United States
Department of
Agriculture

Forest
Service

Intermountain
Region

September 2006

Wasatch-Cache National Forest Noxious Weed Treatment Program

Final Environmental Impact Statement (Errata to the Draft Environmental Impact Statement)

Box Elder, Cache, Davis, Duchesne, Morgan, Rich, Salt Lake, Summit, Tooele, Wasatch, and Weber Counties, Utah

Uinta County, Wyoming

WASATCH-CACHE NATIONAL FOREST
NOXIOUS WEED TREATMENT PROGRAM
Final Environmental Impact Statement
Box Elder, Cache, Davis, Duchesne, Morgan, Rich, Salt Lake, Summit, Tooele, Wasatch, and Weber Counties, Utah

Uinta County, Wyoming

September 2006

Lead Agency:	**USDA Forest Service**
Cooperating Agencies:	**N/A**
Responsible Officials:	**Faye Kreuger** **Forest Supervisor** **Wasatch-Cache National Forest** **8236 Federal Building** **125 S. State Street** **Salt Lake City, UT 84138**
For Information Contact:	**Michael Duncan** **Wasatch-Cache National Forest** **8236 Federal Building** **125 S. State Street** **Salt Lake City, UT 84138**

Abstract: The U.S. Forest Service, Intermountain Region, proposes to treat noxious weeds on 1.2 million acres of Wilderness and non-Wilderness areas on the Wasatch-Cache National Forest (W-CNF). The project addresses existing and future potential noxious weed infestations. This Final Environmental Impact Statement (EIS) describes and analyzes the effects, in detail, of three alternatives. The Proposed Action is Alternative 2, which provides noxious weed treatment using the most effective methods available, balanced on a site-by-site basis while reducing potential impacts to sensitive resources. Alternative 1 represents no change in existing management, and Alternative 3 provides noxious weed treatment using methods other than herbicides, including mechanical, controlled grazing, and biological agents.

This is a “short form” Final EIS permitted under the CEQ Regulations for implementing the National Environmental Policy Act (NEPA). These regulations state: “If changes in responses to comments are minor and are confined to the responses described in paragraphs (a)(4) and (5) of this section, agencies may write them on errata sheets and attach them to the statement instead of rewriting the draft statement” (40 CFR 1503.4 [c]). This “short form” Final EIS is also consistent with CEQ regulation for reducing paperwork (40 CFR 1500.4[m]).

Final Environmental Impact Statement

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APPENDIX E

Errata

The following errata summarizes clarifications, updates, and/or corrections made to the Wasatch-Cache National Forest Noxious Weed Treatment Program Draft Environmental Impact Statement (DEIS) (2006). An errata is appropriate for a Final Environmental Impact Statement (FEIS) that has minor changes from the DEIS (40 CFR 1503.4[c]). The organization of the errata items follows the formatting in the DEIS.

Executive Summary

Page ES-2: *Factors in Weed Treatment*. Add the following sentence to the end of the last paragraph:

"Monitoring, as described in Appendix F, would be used to determine the effectiveness and appropriateness of applied treatments and restoration of treated sites."

Page ES-17: *Decisions to be Made*. Replace last sentence on page with the following sentence:

"In addition, the Forest Service will decide what, if any, treatment methods will be allowed within wilderness."

Chapter 1—Purpose and Need

Page 1-14: *Monitoring and Restoration*. Replace first paragraph on page with the following paragraph:

"A monitoring program would be implemented as part of the proposed project to monitor the application and effectiveness of the applied treatments. Monitoring results, combined with the Decision Tree (Figure 1-3) and the adaptive management approach described below in Section 1.4.3.3, would guide the future application of treatments by building on the experience gained through prior treatment applications. Appendix F presents monitoring activities to be included as part of the proposed project's design."

Page 1-18: *Decisions to be Made*. Replace last sentence on page with the following sentence:

"In addition, the Forest Service will decide what, if any, treatment methods will be allowed within wilderness."

Chapter 2—Alternatives, Including the Proposed Action

No changes are proposed for Chapter 2.

Chapter 3—Affected Environment

No changes are proposed for Chapter 3.

Chapter 4—Environmental Consequences

Surface Water and Groundwater Quality

Page 4-76 (in Section 4.3.2.2): Replace last sentence of first (partial) paragraph on page 4-76 with:

"Resultant concentrations in tributaries to the Ogden River or any other drainage on the W-CNF that receive this same amount of 2,4-D from a runoff-dominated site over a 6-hour period would exceed the State of Utah's drinking water standard if flow is less than 70 cfs."

Page 4-76 (in Section 4.3.2.2, *Low Flow Watersheds* subsection): Following the "Low Flow Watersheds" subsection heading, and the first paragraph, add the following text as the second paragraph:

"The following examples are for a single day, one-time herbicide application at a concentration suitable for successfully treating the target weed species. The single day, one-time application would prevent the potential problem of accumulation of residual herbicides at the soil surface from previous treatments."

Page 4-129 (in Section 4.4.6.2): Replace in first paragraph, first sentence; and in second paragraph, second sentence:

". . .Idaho SHPO. . ." with ". . .Utah SHPO. . ."

