production and associated royalties from as many as 14 Federal oil and gas wells in the first decade of the 2006 Plan.

Under this alternative, 84,311 acres of Federally owned oil and gas mineral rights (100% or partial) would be available for leasing. (See Table 3 - 70)

Minerals Indicator 2 - Management of National Forest System lands over privately owned mineral rights

Management of NFS land over privately owned mineral rights would not vary by alternative. The effects of managing privately owned mineral rights would be the same as those discussed under Issue 2 in Effects Common to all Alternatives.

Cumulative Effects

Minerals Indicator 1 - Leasing of Federally owned mineral rights for oil and gas

No Surface Occupancy (NSO) stipulations could mean less drilling on the WNF. Based on the RFDS developed by the Bureau of Land Management, the NSO stipulations could result in 7 to 14 less wells drilled on Federal leases. This could result in 9 to 16 fewer surface acres disturbed. A decline in production would reduce royalty revenues to the U.S. Treasury and payments to affected counties. In addition, decreased production would reduce local income realized from oil and gas operations and related activities. Most salaries paid to workers and fees paid to contractors are spent locally. Loss of domestic oil and gas production could also mean more dependence on foreign sources and higher fuel prices.

Other constraints, such as Timing Limitation Stipulations or Controlled Surface Use, would increase the costs of oil and gas activities, but not as much as NSO designations.

Table 3 - 73 of projected minerals outputs for the first decade of the 2006 Forest Plan is based in part on the RFDS and acreage designated for No Surface Occupancy in each alternative. The rational for the projected number of new oil and gas wells and associated surface disturbance, and for the number of depleted wells and associated reclaimed acres, can be found in the RFDS. The RFDS projections of new oil and gas drilling activity were made without regard to mineral ownership.

There is no way to accurately forecast how many of those wells would be drilled for Federally owned mineral and thus affected by the NSO designation. Currently, 35 percent of the wells on the WNF were drilled for Federally owned minerals, with 65 percent drilled for privately owned minerals (outstanding and reserved). Because of the small number of projected new wells, and the relatively small percentage of NSO areas on the Forest, it is theoretically possible that all of the projected new wells could be drilled outside NSO areas. Given that scenario, none of the 234 projected new wells would be affected by any of the alternatives (thus the high-end number of the ranges in Table 3 - 73). The low end numbers of the ranges were calculated by taking into account the percentage of NSO designation in each alternative and the percentage of projected new wells that may be drilled on Federal minerals, assuming random distribution of all the projected new wells.

Table 3 - 73. Projected minerals outputs for management activities for first decade.

	Management Activity	Alt. A (12% NSO)	Alt. B (8% NSO)	Alt. C (16% NSO)	Alt. D (9% NSO)	Alt. E (11% NSO)	Alt. E Modified (13%NSO)	Alt. F (17% NSO)
Oil & Gas Activities	Number of new wells	224 to 234	227 to 234	221 to 234	227 to 234	225 to 234	223 to 234	220 to 234
	Total acres of surface disturbance	260 to 272	264 to 272	257 to 272	263 to 272	262 to 272	259 to 272	256 to 272
	Acres of reclaimed disturbance[1]	144 to 151	146 to 151	142 to 151	146 to 151	145 to 151	143 to 151	142 to 151
	Net acres needed for new production	116 to 121	118 to 121	115 to 121	118 to 121	117 to 121	116 to 121	114 to 121
	Depleted wells plugged	108	108	108	108	108	108	108
	Orphan wells plugged	20	20	20	20	20	20	20
	Acres reclaimed by plugging	70	70	70	70	70	70	70
Surface Coal Mining	Total acres of surface disturbance[2]	1250	1250	1250	1250	1250	1250	1250

[1] These acres, initially needed for well development, exceed those needed to support production.

[2] Subject to valid existing rights or compatibility determinations by OSM.

Minerals Indicator 2 - Management of National Forest System surface over privately owned mineral rights

Constraints to the exploration and development of privately owned minerals underlying NFS land as the result of applying the Secretary of Agriculture's rules and regulations (in the case of reserved minerals) or negotiated terms and conditions (in the case of outstanding minerals) could increase operating costs or decrease production.

Approximately 56 percent of the WNF is underlain by reserved or outstanding mineral rights totaling approximately 133,910 acres.

Social and Economic Effects

Affected Environment

History

Native American Cultures

Paleo-Indians are believed to have been the first humans to reach the area that is now Ohio, approximately 12,000 years ago. These nomadic peoples hunted large game such as the mastodon, elk, and caribou that migrated into Ohio after the glaciers retreated northward. With continued warming, the Ohio territory became increasingly deciduous. Consequently, during the Archaic Period (ca. 8,000 - 1,000 B.C.) people were able to eat a broader variety of plant and animal species that were supported by a more temperate environment. Late within this period, horticulture and burial rituals began. The Woodland Period (ca. 1,000 B.C. - A.D. 1,200) was characterized by more stationary lifestyles that allowed the development of agriculture, the manufacture of ceramics, and elaborate burial practices. Burial of the dead in constructed earthen mounds was common in Early (Adena) and Middle (Hopewell) Woodland times. The Hopewell people established extensive trade networks across the country to obtain raw materials to fashion exotic items to bury with their dead. Grave goods were made out of copper from Lake Superior, mica from North Carolina and Tennessee, silver from Canada, obsidian from Wyoming, and marine shell from the Gulf of Mexico.

The Late Woodland people, probably the descendants of Middle Woodland groups, discontinued their ancestors' mound-building and extensive trading activities. However, the Late Woodland people appear to have been more successful at growing crops, and they lived in larger communities than earlier groups. Finally, the late prehistoric Fort Ancient people (ca. 1000 - A.D. 1650) lived in large floodplain villages often organized around central plazas as well as in upland hunting camps. Mortuary practices were not as complex as those of the Hopewell, and they became more dependent on maize agriculture than on hunting and gathering.

Southeastern Ohio was apparently abandoned in very late prehistoric times. The people either emigrated to avoid conflicts with tribes farther east seeking control over fur trade with Europeans on the East Coast, or they succumbed to diseases that originated in the European colonies and were passed from one Indian settlement to another.

Immediately prior to the arrival of American settlers (primarily of Europe descent), southeastern Ohio had no permanently settled native groups. Historic Native American tribes such as the Shawnee, Wyandotte, and Delaware lived and hunted extensively in southeastern Ohio in nomadic groups instead of large villages. Their primary settlements appear to have been further west in the Scioto and Miami River Valleys.

Frontier and Statehood

The first European explorers reached the Ohio territory around 1650. Documents including observations of their travels are the earliest written accounts of the area. Prior to the War for American Independence, the land in present-day Ohio was claimed by Great Britain. In the late 18th century, British colonial authorities prohibited settlement west and north of the Ohio River. However, frequent hunting and exploring expeditions on Indian land led to inevitable conflicts.

Following the War for Independence, the land from the Appalachian Mountains to the Mississippi River was ceded to the new United States of America in treaty with England (Beard and Beard, 1930). At that time, the States of Connecticut, New York, Pennsylvania, and Virginia all laid claim to the new territory; however, by 1786, all of those separate claims had been ceded to the central government functioning under the Articles of Confederation (Brown, 1922). In return for ceding their larger, and conflicting, claims, Virginia and Connecticut retained rights to 4.2 million and 3 million acres, respectively. Congress intended to grant these lands to veterans of the American Revolution or survivors of soldiers who died in the conflict. George Washington, himself a surveyor who had visited Ohio in 1754, received a warrant for 23,333 acres in Ohio, though he never claimed this land. To help veterans locate and settle their land without unnecessary disputes, Congress passed the Public Lands Act of 1785, directing that the new territories be surveyed on a grid, with tracts six miles square called townships (Dean and Speas). Lands not claimed by Revolutionary War veterans would be sold to help the government repay the costs of fighting the war.

The earliest and heaviest settlement of Ohio in the 18th century occurred in the southeastern region not only because Marietta was the first settlement within the Northwest Territory, but because it is geographically close to Pennsylvania and Virginia, from which the majority of early settlers came.

In 1787, Congress passed “An Ordinance for the Government of the Territory of the United States Northwest of the River Ohio”, more commonly referred to as the Northwest Ordinance of 1787. This historic legislation achieved several important results. First, it allowed for the sale of lands in the Northwest Territory to land companies and private citizens. Second, it administered the settlement of the new lands through territorial governments. Third, it laid out the method by which the new territories would eventually gain statehood. Fourth, Congress forbade slavery in the new territories or states, but allowed owners to reclaim escape slaves who had crossed the Ohio River, a momentous decision that would have significant repercussions for people of southern Ohio. And fifth, Congress established what would become basic tenets for the relationship between the Federal government and the States.

Soon after adopting the Northwest Ordinance of 1787, Congress began selling large tracts of Ohio land to land companies, which would survey and sell the individual parcels within the sections to settlers. The first of these was the purchase of 1.5 million acres along the Ohio River to the Ohio Company, headed by several officers of the Revolutionary War, including General Rufus Putnam.

General Anthony Wayne, for whom the Forest is named, was a celebrated Revolutionary War soldier. In 1792, he came out of retirement to take command of the U. S. Army of the Northwest, appointed by President George Washington to defend the American frontier against Indian attacks. After several years spent constructing fortifications, Wayne's move against the Shawnee Nation culminated in the Battle of Fallen Timbers. Upon defeating the Indians at Fallen Timbers, Wayne's negotiations eventually resulted in the 1795 Treaty of Greenville. By defining the boundaries of Indian and settlers' land in Ohio, the treaty facilitated settlement far up the tributaries of the Ohio River.

In 1800, Congress passed the Harrison Land Act, designed to further expedite the selling of Federal lands in the Northwest Territories. The Act, proposed by future President William Henry Harrison, established Federal land offices that would identify available Federal lands and accept bids from potential buyers, who were allowed to buy the property on credit. The first Federal land office opened in Steubenville, Ohio, July 1800. The response was immediate. By 1803, the Ohio territory's population had reached 60,000, the level required for statehood, and Ohio entered the Union on March 1, 1803.

The earliest and heaviest settlement was in the southeastern part of the State, closest to Pennsylvania and Virginia – which provided most of the settlers. Early settlers were primarily of English, Welsh, Scottish, and Irish descent. Over the next 20 years, land offices sold more than 9 million acres in Ohio. In 1832, Congress lowered the minimum purchase of Federal land from 320 acres to 40 acres. Federal land offices remained in operation in Ohio until 1866.

Early African American History and the Underground Railroad Movement

By the 1820s, several thousand African Americans had settled in Ohio, but early slave laws discouraged their settlement. In spite of the severe fines and legal penalties, Ohioans were quite active in aiding fugitive slaves on their journey north on the Underground Railroad to freedom. A number of small black communities sprang up in southeastern Ohio and quite often served as "stations" along this network of safe houses.

For African Americans enslaved in the South during the early 19th Century, the flight to freedom was long and dangerous. Runaway slaves could expect harsh treatment if caught, and a bounty was paid for their return. Escapees relied upon sympathetic strangers to give them food and shelter along their perilous trek. They followed a route that had no maps, directed from one safe haven to another along the Underground Railroad. Escaping slaves not only traveled north, but also southward to places like Mexico, Puerto Rico, Cuba, the Bahamas, and Jamaica.

By necessity, the routes of the Underground Railroad generally avoided cities, where more people meant a greater risk of being caught. The paths to freedom ran through many areas that are now part of the Wayne National Forest. Also within the Forest are the remains of two early African American rural settlements that were involved in the Underground Railroad movement – Pokepatch on the Ironton Ranger District and Paynes Crossing on the Athens Ranger District.

Early Industry

Southeastern Ohio was rich in natural resources, but its lands were difficult to farm due to the steep unglaciated topography and poor soils. The coal, iron, timber, salt, clay, oil, and gas from the region was extracted and transported elsewhere for processing and use. Because very little of this economy-building resource processing occurred here, there was a negative effect on the area's development, wealth, and appearance. For example, large industrial centers comparable to Toledo, Cincinnati, and Cleveland did not emerge, and the area did not seem to benefit from the wealth of its resources. However, southeastern Ohio fueled industrialization and contributed significantly to Ohio's high ranking in industrial output and the development of the nation in the 19^{th} and early 20^{th} centuries.

Coal has been mined for over 200 years in southeastern Ohio, mostly in deep underground mines for over a century. Seven of the top nine coal mining counties in Ohio were in southeastern Ohio. Safety and wage concerns fueled establishment here of one of the earliest labor unions that grew to 700,000 members nationwide by 1881. In 1884, reduced wages imposed by the coal operators in New Straitsville resulted in a violent strike. Striking miners set coal cars on fire and sent them into the New Straitsville mine. This caused an enormous underground fire that still burns today because the coal seam provides a perpetual fuel source.

The Muskingum and Hocking River Valleys held rich clay deposits that supported the development of major pottery and tile industries in Perry and Hocking counties. By 1840, the Zanesville area was home to 25 potteries, the largest producer of brick in the nation, and the largest producer of clay tile in the world. The clay company town of Haydenville was built from brick and tile made on site at the factory, and its one-of-akind architecture still survives today. Its primary clay source is situated in the Dorr Run area of the WNF.

Ohio's Hanging Rock Iron Region is 100 miles long and 28 miles wide. The region boomed between 1818 and 1916 and produced some of the best iron in the country, supplying most of the armament for the Civil War. The area was famous for iron plantations, thousands of acres owned by the iron companies where iron ore, limestone, and timber for charcoal were found in close proximity. Each year, a furnace could produce up to 3,000 tons of iron, consuming 350 acres of timber for conversion into charcoal, 7,888 tons of iron ore, and 411 tons of limestone. The remains of hundreds of charcoal kilns and ore and limestone quarries can be found on the Ironton Ranger District. A total of 69 furnaces were built, but only a dozen still stand today. Three of these are now managed by the Forest – Vesuvius (listed on the National Register of Historic Places in 1990), Cambria, and Aetna.

By the 1930s Southeastern Ohio's Industrial Age was waning, and its economy was declining. Population growth slowed and even declined in some places, and industrial technology began to change. Coal mining became mechanized. Iron production fell with the exhaustion of the forests for fuel and the development of competing iron fields in Minnesota. Many of the clay extraction industries were replaced by smaller facilities. The degraded state of many of Ohio's natural resources and associated pollution resulting from the industrial age generated increasing calls for conservation and restoration.

Population

Ohio ranks 7th nationally among the states in population, with more than 11 million residents in 2000. The State's population at present is spread widely among metropolitan and non-metropolitan areas, with approximately 64 percent living in urban areas, 17 percent in suburban areas, and 19 percent in "exurban" and rural areas statewide (Irwin and Reece, 2002). Ohio has six cities with populations larger than 150,000. Population density is highest in the northeastern, central, and southwestern portions of the State, anchored by the major metropolitan areas of Cleveland, Columbus, and Cincinnati, respectively. Although population density is lowest in southeastern Ohio, population growth statewide, and population shifts within the State to the Forest-wide region, combined with an aging population that is becoming more racially/ethnically diverse, will present important challenges and opportunities for the Wayne National Forest.

Historically, both Ohio and the Forest-wide region (the 12 counties in which the WNF lies) have increased in population through the decades, but Ohio's population has grown at a much faster rate than that of the region (see Table 3 - 74). As a result, the portion of Ohio's total population living in the Forest-wide region has declined over the past century, from nearly 6 percent in 1930 to just under 4 percent in 2000. During these 70-years, Ohio's total population grew by 71 percent percent while the Forest-wide region's population grew by just 22 percent percent.

However, in recent decades, the region's population has been growing faster than the State's. Between 1970 and 2000, the Forest-wide region's population has grown by 14.2 percent while the State's overall population has increased by just 6.6 percent (see Table 3 - 74). This trend illustrates the national "non-metropolitan turnaround" of the 1970s and the "rural rebound" phenomenon of the 1990s, in which certain rural areas gained population faster than did most metropolitan areas. The recent increasing rates of migration from urban to rural areas have been linked to growing numbers of retirees and to the presence of recreational and esthetic amenities in particular rural places (Johnson and Beale, 1998).

The region's population is expected to be 488,180 in 2020, which is 8.5 percent higher than the region's 2000 population. The State's 2020 population is expected to be over 12 million, 9.2 percent higher than the State's 2000 population. Such population growth would likely lead to increased demands on forest and land resources.

Population in Wayne National Forest counties has increased at a rate that is only 1/3 of the average for Ohio as a whole.

Table 3 - 74. Total population trend 1930-2020 for WNF counties.

Location	1930	1940	1950	1960	1970	1980	1990	2000	Net change (1930-2000)	% Change (1930-2000)	2010	2020
Athens	44,175	46,166	45,839	46,998	54,889	56,399	59,549	62,223	18,048	41%	66,810	71,950
Gallia	23,050	24,930	24,910	26,120	25,239	30,098	30,954	31,069	8,019	35%	31,230	31,670
Hocking	20,407	21,504	19,520	20,168	20,322	24,304	25,533	28,241	7,834	38%	31,440	34,920
Jackson	25,040	27,004	27,767	29,372	27,174	30,592	30,230	32,641	7,601	30%	35,030	37,680
Lawrence	44,541	46,705	49,115	55,438	56,868	63,849	61,834	62,319	17,778	40%	62,700	63,700
Monroe	18,426	18,641	15,362	15,268	15,739	17,382	15,497	15,180	(3,246)	-18%	14,920	14,800
Morgan	13,583	14,227	12,836	12,747	12,375	14,241	14,191	14,897	1,314	10%	15,590	16,420
Noble	14,961	14,587	11,750	10,982	10,428	11,310	11,336	14,058	(903)	-6%	15,390	16,800
Perry	31,445	31,087	28,999	27,864	27,434	31,032	31,557	34,078	2,633	8%	36,730	39,720
Scioto	81,221	86,565	82,910	84,216	76,951	84,545	80,327	79,195	(2,026)	-2%	79,980	81,340
Vinton	10,287	11,573	10,759	10,274	9,420	11,584	11,098	12,806	2,519	24%	14,100	15,510
Washington	42,437	43,537	44,407	51,689	57,160	64,266	62,254	63,251	20,814	49%	63,170	63,670
Forest-wide region	369,573	386,526	374,174	391,136	393,999	439,602	434,360	449,958	80,385	22%	467,090	488,180
State	6,646,697	6,907,612	7,946,627	9,706,397	10,652,017	10,797,603	10,847,115	11,353,140	4,706,443	71%	11,828,270	12,402,140
Region population as % of State pop.	5.56%	5.6%	4.71%	4.03%	3.70%	4.07%	4.00%	3.96%			3.95%	3.94%

Sources: Woods and Poole Economics, (2002); U.S. Census Bureau (http://www.census.gov/index.html - website accessed on 9/3/2003)

In the year 2000, Scioto County with 79,195 residents had the largest population of the 12 counties in the Forest-wide region (see Table 3 - 74). Washington County had the region's highest percent change in population through the years 1930 to 2000, growing 49 percent. On the other hand, Vinton County had the region's smallest 2000 population, 12,806. Monroe County's population showed the largest decline in the region from 1930 to 2000, decreasing by 18 percent.

In the more recent years, from 1970 to 2000, Hocking County has grown the fastest in the region with its population increasing by 39 percent. At the other end of the scale, Monroe County's population declined by 3.6 percent during this same period.

According to population projections, the fastest-growing county in the region over the next two decades is again expected to be Hocking, with a projected growth rate of 23.7 percent from 2000 to 2020. In total, the population in the Forest-wide region is expected to increase by 8.5 percent during that time, with 11 counties gaining and one county losing population (see Table 3 - 74).

Ethnicity

The ethnic/racial background of the U.S. population is becoming increasingly diverse. In fact, it has been estimated by the U.S. Census Bureau that by the year 2050, whites will no longer comprise a majority of the U.S. population (U. S. Census Bureau, 2000). In Ohio, just under 15 percent of the population was identified as ethnic/racial minorities in 2000, but the percentage is expected to increase. Minority populations tend to have different use patterns for public lands, and management priorities, than do whites (Carr and Williams, 1993; Johnson, 1998; Taylor, 1989). Thus, understanding ethnic/racial characteristics of the population will likely be a critical component of effective public lands management.

In the year 2000, the majority of the population was identified as white (non-Hispanic) in Ohio and in the Forest-wide region (see Table 3 - 75). The population of the region had lower ethnic/racial diversity than did the State as a whole, with nearly 97 percent whites in the region, compared to 85 percent whites in the entire State. The greatest proportion of individuals with minority ethnic/racial background were identified as African-American (11.5 percent statewide, 1.9 percent in the region), followed by Hispanic (1.9 percent statewide, 0.5 percent in the region), and Asian-American (1.2 percent statewide, 0.2 percent in the region).

In the future, ethnic/racial diversity is expected to increase both statewide and in the region. Between 2000 and 2020, the portion of the population comprised of African-Americans is projected to increase from 11.5 percent to 12.8 percent of the State's population, and from 1.9 percent to 2.1 percent of the region's population. During the same period, the portion of the population comprised of Hispanics is projected to increase from 1.9 percent to 3.4 percent of the State's population, and from 0.5 percent to 1.1 percent of the region's population. In addition, the portion of the population comprised of Asian-Americans is projected to increase from 1.2 percent to 2.1 percent of the State's population, and from 0.2 percent to 0.9 percent of the region's population.

Within the region in 2000, Noble County had the highest percentage of minority population (7.45 percent) among the 12 Forest-wide counties. In contrast, Monroe County was least ethnic/racially diverse (0.86 percent non-white). The population projections from the year 2000 to the year 2020 predict that Noble County will have the highest percentage of minority population (10.71 percent), while Perry County will have the lowest percentage of minority population (1.38 percent). Noble County is expected to see the largest shift in minority percentage, from 7.45 percent in 2000 to 10.71 percent in 2020.

Table 3 - 75. Percentage of White and Minority Populations.