Page 4-130 (in Section 4.4.6.2): Replace in fourth paragraph, first sentence:

". . .Idaho SHPO. . ." with ". . .Utah SHPO. . ."

Chapter 5—List of Recipients

Page 5-1: Change "DEIS" in first heading to "FEIS."

Page 5-1: ***State and Local Government Agencies*. The following state and local Agencies were added to the list:**

Brigham Young University Department of Botany & Range Science

Chapter 6—Literature Cited

No changes are proposed for Chapter 6.

Chapter 7—Acronyms and Abbreviations

No changes are proposed for Chapter 7.

Chapter 8—Glossary

No changes are proposed for Chapter 8.

Chapter 9—List of Preparers

No changes are proposed for Chapter 9.

Appendix F

Monitoring Plan

APPENDIX F

Monitoring Plan

Implementation monitoring would be performed during treatment application and recorded on a pesticide application report to indicate that the appropriate treatment application standards and mitigation measures were followed. Samples of the treated sites and all restored sites would be monitored for effectiveness through field checks to determine the following:

- Whether the desired management objectives of eradicating, controlling, or containing aggressive weeds were achieved; and if not, what follow-up treatments would be necessary to achieve objectives;
- Whether site restoration techniques have resulted in the re-establishment of native plants; and if not, what follow-up treatments would be necessary to achieve establishment; and
- Whether the native vegetation has adequately responded in non-restored treatment areas to provide for adequate site protection; and, if not, what follow-up restoration treatments are necessary.

Treatment method and date, target species, and monitoring results are recorded for each monitored treatment site to compile a long-term database for treatment effectiveness under various conditions.

Herbicide applications adjacent to sensitive resources (streams, sensitive plants, amphibian breeding areas, etc) will be monitored to determine the amount and distribution of spray drift. Monitoring herbicides application, including drift detection at selected sites, will include the following activities:

- Spray detection cards will be placed on the perimeter of the treatment area and inside the buffer around sensitive areas. The cards will be visually examined and photographed immediately after spraying.
- A written summary will document the drift pattern as interpreted from the detection cards and the photos.
- For broadcast spraying, selected sites will be monitored for runoff by observing if surface erosion leading to a water body is present. Indicators of surface erosion are rilling and sediment deposition. Whenever there is reason to suspect that herbicides may have entered the stream during the spraying operation, water samples will be collected immediately after spraying. Laboratory analysis by an independent lab will test the water samples for herbicides.

If necessary, the application methodology will be modified.

Appendix G

Comment Letters and Responses to Public Comments on the Wasatch-Cache National Forest Noxious Weed Treatment Program Draft EIS

APPENDIX G

Comment Letters and Responses to Public Comments on the Wasatch-Cache National Forest Noxious Weed Treatment Program Draft EIS

TABLE G-1
Draft EIS Comment Letters

Reference Number	Source of Letter
Section 1—Federal, State, Local, and Tribal Governments	
1	Bill Wichers, Deputy Director, Wyoming Game and Fish Department
2	Robert F. Stewart, Regional Environmental Officer, U.S. Department of the Interior
3	Larry Svoboda, Director, NEPA Program, Office of Ecosystems Protection and Remediation, Environmental Protection Agency, Region 8
Section 2—Other Interested Parties	
4	B. Sachau

Section 1

Federal, State, Local, and Tribal Governments

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Comment Letter No. 1

WYOMING GAME AND FISH DEPARTMENT

5400 Bishop Blvd. Cheyenne, WY 82006
Phone: (307) 777-4600 Fax: (307) 777-4610
Web site: http://gf.state.wy.us

April 14, 2006

(1)

WER 7825
Wasatch-Cache National Forest
Draft Environmental Impact Statement
Noxious Weed Treatment Program

Mike Duncan
Wasatch-Cache National Forest
125 South State Street
Federal Building Room 8236
Salt Lake City, UT 84138

Dear Mr. Duncan:

The staff of the Wyoming Game and Fish Department has reviewed the Draft Environmental Impact Statement for the Noxious Weed Treatment Program for the Wasatch-Cache National Forest. We support this DEIS as it is currently written. 1.1

Thank you for the opportunity to comment.

Sincerely,

for BILL WICHERS
DEPUTY DIRECTOR

BW:VS:gfb
cc: USFWS

"Conserving Wildlife - Serving People"

Page 1 of 1

1.1 Your review and support of the DEIS is noted.

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Denver Federal Center, Building 56, Room 1003
Post Office Box 25007 (D-108)
Denver, Colorado 80225-0007

TAKE PRIDE® IN AMERICA

April 21, 2006

ER 06/211
9043.1

Faye Kreuger, Forest Supervisor
Wasatch-Cache National Forest
8236 Federal Building
125 S. State Street
Salt Lake City, UT 84138
ATTN: Melissa Blackwell

Dear Ms. Kreuger:

The Department of the Interior (Department) has reviewed the draft environmental impact statement (DEIS) for the Wasatch-Cache National Forest Noxious Weed treatment Program, Wasatch-Cache National Forest and offers the following comments.