Location	2000 White Population	2000 % White	2000 Minority Population	2000 % Minority	2010 White Population	2010 % White	2010 Minority Population	2010 %Minority	2020 White Population	2020 % White	2020 Minority Population	2020 %Minority
Athens	58,750	94.42%	3,460	5.56%	62,200	93.10%	4,610	6.9%	66,300	92.15%	5,660	7.87%
Gallia	29,790	95.91%	1,260	4.06%	29,830	95.52%	1,390	4.45%	30,150	95.20%	1,520	4.80%
Hocking	27,780	98.27%	480	1.70%	30,910	98.31%	520	1.65%	34,290	98.20%	620	1.78%
Jackson	32,090	98.35%	540	1.65%	34,380	98.14%	650	1.86%	36,940	98.04%	750	1.99%
Lawrence	60,420	97.00%	1,880	3.02%	60,580	96.62%	2,120	3.38%	61,240	96.14%	2,450	3.85%
Monroe	15,040	99.19%	130	0.86%	14,750	98.86%	170	1.14%	14,590	98.58%	210	1.42%
Morgan	14,260	95.77%	620	4.16%	14,820	95.06%	770	4.94%	15,500	94.40%	900	5.48%
Noble	13,040	92.55%	1,050	7.45%	14,040	91.23%	1,360	8.84%	15,000	89.29%	1,800	10.71%
Perry	33,740	98.97%	340	1.0%	36,290	98.80%	440	1.20%	39,170	98.62%	550	1.38%
Scioto	75,860	95.83%	3,300	4.17%	76,170	95.24%	3,340	4.18%	77,020	94.69%	4320	5.31%
Vinton	12,630	98.67%	170	1.33%	13,880	98.44%	220	1.56%	15,260	98.39%	240	1.55%
Washington	61,870	97.86%	1,350	2.14%	61,550	97.44%	1,620	2.56%	61,760	97.00%	1,910	3.00%
Forest-wide total	435,270	96.76%	14,580	3.24%	449,400	96.31%	17,210	3.69%	467,220	95.71%	20,930	4.29%
State	9,672,860	85.15%	1,687,090	14.85%	9,844,830	83.23%	1,983,440	16.77%	10,101,590	81.45%	2,300,540	18.55%

Source: Woods and Poole Economics, (2002).

Economy

The current economic health and vitality of the rural counties in the WNF planning area continues to lag behind both national and State indicators. These counties make up one of the most impoverished areas in Ohio. They remain a part of the Appalachian Regional Commission, a national program created in 1965 that targeted counties in the Appalachian chain for economic development to reverse the damaging trends of chronically higher unemployment, net outward migration, and acute lower levels of income. Thus the Forest-wide area is a target in Ohio for community and economic development by both State and Federal governments.

Important components in assessing the region's economy include number of jobs, unemployment levels, and diversification. The 12 counties in the Forest-wide region comprise only a small portion of the State's total jobs, and the region generally sees unemployment rates higher than the State's. At a broad scale, the region is more economically diverse than the State, with the trade/services sector comprising the lion's share of jobs. The natural resources sector comprises a relatively small portion however.

Income

Incomes have increased steadily over the years, but people living in WNF planning area counties usually have had substantially lower income levels than the State average. In 1970, the mean household income for the region was $32,276, while the statewide mean was $46,163 (See

Table 3 - 76).

Today, the discrepancy between region and statewide income levels has not changed. In 2000, the average household income for the 12-county region was $45,247, while the average household income for the entire State was $65,526 (See

Table 3 - 76). Similarly, in 2000 income per capita averaged $17,860 for counties in the Forest-wide region but $26,250 statewide.

In the region, Washington County had the highest per capita and mean household income ($21,495 and $52,801 respectively) in the year 2000. In fact since 1970, Washington County has consistently maintained the highest income levels in the region. On the other hand, the county with the lowest income levels in the region has changed over time. In 1970, Vinton County had the lowest mean household and per capita income ($26,039 and $8,202 respectively). However in 2000, Noble County had the lowest average household income of $37,989 and per capita income of $14,058.

In the future, both State and regional income levels are expected to rise. However, projections out to 2020 show the 12 counties in the Forest-wide region with substantially lower income levels than the State average. By 2020, Gallia County is expected to have the highest mean household ($68,419) and per capita ($27,564) income levels. Noble County is predicted to continue to have the lowest income levels in the region (mean household income: $45,766 and income per capita: $17,294).

Average household income in WNF counties is only two-thirds of the State average.

Table 3 - 76. Mean Household Income (1996 $).

Location	1970	1980	1990	2000	2010	2020
Athens	$28,295	$33,779	$37,290	$43,200	$47,780	$52,920
Gallia	$29,968	$40,549	$40,726	$50,782	$58,506	$68,419
Hocking	$33,241	$38,000	$42,661	$49,317	$52,660	$57,222
Jackson	$29,959	$34,813	$39,287	$46,620	$52,965	$59,154
Lawrence	$31,699	$39,600	$40,185	$43,949	$47,872	$53,333
Monroe	$36,197	$45,243	$41,047	$44,972	$48,973	$54,941
Morgan	$35,987	$42,032	$45,125	$42,430	$45,722	$50,287
Noble	$29,710	$38,773	$38,074	$37,989	$41,503	$45,766
Perry	$32,179	$39,252	$40,434	$43,681	$48,207	$53,946
Scioto	$35,390	$37,610	$38,902	$46,296	$52,309	$60,426
Vinton	$26,039	$34,711	$37,643	$40,930	$44,124	$48,162
Washington	$38,643	$44,314	$45,706	$52,801	$58,287	$65,787
Forest-wide average	$32,276	$39,056	$40,590	$45,247	$49,909	$55,864
State	$46,163	$50,553	$57,028	$65,526	$73,283	$82,648

Source: Woods and Poole Economics, (2002).

Employment

Over the past three decades, the numbers of jobs available statewide and in the Forest-wide region have increased substantially. As shown in Table 3 - 77, the total number of full-time and part-time jobs increased statewide by 47 percent and by 38 percent in the region. The region's share of all jobs statewide declined slightly from 2.9 percent in 1970 to 2.7 percent in 2000.

Table 3 - 77. Full-time and Part-time Employment Trend 1970-2000 for WNF Counties.

Location	1970	1980	1990	2000	Net Change (1970-2000)	% Change (1970-2000)
Athens	18,875	21,012	24,527	27,887	9,012	48%
Gallia	9,083	12,801	13,674	16,784	7,701	85%
Hocking	6,983	8,091	8,703	9,747	2,764	40%
Jackson	9,162	10,080	11,492	14,844	5,682	62%
Lawrence	14,005	15,340	15,836	18,540	4,535	32%
Monroe	7,802	10,005	7,334	7,424	(378)	-5%
Morgan	4,744	5,452	6,263	5,928	1,184	25%
Noble	3,110	3,620	3,959	5,102	1,992	64%
Perry	7,311	8,074	9,848	10,267	2,956	40%
Scioto	26,852	27,084	27,719	32,796	5,944	22%
Vinton	2,461	3,540	3,643	3,408	947	39%
Washington	23,763	27,011	29,869	33,003	9,240	39%
Forest-wide	134,151	152,110	162,867	185,730	51,579	38%
State	4,682,839	5,215,316	5,910,736	6,877,576	2,194,737	47%

Source: U.S. Department of Commerce, (2002).

Within the Forest-wide region, Scioto County had the highest number of jobs from 1970 to 1980 (See Table 3 - 77). But by 1990, Washington County had become the leader in this statistic. It continued to have the highest number of jobs (33,003) in 2000. This trend gave Washington County the highest net change from the year 1970 to 2000, with an increase of 9,240 jobs (a 39 percent increase). The only county in the region with a decline in the number of jobs, from 1970 to 2000, was Monroe County (378 fewer jobs, or a loss of 5 percent). In terms of largest percent change in number of jobs, Gallia County had the highest growth, increasing full and part-time jobs by 85 percent (7,701 jobs) from 1970 to 2000. In contrast, Vinton County has had the least number of full and part-time jobs in the region throughout the past three decades. In 2000, Vinton County had 3,408 jobs.

Unemployment Rates

While the number of jobs in a county indicates the size of the local economy, unemployment figures provide additional information about the job opportunities available to the local workforce. As of July 2002, unemployment rates in 10 of the 12 Forest-wide counties exceeded the statewide average (Table 3 - 78). County unemployment rates in the region ranged from a low of 4.9 percent in Athens to a high of 13.3 percent in Morgan.

Table 3 - 78. Unemployment rates in the Forest-wide region and State. (July 2002).

County	Unemployment Rate
Athens	4.9%
Gallia	6.8%
Hocking	7.2%
Jackson	8.4%
Lawrence	6.8%
Monroe	6.6%
Morgan	13.3%
Noble	6.8%
Perry	11.5%
Scioto	7.8%
Vinton	12.4%
Washington	5.3%
State average	5.8%

Source: Ohio Department of Development, Office of Strategic Research, Ohio County Profiles, http://www.odod.state.oh.us/research/Files/s0.html.

Ten of the 12 WNF counties have unemployment rates higher then the State average.

Economic Diversification

Economic sector diversity indicates how employment is distributed across different sectors of the economy. An area with high sector diversity features employment in many different sectors. Greater diversity can make a community more resilient in the face of change, since decline within one sector may be offset by employment in other sectors. Economic analysts have divided the economy into four general economic sectors, each comprised of a number of related industries. These sectors are as follows:

- Government
- Farming, agricultural services, and mining
- Construction, manufacturing, and transportation
- Wholesale and retail trade, finance/insurance/real estate, and services.

Table 3 - 79. Jobs and Earnings (1996 $) by Economic Sector (2000)

Location	Farming, Agricultural Services, and Mining Jobs	Farming, Agricultural Services, and Mining Wages (millions)	Construction, Manufacturing, and Transportation Jobs	Construction, Manufacturing, and Transportation Wages (millions)	Government Jobs	Government Wages (millions)	Wholesale and Retail Trade, Finance/Insurance/Real Estate, and Services Jobs	Wholesale and Retail Trade, Finance/Insurance/Real Estate, and Services Wages (millions)
Athens	940	$3.87	2,980	$69.58	10,360	$360.86	13,460	$227.63
Gallia	1,170	$2.84	3,540	$129.42	2,120	$71.80	9,540	$185.13
Hocking	670	$5.51	3,330	$100.48	1,740	$57.68	4,550	$64.53
Jackson	1,220	$31.90	5,600	$162.76	1,570	$50.14	6,870	$108.13
Lawrence	790	$3.43	4,070	$129.04	3,980	$115.49	10,380	$144.58
Monroe	1,390	$20.38	3,000	$117.32	1,000	$27.07	2,090	$24.32
Morgan	1,030	$21.68	1,750	$65.76	780	$21.92	2,110	$26.18
Noble	820	$7.20	1,090	$36.73	1,150	$31.65	2,250	$29.98
Perry	1,350	$13.87	3,120	$94.08	1,840	$48.22	4,710	$71.38
Scioto	1,120	$5.99	6,290	$211.96	5,860	$199.41	19,940	$361.44
Vinton	300	$3.58	1,050	$29.10	860	$21.91	1,360	$20.01
Washington	2,420	$17.80	9,620	$358.44	3,580	$115.05	18,130	$346.10
Forest-wide	13,220	$138.05	45,440	$1,504.67	34,840	$1,121.20	95,390	$1,609.41
Sector as a % of all sectors Forest-wide	7%	3%	24%	34%	18%	26%	51%	37%
State	183,730	$2,762	1,798,410	$76,671.01	808,310	$30,781.12	4,090,450	$102,308.08
Sector as a % of all sectors statewide	3%	1%	26%	36%	12%	15%	59%	48%

Source: Woods and Poole Economics, (2002).

In 2000, the wholesale trade, retail trade, and services sector represented the largest share of the economy in the Forest-wide region, generating $1,609,410,000 in wages and accounting for 95,390 jobs (Table 3 - 79). This sector comprised 37 percent of wages and 51 percent of jobs across all sectors in the region. Construction, manufacturing, and transportation sector, the second largest sector, generated $1,504,670,000 in wages and accounted for 45,440 jobs. This sector comprised 34 percent of wages and 24 percent of all jobs in the region.

Compared to the entire State, the region is more dependent on the farming, agricultural services, mining sector as well as the government sector. In the region, the farming, agriculture services, and mining sector comprises 7 percent of jobs and 3 percent of wages, compared to just 3 percent of jobs and 1 percent of wages statewide. Additionally, the government sector generates 18 percent of jobs and 26 percent of wages in the region, compared to just 12 percent of jobs and 15 percent of wages statewide. In contrast, the region is less dependent on the wholesale trade, retail trade, and services sector, with 51 percent of jobs and 37 percent of wages in the region, compared to 59 percent of jobs and 48 percent of wages statewide.

The variability among counties in the WNF region is apparent when jobs and wages across all economic sectors are totaled for each county (Table 3 - 80). In 2000, Washington County had the greatest number of jobs (33,740) and generated the most wages ($837,380,000). Scioto County was not far behind with 33,220 jobs and $778,810,000 in wages. Conversely, Vinton County had the fewest number of jobs (3,570) and generated the least in wages ($74,600,000) in 2000.

Economic diversity indices were also calculated for both the State and the counties in the WNF region using the Shannon-Weaver index. The Shannon-Weaver index is based upon the spread of jobs throughout each economic sector and ranges from 0 (no economic diversity) to 1.0 (perfect economic diversity, with an equal number of jobs in each sector). These calculations indicate that, while both the State and the Forest-wide region have somewhat diverse economies, the region's economy (0.86) was more diversified than the State's (0.62) in 2000 (See Table 3 - 80).

Within the Forest-wide region, there was substantial variability among the 12 counties in 2000. At 0.74, Washington County had the lowest economic diversity in the region, whereas Morgan County had the highest economic diversity (0.95). Regardless of the variability, all 12 counties displayed high economic diversity when compared to the State.

These calculations reflect greater diversity in the Forest region, compared to the State, when jobs are aggregated into the four broad sectors listed above. If job diversity were to be calculated across more narrow industry groupings, with more than four categories, the results might differ substantially. Here, the four broad categories were used because they provide a useful, high-level indicator of diversity at the broadest scale.

Table 3 - 80. Total Jobs and Earnings Across all Four Economic Sectors (2000) and Economic Diversity Index

County	Jobs	Wages (1996 $ in millions)	Shannon-Weaver Diversity Index[a]
Athens	27,760	$661.94	0.77
Gallia	16,340	$389.19	0.79
Hocking	10,300	$228.19	0.87
Jackson	15,270	$352.94	0.84
Lawrence	19,220	$392.54	0.81
Monroe	7,470	$189.10	0.94
Morgan	5,670	$135.55	0.95
Noble	5,300	$105.57	0.94
Perry	11,040	$227.54	0.92
Scioto	33,220	$778.81	0.75
Vinton	3,570	$74.60	0.92
Washington	33,740	$837.38	0.74
Forest-wide total	188,900	$4,373.35	0.86
State	6,880,900	$212,522.13	0.62

Sources: Woods and Poole Economics, (2002); Shannon and Weaver, (1949); Zar, (1996). [a] Calculated with Shannon-Weaver's index of diversity: $J' = H'/H'_{max}$ where $H' = \Sigma\, p_i \log p_i$ and $H'_{max} = \log kp_i$ = the proportion of total employment of the region that is located in the *i*th economic sector and k = number of economic sectors. All indices range between 0 (no diversity) and 1.0 (perfect diversity).

The economic sector in the WNF counties is more diverse than the State's as a whole.

In the future, job trends are expected to favor employment primarily in the wholesale trade, retail trade, and services sector. In the Forest-wide region, this sector is projected to account for 108,580 jobs and generate $2,017,910,000 in wages (see Table 3 - 81). This sector is expected to consist of 52 percent of jobs and 39 percent of all wages in the region. The second-largest sector is expected to be construction, manufacturing and transportation, which is projected to generate 46,590 jobs and $1,669,850,000 in wages. This sector is expected to comprise 22 percent of jobs and 32 percent of all wages in the region by 2010.

Compared to the entire State, the region will likely continue to depend more on the farming, agricultural services, and mining sector and government sector in the future. In the region, the farming, agricultural services, and mining sector is expected to comprise 7 percent of jobs and 3 percent of wages, compared to just 3 percent of jobs and 1 percent of wages statewide in 2010. The government sector is expected to produce 38,780 jobs and yield $1,330,450,000 in wages. In 2010, the government sector is expected to account for 19 percent of jobs and 26 percent of wages, compared to 11 percent of jobs and 14 percent of wages statewide. In contrast, the region is projected to be less dependent than the State on the wholesale, trade, retail trade, FIRE, and services sector. In 2010, this sector is expected to account for 52 percent of jobs and 39 percent of wages, compared to 61 percent of jobs and 50 percent of wages statewide.

Table 3 - 81. Projected Jobs and Earnings (1996 $) by Economic Sector (2010)

	Farming, Agricultural Services, and Mining		Construction, Manufacturing, and Transportation		Government		Wholesale and Retail Trade, Finance/Insurance/Real Estate, and Services	
Location	Jobs	Wages (millions)	Jobs	Wages (millions)	Jobs	Wages (millions)	Jobs	Wages (millions)
Athens County	1,010	$5.10	3,030	$74.99	11,680	$433.14	15,740	$294.98
Gallia County	1,140	$3.17	3,710	$146.72	2,210	$80.45	11,070	$242.50
Hocking County	720	$6.72	3,570	$116.40	1,930	$67.98	5,410	$84.13
Jackson County	1,340	$40.00	6,500	$209.39	1,860	$62.98	7,920	$137.05
Lawrence County	790	$3.87	4,070	$136.66	4,660	$144.53	11,820	$179.38
Monroe County	1,460	$25.09	2,870	$121.39	1,060	$30.25	2,290	$28.89
Morgan County	1,110	$26.20	1,710	$70.19	840	$25.23	2,440	$32.43
Noble County	850	$8.54	1,090	$40.31	1,340	$39.48	2,760	$39.97
Perry County	1,420	$16.74	3,420	$110.91	2,000	$55.92	5,600	$93.56
Scioto County	1,140	$7.25	6,260	$229.17	6,510	$235.69	22,590	$450.28
Vinton County	330	$4.32	1,080	$32.99	970	$26.22	1,660	$26.78
Washington County	2,480	$20.84	9,280	$380.73	3,720	$128.58	19,280	$407.96
Forest-wide	13,790	$167.84	46,590	$1,669.85	38,780	$1,330.45	108,580	$2,017.91
Sector as a % of all sectors Forest-wide	7%	3%	22%	32%	19%	26%	52%	39%
State	191,750	$3,286.38	1,923,210	$89,490.75	874,760	$35,365.21	4,625,070	$128,543.77
Sector as a % of all sectors statewide	3%	1%	25%	35%	11%	14%	61%	50%

Source: Woods and Poole Economics, (2002).

County Planning and Zoning

Six of the 12 counties that have land within the Forest's proclamation boundary have land use plans (Table 3 - 82). At present, county planning and zoning provide relatively limited information that the Forest could use to avoid acquiring land the counties see as important to future development.

Table 3 - 82. Status of county planning and zoning.

County	Land Use Plan Completed	Comments
Athens	Yes	
Gallia	Yes	Commissioners' office states Gallia does have a farm land use plan, and an outdated comprehensive plan that is not in use.
Hocking	Yes	Commissioners' office states their plan was completed in 1968, and is currently being updated.
Jackson	Yes	
Lawrence	No	Commissioners' office states zoning does not extend beyond the city of Ironton, except for floodplain building restrictions.
Monroe	No	
Morgan	No	Commissioners' office states a county land use plan is currently being developed. Malta Township does have a land use plan, but Malta lies outside the Forest's proclamation boundary.
Noble	Yes	Commissioners' office states Buffalo and Wayne Townships are zoned, but both are outside the Forest's proclamation boundary. Noble County's Sustainable Communities Plan does provide pertinent information for Forest management.
Perry	No	Commissioners' office states Hopewell, Reading and Thorn Townships are zoned, but they all lie outside the Forest's proclamation boundary.
Scioto	No	Commissioners' office states Porter, Valley and Clay Townships are zoned, but they all lie outside the Forest's proclamation boundary.
Vinton	No	
Washington	Yes	

Environmental Consequences

Effects Common to All Alternatives

Effects of National Forest Ownership

The Forest's land acquisition program has been the subject of some opposition, based on concerns that National Forest ownership may discourage residential and industrial development and adversely impact local tax revenues for schools and county governments. Federal land cannot be developed for residential or industrial purposes. Also, State and local governments cannot tax Federal land, so government jurisdictions that include Federal lands face a reduced land base on which to levy property taxes.

These concerns resulted in a moratorium (included in the 1995 appropriations bill for Interior and Related Agencies) on the purchase of land by the Wayne National Forest within Lawrence, Washington, Monroe, and Gallia Counties in Ohio. The language was subsequently removed in the Fiscal Year 2000 appropriations bill. The Ohio State Legislature also considered action on this issue. In 1999, a bill was introduced to amend the State of Ohio's consent law. It passed the Ohio House of Representatives in November 2000 but did not come to a vote in the Senate.

To assess the impacts of National Forest ownership on local tax revenues, it is necessary to understand not only the tax-exempt nature of Federal lands but also the Federal payments to local governments that arise from Federal land located in their jurisdictions. These Federal payments should be compared to property tax revenues that would be expected if the land were privately owned and evaluated within the context of other sources of local government funding.

Federal Funding Programs

Although National Forests do not pay property taxes for the land managed by the Federal government, the Federal government helps fund State and local governments through three major programs: the 25 Percent Fund, Payment in Lieu of Taxes (PILT), and a share of mineral royalties.

The 25 Percent Fund provides a means to share 25 percent of the gross revenue from fees collected on National Forest System (NFS) lands for activities such as timber, grazing, camping, and special use permit fees. The funds are paid to the States annually and then given to counties where the funds originated, based on National Forest acreage within those counties. The funds must be used for schools and roads. Counties may choose one of two formulae for calculating their payments: the traditional formula based on current year revenue and the newer "Full Payment" option based on the average of the highest three years of revenue during fiscal years 1986 through 1999.

The Federal Payments in Lieu of Taxes (PILT) Act of 1976 established funds to compensate county governments for private property taxes forgone due to Federal ownership (Chapter 69, 31 U.S.C. 6901-6907; Payments in Lieu of Taxes Act). Like the 25 Percent Fund, PILT payments are made to the counties based on acres of National Forest land within the county, but only for NFS land that was privately owned prior to Federal acquisition, called entitlement acres. If the lands were already in public ownership, such as those previously owned by State government, these lands were already tax exempt, and are not considered “entitled” to PILT dollars. This statutory requirement explains why some counties do not receive money for every acre of National Forest land. In addition to entitlement acres, PILT payment amounts depend on several additional factors: population of a county, amount of payments from other Federal agencies during the previous year, existence of State “pass-through” laws which require other Federal payments to be channeled to local entities rather than county governments, and the Consumer Price Index.

A third major Federal program that provides funds to States and counties involves mineral royalties generated on Federal lands. For lands acquired by the Forest Service under the Weeks Act, which includes WNF lands, the Federal government shares 25 percent of gross mining receipts with the State. Mineral royalties historically have been added to the 25 Percent Fund, earmarked for schools and roads, but after 1992 an administrative change shifted these payments to a separate fund for counties, not earmarked for schools and roads.

Payment in Lieu of Taxes

Data are available to assess trends in Federal payments to local governments in the Forest-wide Region from the 25 Percent Fund (including mineral royalties until 1992) and PILT (see Table 3 - 83). The 25 Percent Fund payments declined from a high in 1985 of $192,525 to a low of $11,400 in 1996. This decrease coincided with a trend of timber production decline across all National Forests starting in the 1980s, as well as litigation against the WNF that halted most timber sales. In addition, after 1992 mineral royalties were managed via a separate reporting and delivery system instead of being added to the 25 Percent Fund. Together these changes precipitated a decrease of approximately 94 percent, between 1985 and 1996, in the total real dollars available for disbursement from the Federal government for roads and schools within the 12 counties.

Table 3 - 83. PILT and 25% Fund Payments to counties in the WNF (Inflation Adjusted).

Year	Actual Acres	PILT	25% Fund	Total	Inflation Adjusted	Adjusted per actual acre
1970	140,250		$11,785	$11,785	$47,658	$0.33
1971	146,789		$11,619	$11,619	$45,012	$0.30
1972	153,917		$22,026	$22,026	$82,685	$0.44
1973	159,401		$19,854	$19,854	$70,164	$0.44
1974	161,956		$9,666	$9,666	$30,766	$0.19
1975	163,345		$32,274	$32,274	$94,110	$0.58
1976	166,085			$33,545	$92,483	$0.57
1977	168,350			$144,612	$374,400	$2.22
1978	170,173			$158,361	$381,086	$2.24
1979	172,766			$147,145	$318,008	$1.84
1980	174,641			$146,516	$278,966	$1.60
1981	176,527			$146,751	$253,292	$1.43
1982	176,787	$72,335	$89,550	$161,975	$263,371	$1.48
1983	177,150	$33,615	$75,386	$109,001	$171,676	$0.96
1984	177,701	$37,201	$155,511	$192,712	$287,975	$1.62
1985	177,977	$56,567	$192,525	$249,092	$363,176	$2.04
1986	177,977	$17,143	$95,448	$112,591	$161,230	$0.91
1987	178,965	$17,689	$176,267	$193,956	$267,853	$1.50
1988	186,395	$38,975	$92,636	$131,611	$174,516	$0.94
1989	186,395	$18,694	$171,536	$190,230	$240,640	$1.29
1990	197,938	$50,311	$134,296	$184,607	$221,528	$1.12
1991	202,751	$19,951	$150,639	$170,590	$196,519	$0.97
1992	211,707	$20,583	$132,986	$153,569	$171,690	$0.81
1993	217,758	$22,023	$37,692	$59,715	$64,850	$0.30
1994	218,809	$30,606	$30,110	$60,716	$64,298	$0.29
1995	221,707	$129,096	$15,554	$144,650	$148,989	$0.67
1996	227,055	$216,199	$11,400	$227,599	$227,599	$1.00
1997	227,128	$141,106	$16,380	$157,486	$154,021	$0.68
1998	228,401	$150,237	$13,663	$163,900	$157,853	$0.69
1999	229,654	$156,524	$22,984	$179,508	$169,096	$0.74

a Inflation figures adjusted are based on 1996 dollars. See www.jsc.nasa.gov/bu2/infateCPI.html

In contrast with 25 Percent Fund payments, PILT payments to counties in the Forest-wide region have increased substantially in recent years. In 1995, Congress passed new PILT legislation that set a schedule for increasing PILT payments. Although Congress has never fully funded the new authorized payment levels, PILT payments to Forest-wide region counties did increase substantially after 1994 (see Table 3 - 83).

Despite increasing PILT payments, the decreased 25 Percent Fund payments depressed total Federal payments to local governments. Combined PILT and 25 Percent Fund payments dropped from $249,092 in 1985 to under $40,000 in 1993 and 1994 before rebounding somewhat to $227,599 in 1996. During this time, the Wayne saw a significant increase in funds available for acquisition of lands. Federal ownership on the Forest increased by more than 43,000 acres between 1989 and 1999, further diluting the available 25 percent Funds available for school districts within the Wayne on a per-acre basis (see Table 3 - 83).

In addition to the payments for PILT, revenue sharing and mineral royalties cited above, counties also receive additional direct payments or project dollars for other services provided to the National Forest. Counties with NFS lands are eligible for funding under the Forest Highway Program administered by the Federal Highway Administration. Counties may enter cooperative law enforcement agreements with the U.S. Forest Service to be reimbursed for expenditure of funds in support of law enforcement activities on NFS lands. Local fire departments may enter cooperative agreements to be reimbursed for forest fire-fighting response. And eligible communities within the National Forest may apply for Rural Development grants administered by the U.S. Forest Service State and Private Forestry.

Table 3 - 84 shows that the average annual combined Federal reimbursements and payments to the 12 counties within the Wayne has been approximately $2.74 per acre.

The Wayne National Forest makes a significant contribution the region's economy.

Table 3 - 84. All Forest-related Federal Payments to the 12 Counties.

Source	Year 1997	Year 1998	Year 1999	Year 2000	Year 2001	Year 2002	Year 2003
PILT	$141,106	$150,237	$156,524	$168,320	$237,758	$267,551	$278,071
Revenue Sharing	$16,380	$13,663	$22,984	-$3,116	$40,419	$61,371	$76,194
Mineral Royalties	$19,209	$14,853	$16,914	$15,858	$23,193	$10,844	$14,822
Coop LE	$35,000	$49,000	$36,500	$32,800	$32,500	$32,500	$32,500
Forest Highways	$586,856	0.00	$250,123	$507,304	$550,000	250,000	200,000
Road Projects	0.00	0.00	0.00	0.00	$49,698	0.00	0.00
Fire Equip Rentals*	$10,000	$10,000	$10,000	$10,000	$10,000	$4,261	$735
Total	**$808,551**	**$237,753**	**$493,045**	**$731,166**	**$943,567**	**$626,527**	**$602,322**
Forest Acres	227,128	228,401	229,654	231,290	232,926	233,638	236,175
Average per acre	$3.56	$1.04	$2.15	$3.16	$4.05	$2.68	$2.55

***** - Reductions in this category are directly related to low incidents of fires.

- Average per acre payment over the seven years shown is $2.74

In response to substantially lower Federal 25 Percent Fund payments after 1992 and increasing Federal land ownership, some citizens in southeastern Ohio became increasingly concerned that Federal ownership of land in the region was having a negative effect on the tax base. The PILT program was targeted in particular, and most objections were based on its effect on the area's schools, even though the only program that directly reimburses schools is the 25 Percent Fund (PILT and mineral royalty payments are made directly to the general fund of each county).

Ownership Impacts on Development

One measure of the impact of the National Forest land base on the potential for future development of land within the 12 counties is to correlate the relative acreage of the Wayne in each county with the acreage enrolled in Ohio's Current Agricultural Use Valuation (CAUV). CAUV lands are, by definition, undeveloped. While the purpose of the CAUV program is to retain open space in Ohio, lands in CAUV are available for development if the current owner (1) chooses to develop the property rather than continue with agricultural pursuits, and (2) repays the prior three years of tax savings resulting from CAUV enrollment. The following is a brief explanation of the CAUV program:

In the early 1970s, agricultural landowners faced rising property taxes as law changes increased the property assessment rate, the economy experienced high inflation, and growing metropolitan areas exerted development pressures. To help reduce the tax burden on agricultural landowners, the Ohio Constitution (Article 2, Section 36) was amended in a 1974 statewide referendum to allow agricultural land value to be based on its current rather than its potential use (referred to as highest and best use value, or HBUV). The resulting legislative program is called current agricultural use valuation, or CAUV. Based on data from the Ohio Department of Natural Resources, LBO (Legislative Budget Office) estimates that 20 percent of CAUV land in Ohio is timberland (3.2 million acres) (Petry, 2000).

In all counties, CAUV lands significantly exceed the amount of NFS lands (see Table 3 - 85). Based only on the amount of open space represented by CAUV, these figures suggest that all 12 counties have sufficient additional lands now enrolled in CAUV that could be developed if market conditions warranted.

Table 3 - 85. CAUV enrolled acreage in the 12 counties of the WNF, 2003.

County	WNF Acres	WNF % of County	Total acres in County	CAUV Acres	CAUV % of County
Athens	18,365	5.8%	325,327	98,734	30.35%
Gallia	16,954	6%	301,543	139,303	46.2%
Hocking	24,151	9.5%	270,974	58,230	21.5%
Jackson	1,701	0.6%	269,632	71,998	26.7%
Lawrence	68,843	24.2%	292,375	110,652	37.8%
Monroe	24,137	8.4%	292,441	148,587	50.8%
Morgan	3,328	1.2%	269,725	133,994	49.7%
Noble	694	0.3%	258,738	95,316	36.8%
Perry	22,257	8.5%	263,841	106,179	40.2%
Scioto	11,625	3%	394,358	192,413	48.8%
Vinton	1,869	0.7%	265,526	63,776	24.0%
Washington	39,002	9.5%	409,125	174,460	42.6%
Total	232,926	6.6%	3,613,605	1,393,642	38.6%

Source: The Ohio Department of Taxation.

In all 12 counties, the amount of acreage enrolled in CAUV increased between 1990 and 2003 (see Table 3 - 86). The increases ranged from 12.0 percent in Washington County to 46.8 percent in Hocking County, with a Forest-wide average of 23.5 percent. This overall increase in CAUV enrollment suggests two conclusions. First, there does appear to be sufficient demand for undeveloped land in the 12 counties to keep landowners from electing to preserve open space for the tax benefit. Second, many land owners in the region do not anticipate near-term demand for development, as they would have to repay the prior three years of tax savings if CAUV lands were converted to other uses.

Table 3 - 86. CAUV enrollment by year in the 12 counties of the Wayne.

Year	Athens	Gallia	Hocking	Jackson	Lawrence	Monroe	Morgan	Noble	Perry	Scioto	Vinton	Washington	Forest-wide
1990	61,363	118,854	31,002	53,143	93,335	115,395	109,008	68,159	80,667	141,246	39,937	153,549	1,065,658
1991	62,834	120,432	30,557	54,108	95,089	116,377	110,629	72,633	83,182	143,030	39,822	155,165	1,083,858
1992	66,302	121,062	32,796	55,854	98,372	117,604	112,363	74,753	85,485	148,805	39,311	157,709	1,110,416
1993	71,570	119,609	37,584	58,363	101,469	123,291	114,662	80,056	86,652	151,090	42,921	159,253	1,146,520
1994	75,563	123,711	38,880	61,486	103,235	129,047	118,865	81,738	87,458	154,734	44,951	146,631	1,166,299
1995	80,654	123,196	39,955	60,402	104,227	131,491	121,307	83,358	90,609	156,121	48,534	139,843	1,179,697
1996	85,919	125,054	40,646	62,526	105,948	135,330	120,847	83,993	94,328	162,415	48,819	155,977	1,221,802
1997	87,047	128,189	41,252	65,867	107,403	138,764	126,599	87,994	95,581	165,019	50,232	157,784	1,251,731
1998	89,134	130,430	50,778	66,637	107,605	141,587	127,988	89,438	96,976	169,300	52,774	158,732	1,281,379
1999	90,163	131,679	52,768	68,065	109,047	142,417	129,421	91,494	98,384	180,474	55,355	163,006	1,312,273
2000	93,018	135,367	53,817	68,768	109,839	144,775	131,827	93,281	104,138	178,480	59,061	168,999	1,341,370
2001	92,143	136,953	54,728	69,616	110,006	146,607	133,567	93,980	102,124	183,580	62,776	169,293	1,353,373
2002	97,776	136,003	55,798	71,093	110,916	147,107	134,499	93,948	107,135	188,070	62,100	172,203	1,376,648
2003	98,734	139,303	58,230	71,998	110,652	148,587	133,994	95,316	106,179	192,413	63,776	174,460	1,393,642
Net Change	37,011	20,4492	27,228	18,855	17,317	33,192	24,986	27,157	25,512	51,167	23,839	20,911	327,984
Percent Change	37.5%	14.7%	46.8%	26.2%	15.7%	22.3%	18.6%	28.5%	24.0%	26.6%	37.4%	12.0%	23.5%

Source: Ohio Department of Taxation.

Not all open, undeveloped acreage in each county is enrolled in CAUV. Some undeveloped properties are enrolled in other abatement programs, such as Forest Tax law. Other lands available for development may not be enrolled in a tax abatement program. Still other lands may have a current use that is less than the optimal use and so are available to be developed to a higher degree.

Given the current levels of undeveloped, privately owned land in Southeast Ohio, there is minimal potential for conflict between conservation by the Forest Service and development by residential, commercial, and industrial interests. Even if the Wayne grows to the 322,000 acres envisioned by the 1988 Forest Plan, the additional acres would represent only a six percent reduction in the almost 1.4 million acres currently enrolled in CAUV. At 322,000 acres, the Wayne would still hold less than 10 percent of the total 3.6 million acres in the 12-county region.

Additionally, Forest priorities for land acquisition tend to be properties with limited potential for future commercial or industrial development. The Forest's priority for ownership consolidation targets existing in-holdings surrounded by NFS land. Generally, in-holdings are remote areas that would be less desirable for commercial or industrial development because of infrastructure and labor limitations:

- Access to highways for transportation of resources or products. No interstate highways pass through the Wayne. Only two restricted access highways lie within the Proclamation Boundary. Few of the State and county roads within the Forest were designed for heavy industrial use.
- Access to utilities, including water and sewage lines for industrial and commercial sites. The rural areas within the Forest boundary rely heavily on wells and septic systems, which are generally insufficient to support the demands of industrial or commercial users.
- An available labor pool. While rural communities often have high unemployment rates, the population is often so scattered that companies find it difficult to recruit a qualified workforce in remote areas.

Potential employers would more likely locate a business or factory near one of the area's larger towns, like Nelsonville, Marietta, or Ironton, rather than in a remote area, away from a population center and ready transportation.

There are occasions when another use is identified for NFS land that best serves the public interest. In those cases, the Forest Service is willing to complete land exchanges. The Wayne has participated in land exchanges that benefit communities struggling with new needs resulting from development, such as new school construction in the Rock Hill School District of Lawrence County or a new sewage plant in New Straitsville.

Although in-holdings in the Forest may not be suitable for commercial or industrial development, they may be very attractive to private individuals for development as housing for year-round residence as well as weekend retreats. Indeed, "gateway" communities to public forest and park lands nationwide are becoming increasingly popular for residential development. Thus Federal land ownership may actually foster residential development on private land nearby, even as it prevents residential development on Federally owned parcels, because of the positive effects of public land on the quality of life.

Ownership Impacts on Local Tax Bases

Property taxes are a critical source of revenue for many local governments and school districts. Since NFS land is tax-exempt, there is potential for Federal ownership to negatively impact local tax bases. Analyses described below, however, suggest that the preclusion of private residential development on Federal lands actually helps county government finances because service and infrastructure costs in rural places often exceed property tax revenues associated with residences. In addition, Federal payments are frequently higher than property tax collected on CAUV-enrolled lands in the counties. Moreover, many counties in the Forest-wide region do not exceed the State average of tax-exempt land, as other counties have higher levels of non-Federal tax-exempt holdings (churches, State lands, universities, etc.). Also, the impact of declining 25 Percent Fund payments to schools is lessened by the relatively small portion of school funding that comes from this source, compared to other sources. Finally, counties may gain increased sales tax revenues as visitors to the Forest spend money locally. Several opportunities exist for local jurisdictions in the Forest-wide region to increase revenues.

Residential Development Tax Revenues and Service Costs

As noted, residential development is precluded on Federally owned parcels. But this does not necessarily have a negative impact on local government finances. Even though residential development can generate tax revenues, it can incur substantial public costs. Several studies have closely examined the economic impact of residential development in rural areas. As reported in a National Park Service study (NPS, 1995), residential development almost always results in increased public service requirements, for example transportation and utility costs including roads, utilities, sanitary sewage, water, natural gas, and electricity; as well as service costs including libraries, recreation, schools, health care, police and fire protection, and solid waste collection and disposal. In many cases, the cost of providing these services greatly exceeds the tax revenues generated from the development.

In an analysis of the economic impacts of open space, the Duchess County, New York, planning department found that farms and other types of open land can actually subsidize local government by generating more in property taxes than they demand in services. Residential lands required $1.12 to $1.36 for every tax dollar contributed, while agricultural lands required only $0.21 to $0.48 for every dollar (Sayer, 1994 in NPS, 1995).

According to an American Farmland Trust (1986) study of Loudoun County, Va., “over a wide range of development densities . . . the ongoing public costs of new residential development will exceed the (public) revenues from such development.” Of those units analyzed, annual revenues per thousand dwellings were between $2.7 million and $2.9 million, while costs averaged between $3.5 and $5.0 million. The annual net deficit per thousand units ranged from $0.6 million to $2.3 million (1986 dollars). The greatest predicted shortfall was for the lowest-density units, termed by the Trust as “rural sprawl.” For all densities, school expenses were the largest proportion of total costs (American Farmland Trust, 1986 in NPS, 1995).

In Culpepper County, Va., the average new residential unit can be expected to produce a deficit in the county budget of $1,242 (1988 dollars) (Larson and Vance, 1988). According to the authors, this study addresses the widespread but erroneous perception that residential growth, in expanding the tax base, improves local fiscal health. While residential development produces increased revenues from real estate taxes and other sources, it also increases demand for public service expenditures and generates demand for expanded public facilities (NPS, 1995).

A companion study concluded that for every dollar of tax revenue collected from residential land uses in Culpepper County in 1987, $1.25 was spent on county services. For every dollar collected from industrial/commercial or farm/forest/open space lands, only $0.19 was spent on services (Vance and Larson, 1988 in NPS, 1995).

A similar study conducted by the Davey Resource Group of Kent, Ohio, found that in Shelby County, Ohio, “for every dollar raised from residential land use related revenues, Shelby County spent $1.11 in direct services.” The study also demonstrated the manner in which farm, forest, and open space land uses were positive fiscal contributors to the county’s bottom line. Specifically, “for every dollar raised to provide public services for farm, forest and open space uses, only $0.29 was spent to provide services for these land uses” (Reiss, no date). A comparison of the relative costs of providing services to different land uses as a percentage of tax revenue from that land use appears in Table 3 - 87.

Table 3 - 87. Cost of Servicing Different Land Uses as a Percentage of Tax Revenue Received.

Study Location	Residential Development	Commercial Development	Farmland, Forest, and Open Space
Culpepper County, VA	125%	19%	19%
Connecticut average	106%	47%	43%
Massachusetts average	112%	42%	33%
New York average	124%	23%	35%
Town of Dunn, WI	106%	29%	18%
Lake Elmo, MN	107%	20%	27%
Independence, MN	103%	19%	47%
Farmington, MN	102%	79%	77%
Madison, OH	167%	20%	38%
Madison Township, OH	114%	25%	30%
Average	116%	32%	37%

Source: *The Economics of Urban Sprawl*. Water Protection Techniques. June, 1997

Forestland is much less costly to administer than residential development.

These studies show that the costs of support services that counties provide to residential developments typically average $1.16 for every dollar in tax revenue raised from that source. Support services for farmland, forests and open space typically cost counties about $0.37 for every dollar in tax revenue. In contrast to residential development, National Forest lands generate payments to counties but do not require public services such as schools, utilities, water and sewage, or solid waste collection and disposal. National Forests directly reimburse counties for some public services through programs such as law enforcement cooperative agreements (

Table 3 - 84).

Fire departments are reimbursed for fighting fires on Forest land with grants administered through the Ohio Department of Natural Resources. Counties are eligible for road maintenance assistance through the Ten Percent Program. After massive flooding in 1997 and 1998, the Forest Service provided more than $2 million to repair roads within the 12 counties. Also, rural and community economic development and promotion of tourism and travel can be assisted by funding available to the Federal Highway Administration (FHWA). These payments are in addition to the major funding sources described in Section 2.3.1: The 25 Percent Fund, PILT, and mineral royalties.

Comparing Federal Payments to Property Taxes Paid by Residents

Property taxes vary widely depending upon the type of land, current usage and improvements. The use of CAUV rates as a comparison to estimate the potential tax on current National Forest lands is reasonable because much of the WNF was enrolled in CAUV at the time it was acquired by the Forest Service. In addition, nearly all NFS lands would qualify for CAUV if the land were privately owned and remained undeveloped. Across the sample taxing districts shown in Table 3 - 88 below, private lands enrolled in CAUV generated between in $1.48 and $2.82 in 2000. These taxes per acre are generally less than the five-year average (1997-2001) for all Federal payments, which was $2.74 per acre (see

Table 3 - 84).

Table 3 - 88. Sample of tax revenue generated by CAUV lands in southeast Ohio.

County	Township	School District	CAU Value of Land[a]	CAU Value	Millage	Tax Revenue	CAUV Acres	$ Per Acre
Hocking	Ward	N-Y SD	$978,620	$342,530	44.475300	$15,234.00	8,091.94	$1.88
Gallia	Walnut	Symmes Valley	$327,200	$114,500	35.897604	$4,110.28	1,569.56	$2.62
Lawrence	Symmes	Symmes Valley	$791,930	$277,450	34.890104	$9,680.26	5,540.38	$1.74
Lawrence	Lawrence	Rock Hill	$131,610	$46,140	30.562669	$1,410.16	824.76	$1.71
Lawrence	Windsor	Symmes Valley	$2,625,730	$919,880	35.151149	$32,334.84	15,767.00	$2.05
Monroe	Graysville	Switzerland	$53,160	$18,610	32.674180	$608.00	358.00	$1.78
Noble	Elk	Switzerland	$634,380	$222,160	51.000000	$11,330.16	4,014.54	$2.82
Vinton	Knox	Alexander	$16,670	$5,840	41.046792	$239.72	161.00	$1.48

[a] Based on Auditor Reports of Abstract Values of Land Trust According to its CAU Values, 2000.

Impact of All Tax-exempt Properties on Counties within the Forest-wide Region

All counties have some properties that are tax exempt. Besides Federal lands, such properties might include State lands, colleges, universities, churches, parks, and fire departments. One measure of how much impact a National Forest has on a local tax base is to compare the level of tax-exempt properties within the Forest-wide counties against the State average. As shown in Table 3 - 89, six of the 12 counties within the Wayne have tax-exempt valuations below the statewide average. In the other counties, other large holdings may account for a greater percentage of the exempt assessment than the National Forest. For example, Athens County has the second highest tax exempt percentage of total assessed valuation in the State, behind only Pike County. Athens County includes Ohio University, Hocking College, and Ohio Department of Natural Resource lands. In Scioto County, the largest holder of tax-exempt valuation is the State of Ohio, where the county includes a State college and a State forest. Only in Monroe County did the Federal government hold the largest percentage of tax-exempt property in the year 2000. Yet Monroe County is below the statewide average for tax-exempt property. These figures suggest that the presence of a National Forest has not created an undue burden in the Forest-wide region due to the tax-exempt nature of Federal lands.

Table 3 - 89. Percentage of each County's Assessed Valuation Reported on All Tax-Exempt Real Property (2000)

County	Percent Exempt
Athens	32.40%
Gallia	19.97%
Hocking	13.20%*
Jackson	11.29%*
Lawrence	14.98%
Monroe	10.90%*
Morgan	9.38%*
Noble	21.09%
Perry	11.55%*
Scioto	25.98%
Vinton	12.36%*
Washington	14.18%
Statewide average	**13.92%**

Source: Ohio Department of Taxation, (2000) - Total Valuation of Real Property.

* Below statewide average.

Six of the twelve WNF counties have more than the State average of tax exempt real property.

Impact of National Forest Ownership on School Funding

As described above (Table 3 - 83), 25 Percent Fund revenues declined substantially after 1992. Since 25 Percent Fund payments are earmarked for roads and schools, this raised considerable local concern over school funding for the 17 school districts in the Forest-wide region. However, analysis reveals that the reduction in Federal impacts did not significantly impact school districts, owing to the relatively small share of school funding provided by the 25 Percent Fund. Table 3 - 90 shows the average enrollment for each district and the average 25 Percent Fund payment per pupil, reported in disbursed dollars. The 25 Percent Fund payment averaged $5.89 per pupil in 1985 and just $0.51 per pupil in 1996. In 1985, the school districts' average spending per pupil (all funds) was $3,280. At its peak, 25 Percent Funds represented approximately two-tenths of one percent of the total per-student funding for each school district within the Wayne's vicinity.

Table 3 - 90. Average 25 Percent fund revenue per student based on total enrollment.

School District	1985	1990	1995
Nelsonville-York	$ 1,671	$ 1,577	$ 1,552
Trimble LSD	1,157	1,128	1,082
Gallia County LSD	3,085	3,188	3,085
Logan-Hocking LSD	3,780	3,812	4,052
Oak Hill Union LSD	1,442	1,311	1,366
Dawson-Bryant LSD	1,556	1,311	1,356
Rock Hill LSD	2,218	2,058	2,021
Symmes Valley LSD	1,006	992	1,044
Switzerland of Ohio LSD	4,057	3,575	3,268
Morgan LSD	2,689	2,735	2,751
Southern LSD	1,132	1,026	1,103
Bloom-Vernon LSD	1,211	1,184	1,207
Green LSD	821	835	824
Wheelersburg LSD	1,760	1,729	1,633
Vinton County LSD	2,517	2,444	2,438
Fort Frye LSD	1,329	1,339	1,275
Frontier LSD	1,238	1,122	1,072
Total Enrollment	32,669	31,366	31,129
25% Fund per student	$5.89	$4.28	$0.50
25% Fund per student in constant dollars (1996)	$8.59	$5.14	$0.51

Source: Ohio Department of Education, http://ode000.ode.state.oh.us

Sales Tax Revenues Generated by the Wayne National Forest

The 12 counties containing NFS land receive tax revenue from spending by visitors to the Forest. Counties and local communities benefit from local sales taxes as well as local lodging taxes. To estimate the contributions to local tax bases from Forest visitors, one must accurately assess the level of visitor spending. This is challenging in a highly dispersed destination, such as the WNF, which has more than 230,000 acres divided across 12 counties. According to estimates from prior studies, spending in the region related to Forest visitation differs between non-local and local visitors. Non-local Forest visitors in the aggregate spend about $31,810,000 annually in the region on recreation in the WNF vicinity (Kriesel, 1996). Local Forest visitors spend an estimated $13,877,500 annually (see further discussion in Section 3 of this assessment); according to a 1996 Department of Development study, 66 percent of respondents spent between $11 and $80 during a day trip, for an average expenditure of $45.50. Counties and community tax rates vary. In the estimates of county tax revenue from visitor spending below, the conservative figure of 1.0 percent is used as the combined sales tax rate because it is the minimum rate across the 12 counties within the Wayne. However, 10 of the 12 counties within the Wayne have higher tax rates, as shown above, so the figures below are low rather than high estimates. No data are available to measure additional revenue for those counties that have passed a lodging tax. Based on these conservative estimates of tax percentage rates, these figures indicate that visitor spending related to the WNF returns at least $1.90 per acre in sales tax revenue directly to the counties (see Table 3 - 91 below). The estimate compares with a MarketVision Research, Inc. summary of the economic impact of tourism in Lawrence County, where the Wayne's Lake Vesuvius Recreation Area and Off-Road Vehicle trails are among the county's most popular attractions. It shows that local tax revenue from tourism is more than $320,000 annually (MarketVision Research Inc., 1997).

Table 3 - 91. County revenue derived from the WNF (based on 1%).

Source	Value	Tax Revenue
Non-local Visitors	$31,000,000	$310,810
Local Visitors	$13,877,500	$138,775
Total		**$449,585**

WNF visitors contribute significant tax revenue to local counties.

Summary of Impacts of Wayne National Forest Land Ownership

The presence of the Wayne, with its ongoing land acquisition program, does not appear to be negatively impacting economic development in the 12 counties. Substantial quantities of land remain undeveloped as indicated by CAUV enrollment, which ranges from 19.9 to 49.7 percent of the land base in these counties. In addition, each county may have additional acreage not enrolled in CAUV that may be available for development.

Similarly, analysis suggests that NFS land does not negatively impact local tax revenues and school funding when all relevant information is considered (Koontz and Bodine, 2003). The five-year average for combined Federal payments to counties in the Forest vicinity was $2.74 per acre. Indirect tax revenue generated by Forest visitors is estimated at an additional $1.90 per acre annually. Combined, the estimated total of $4.69 per acre exceeds estimates for CAUV rates in all the sample taxing districts that have NFS land.

While providing this revenue, National Forests do not require the same level of county services as privately owned lands. Several studies show that open and forested lands typically require only about 37 cents in services for every dollar raised in revenue. Residential development, which is most likely in the rural inholdings within the Wayne, typically requires about $1.16 in county services for every $1 in tax revenue contributed.

As timber revenues declined from their peak in 1985, school districts within the Wayne vicinity saw their Federal revenue sharing decrease. However, the levels of Federal revenue sharing do not appear to have been significant to the funding of any individual district. Of greater importance to the school districts is the State's school funding formula, which offsets the presence of NFS land by basing its funding formula on the assessed valuation, which does not include tax-exempt lands.

Environmental Justice

All Federal actions, including Forest Plan revisions and environmental impact statements, are required by Executive Order 12898 to address questions of equity and fairness in resource decision making. This section considers if any of the alternatives could disproportionately affect minority or low-income communities. The racial and ethnic composition of the analysis area is described above. Approximately three percent of the population within the analysis is non-white, compared to about 15 percent statewide. As reported in the description of the economic environment, communities in the Forest vicinity generally have a lower average household income and higher rates of unemployment than the state at large. There is no indication that any of the alternatives would adversely or disproportionately affect racial minorities or low income groups.

Heritage Resources

Significant differences in effects to heritage resources by alternative implementation are not expected. Because law, regulation, and policy explicitly control heritage resource management on Federal lands, Forest management practices and their effects would not differ substantially among the alternatives. Forest management projects may cause surface disturbances and bring additional people in contact with heritage resources, but the difference between alternatives would remain low because of the protection and mitigation measures common to all alternatives. In general, alternatives that would result in more acres of planned and budgeted management activities could reduce adverse cumulative effects to some degree, due to an increase in inventory and evaluation. However, this additional management may also bring more possibility of inadvertent damage. Again, the protection and mitigation measures common to all alternatives would provide for identified site integrity.

Effects that Vary by Alternative

This section looks at how the alternatives differ in how they would affect the local economy. An economic model was used to estimate the impacts of goods and services provided by the WNF. The model does not consider non-market valued goods and services. Effects such as scenery, water quality, and wildlife habitat, are addressed elsewhere in this Final EIS. This section considers timber production in some detail, because it is the economic factor that varies most among alternatives.

Economic Effects

Timber production, oil and gas production, and recreational opportunities on the Forest affect employment and income in southeastern Ohio. These effects would not be confined to the industries directly involved in these activities, but rather would extend to other related industries. Based on model projections, the estimated total number of jobs created by both direct and indirect effects would range from 694 jobs in Alternative B to 740 jobs in Alternative D. Labor income would increase from $20.6 million under Alternative F to $22.1 million under Alternative D. While these numbers are modest compared with the economy of the entire region, it is important to note that southeast Ohio is depressed economically, so that even small improvements are important. As illustrated in Table 3 - 92, recreation, wildlife and fish resources, timber and mineral production, and Forest Service salaries and contracts all affect local employment. Of these sectors, however, only the effects of timber production would vary substantially among the alternatives.

Table 3 - 92. Employment contributed by program by alternative (Average Annual, Decade 1).

Resource	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt. F
Recreation	187	191	184	191	189	189	183
Wildlife and Fish	72	74	71	74	73	73	70
Grazing	0	0	0	0	0	0	0
Timber	35	145	184	189	191	190	156
Minerals	87	88	86	88	88	88	86
Payments to States/Counties	3	7	7	7	7	7	6
Forest Service Expenditures	177	189	189	190	190	190	189
Total Forest Management	560	694	720	740	738	737	689
Percent Change from Current	---	23.8%	28.5%	32.1%	31.6%	31.6%	23.0%

Table 3 - 93. Labor income in millions of dollars by program by alternative (Average Annual, Decade 1; $1 million).

Resource	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt. F
Recreation	$3.9	$4.0	$3.8	$4.0	$3.9	$3.9	$3.8
Wildlife and Fish	$1.6	$1.6	$1.5	$1.6	$1.6	$1.6	$1.5
Grazing	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Timber	$1.1	$4.4	$5.6	$5.7	$5.8	$5.7	$4.7
Minerals	$2.6	$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	$0.2
Forest Service Expenditures	$7.3	$7.8	$7.8	$7.9	$7.9	$7.9	$7.8
Total Forest Management	$16.5	$20.7	$21.6	$22.1	$22.0	$21.9	$20.6
Percent Change from Current	---	25.8%	31.0%	34.2%	33.8%	32.7%	25.4%

Table 3 - 94. Employment by major industry by alternative (Average Annual, Decade 1).

Industry	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt. F
Agriculture	10	11	10	11	11	11	10
Mining	4	5	4	5	5	5	4
Construction	68	72	70	72	72	72	69
Manufacturing	35	98	122	125	126	126	105
Transportation, Communication, & Utilities	15	20	20	21	21	21	19
Wholesale trade	16	20	21	22	22	22	20
Retail trade	141	156	155	160	159	159	152
Finance, Insurance, & Real Estate	17	21	22	22	22	22	21
Services	121	141	142	147	146	146	138
Government (Federal, State, & Local)	134	149	150	153	152	151	148
Miscellaneous	2	2	2	2	2	2	2
Total Forest Management	560	694	720	740	738	737	689
Percent Change from Current	---	23.8%	28.5%	32.1%	31.6%	31.6%	23.0%

Table 3 - 95. Labori in millions of dollars by major industry by alternative (Average Annual, Decade 1; $1 million).

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

Table 3 - 96. Forest Service revenues and payments in millions of dollars to counties (Annual Avg, Decade 1; $1 million).

Forest Service Program	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt. F
Recreation	$0.2	$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	$0.0
Grazing	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Timber	$0.2	$0.8	$0.9	$0.9	$0.9	$0.9	$0.7
Minerals	$0.0	$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	$0.0
Protection	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Total Revenues	$0.4	$1.1	$1.2	$1.2	$1.2	$1.2	$1.0
Payment to States/Counties	$0.1	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3

Table 3 - 97. Current role of Forest Service-related contributions to the area economy.

	Employment (jobs)		Labor Income ($ million)	
Industry	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
Total	320,548	560	$9,322.8	$16.5
Percent of Total	100.0%	0.2%	100.0%	0.2%

Suited Forestlands

Suited forestlands are lands managed for timber production on a regulated basis. Determining forestland suitability is described in 36 CFR 219.3 and 219.14. The first step separates “forestland” from “non-forestland” like permanent openings and water. “Forestland” is then divided into:

- Lands withdrawn from timber management by an Act of Congress, the Secretary of Agriculture, or the Chief of the Forest Service
- Lands which the Forests cannot assure restocking within 5 years
- Lands where irreversible damage to soil or watersheds would occur.

The remainder is called “tentatively suited” forestlands. To determine total acreage of “suited forestlands”, the tentatively suited forestland is further reduced by land allocation decisions and site-specific issues made during forest planning. These reductions include management area designations, excessive road costs, designated recreation areas, and threatened, endangered and sensitive species habitat. Alternative A would have the greatest amount of suitable forestland, approximately 170,884 acres, while Alternative F would have the least, approximately 131,613 acres. The total National Forest land base is 238,053 acres, so the percentage of NFS land on the Wayne that qualifies as suitable timber lands varies from 72 to 55 percent. (Table 3 - 98.)

Table 3 - 98. Suitable acres by management area and alternative.

Management Areas	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	E Modified (Selected)	Alt. F
DCF	131,298	14,268	81,624	69,950	46,580	46,580	32,247
DCFOHV	32,808	20,186	31,968	20,510	14,550	14,550	14,543
FSM	0	111,030	20,260	35,664	47,721	45,541	29,758
FSMOHV	0	12,622	0	0	0	0	0
GFM	0	0	3,281	3,281	3,281	3,281	3,281
HF	0	0	17,076	17,076	24,679	24,679	24,663
HFOHV	0	0	0	11,458	17,417	17,417	17,417
RC	6,778	6,778	9,704	9,704	9,704	9,704	9,704
TOTALS	**170,884**	**164,884**	**163,913**	**167,643**	**163,932**	**161,752**	**131,613**

Allowable Sale Quantity

Allowable Sale Quantity (ASQ) is the maximum timber volume production permitted from suited forestland within the constraints of a Forest Plan over a decade. Only volume produced from timber harvesting on suitable forestlands contributes to ASQ. Timber harvesting may be used as a management tool on other Forest lands, however, the volume removed does not contribute to meeting the ASQ.

The 1988 Forest Plan's Allowable Sale Quantity (ASQ) is 1.25 MMCF (7.5 MMBF) feet per year. This total includes 1.09 MMCF (6.5 MMBF) of hardwoods and 0.17 MMCF (1.0 MMBF) of pine. Amendment 11 to the 1998 Forest Plan projected an average annual timber harvest of 0.33 MMCF (2.0 MMBF) from 1998 to 2002. (Note: MMCF is one million cubic feet. MMBF is one million board feet International scale and MBF is one thousand board feet.) During the first two years of the 1988 Plan, timber sale volume was near the Plan's projected output. From 1990 to 1995, however, the volume sold went down. Figure 3 - 55 shows the harvests achieved from 1988 through 2003. In addition to the volumes depicted below, very little timber has been harvested since 2003. Approximately 86 MBF was harvested from the Markin Fork Timber Sale in the autumn of 2003 and spring of 2004.

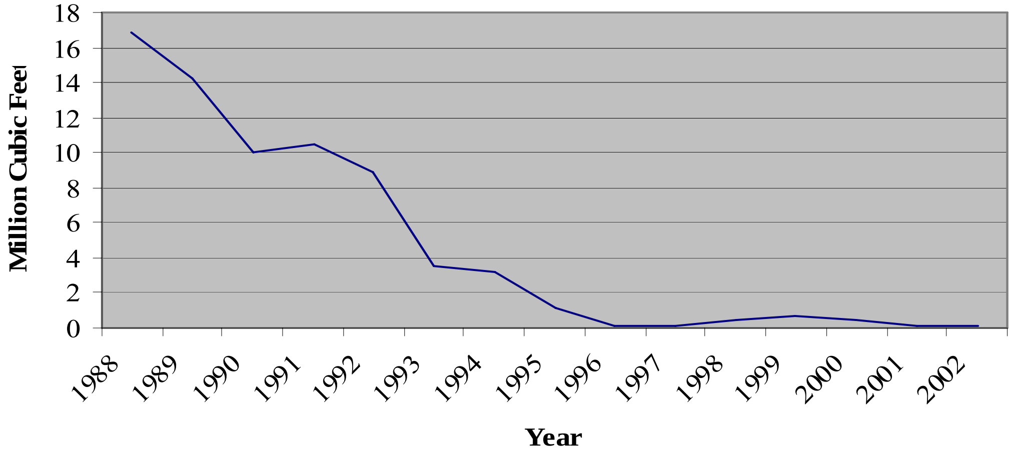


Figure 3 - 55. Harvests on the WNF from 1988 through 2003.

Effects of Management Area Allocation on Allowable Sale Quantity

The Allowable Sale Quantity (ASQ) varies among the alternatives (Table 3 - 98). This variation is a result of land allocation to different management areas as well as variations in the standards and guidelines for each management area. These affect the quantity of land available for treatment plus the intensity of the treatments. ASQ is based on the volume of wood produced from treatments on suited lands. Timber may be harvested to improve stand conditions for the remaining trees, create wildlife habitat, modify the scenic qualities, or to create conditions suitable for tree regeneration. Timber products produced from these harvests are intended to meet some of society's needs. These products are also a part of the Allowable Sale Quantity (ASQ), which is the maximum timber volume capability of an alternative given its management area (MA) assignments.

Suited lands lie within the following management areas: Diverse Continuous Forest, Diverse Continuous Forest with OHV, Forest and Shrubland Mosaic, Forest and Shrubland Mosaic with OHV, Grassland and Forest, Historic Forest, Historic Forest with OHV, and River Corridor. Timber affected by natural mortality events such as fire, windstorms, or insect infestations may be harvested under salvage sales. Any harvest in these management areas would be to meet other objectives and would not contribute to ASQ.

Table 3 - 99. Maximum average annual timber output by alternative (Volume in MMBF).

Decade	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. E Modified	Alt. F
1	2.0	8.4	8.7	9.0	8.4	8.3	7.2
2	2.0	8.4	8.7	9.0	8.9	8.8	7.2
3	2.0	17.9	15.0	10.1	15.0	14.8	11.9
4	4.8	17.9	15.0	10.1	15.0	14.8	11.9
5	4.8	17.9	15.0	10.1	15.0	14.8	11.9
6	4.8	17.9	15.0	10.1	15.0	14.8	11.9
7	5.1	17.9	15.0	10.1	15.0	14.8	11.9
8	5.1	22.1	15.0	10.1	15.0	14.8	11.9
9	6.0	22.1	15.0	10.1	15.0	14.8	11.9
10	6.0	22.1	15.0	10.1	15.0	14.8	11.9
11	6.0	22.1	15.0	10.1	15.0	14.8	11.9
12	6.0	22.1	15.0	10.1	15.0	14.8	11.9
13	6.0	22.1	15.0	10.1	15.0	14.8	11.9
14	6.0	22.1	15.0	10.1	15.0	14.8	11.9
15	6.0	22.1	15.0	10.1	15.0	14.8	11.9
Totals	72.6	283.1	212.4	215.6	212.3	209.5	169.11
Maximum Yearly Average	**4.8**	**18.9**	**14.2**	**14.4**	**14.2**	**14.0**	**11.3**

For the first decade, the ASQ would be highest under Alternative D and lowest in Alternative A. Over the next 100 years, the highest maximum volume would be in Alternative B, and lowest in Alternative A.

The wood harvested from Wayne National Forest land would be a part of the overall timber industry in Ohio. Ohio's forest industry is an extremely important segment of Ohio's economy, particularly in the eastern and southern portions of the state. Between 300 and 500 million board feet of wood are cut from Ohio's forests each year to produce an endless list of paper and wood products. As future demand for forest products increase and to the extent the availability of public forest land for timber harvesting is reduced, private forest land will increasingly be depended upon to meet the demand. (ODNR, 2005)

Long Term Sustained Yield

Long-Term Sustained Yield (LTSY) is the highest uniform wood yield from suited forestlands sustained under specific management intensity consistent with an alternative's objectives. LTSY is displayed for the alternatives in

Figure 3 - 56.

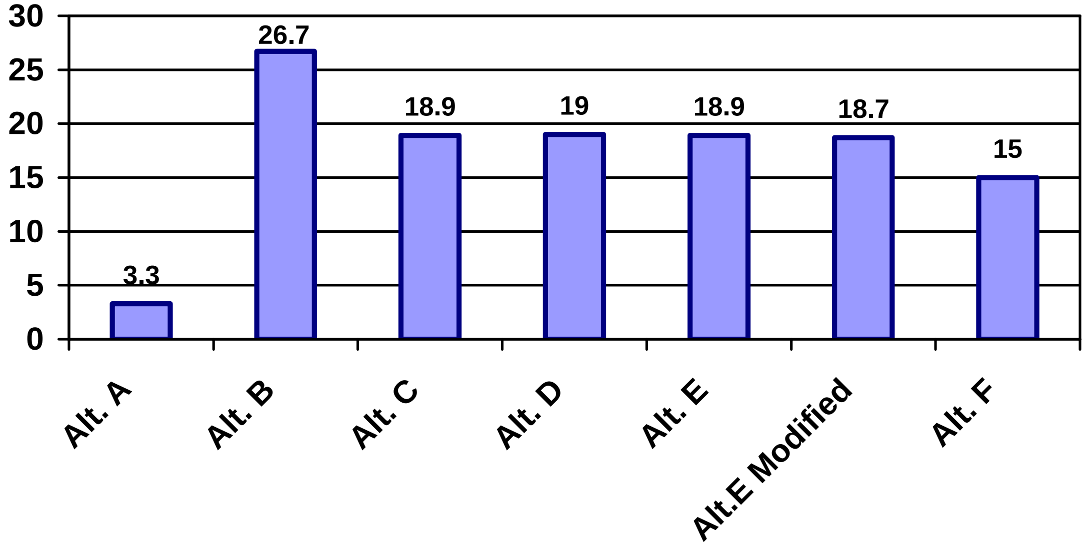


Figure 3 - 56. Long Term Sustained Yield by Alternative Volume in MMBF per Year.

The LTSY ranges from a high of 26.7 million board feet per year in Alternative B to a low of 3.3 million board feet per year in Alternative A.