Page 4-76, Section 4.3.2.2 Alternative 2: Proposed Action, first partial paragraph, last sentence - It is suggested that the last sentence be reworded to indicate that the resultant concentration would exceed the Utah drinking water standard for 2-4,D "if the flow is *less than* 70 cfs." Alternatively, the sentence could state that flows must exceed 481 cfs to dilute this much herbicide to below the standard. 2.1

Page 4-76, Section 4.3.2.2 Alternative 2: Proposed Action, last full paragraph, third sentence - An additional variable should be introduced into the calculation of the maximum number of acres per day that could be treated without exceeding drinking water standards. Pesticide could reside at the soil surface until there was a rainstorm to mobilize it, at which time the residual from several days' application would be delivered to the stream. Therefore, this analysis may have identified the maximum number of acres that could be treated between rainstorms, rather than per day. 2.2

We appreciate the opportunity to provide these comments. If you have any questions concerning our comments, please contact Lloyd Woosley of the USGS Environmental Affairs Program, at (703) 648-5028 or at **lwoosley@usgs.gov**.

Sincerely,

Robert F. Stewart
Regional Environmental Officer

Page 1 of 1

2.1 The referenced sentence will be corrected as you suggest, stating "if the flow is less than 70 cfs."

2.2 This example analysis is for a single day, one-time herbicide application at a concentration suitable for successfully treating the target weed species. Because of this, there would not be consecutive days of treatment and therefore no potential for accumulation of residual herbicide at the soil surface from previous treatments. The referenced paragraph will be revised to make this clear to the reader.

Comment Letter No. 3

======

May 18, 2006

Ref: EPR-N

Mike Duncan
Forest Botanist
Wasatch-Cache National Forest
8236 Federal Building
125 South State Street
Salt Lake City, UT 84138

Re: Wasatch Cache National Forest
Noxious and Invasive Weed Treatment
Project - Draft EIS
CEQ 20060075

Dear Mr. Duncan:

In accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency Region 8 (EPA) has reviewed the Wasatch Cache National Forest Noxious and Invasive Weed Treatment Project - Draft Environmental Impact Statement (DEIS) on the Wasatch Cache National Forest (WCNF). With this project the US Forest Service (USFS) proposes to treat noxious weeds on 1.2 million acres of wilderness and non-wilderness areas. The project addresses existing and future potential noxious weed infestations.

The EPA concurs with the need in the WCNF for an expanded integrated weed management program to prevent the establishment and spread of noxious weeds. The EPA commends proposed efforts to address invasive weed infestations before weed problems become an epidemic. Noxious weeds are a great threat to biodiversity, and can out-compete native plants and produce a monoculture that has little or no plant species diversity or benefit to wildlife. Impacts to native plant communities are much reduced when control actions are taken at an early stage of invasion.

Integrated Weed Management

We support proposed integrated weed management methods in the preferred alternative, Alternative 2, and we recognize that aerial application of herbicides facilitates effective weed management where there are large areas of weed infestation across inaccessible terrain. We do consider it important, however, to ensure that adequate measures are incorporated into aerial applications to mitigate risks of adverse health and environmental effects (e.g., avoid drift of potentially toxic herbicides to aquatic areas or other sensitive areas). The environmental protection measures included Section 2.3.7.4 appear to recognize the need to avoid drift of herbicides to non-target areas. EPA is pleased to see that consideration has been given to assuring the accuracy and safety of aerial pesticide applications. 3.1

An Integrated Weed Management program should also strive to identify the reason(s) why noxious and invasive weeds are present. We therefore suggest adding a discussion to Section 3.3.1.3.1 on the probable causes of noxious and invasive weed establishments within each Management Zone on the Forest (i.e. logging practices, grazing 3.2 cont.

3.1 Your support of integrated weed management methods contained in the Proposed Action (Alternative 2) and the use of environmental protection measures in the accurate and safe aerial application of herbicides (described in DEIS Section 2.3.7.4) is noted.

3.2 Identification of potential specific causes would be part of the integrated weed management approach, as weed inventories are updated annually. The Forest Service employs standard BMPs for different activities on the W-CNF to prevent or minimize the potential for weed introduction and spread.

practices, recreational activities, erosion, etc.). By describing why weeds have become a problem, the Forest may be better able to apply strategies to mitigate root causes. 3.2 cont.

Monitoring and Adaptive Management

The DEIS does not include a monitoring and adaptive management program to guide management actions and assess effectiveness of the Treatment Program. We recommend that a strong monitoring and adaptive management program be added in the Final EIS that includes monitoring of the density and rate of spread and effects of invasive plants on natural resources; effectiveness of herbicides and biological control agents; and the presence of herbicides in surface and ground water in high risk areas. It is important to have an adaptive management program that monitors treatment activities and effects to document effective weed treatment with minimal impacts on non-target species, and to avoid other adverse environmental or public health effects. We encourage the Forest to track weed infestations, control actions, and effectiveness of control action in a Forest-level weed database. 3.3

It is important that monitoring of water samples is included to detect the presence of herbicides from drift, leaching or runoff. This monitoring would typically be targeted at higher risk practices (e.g. aerial application), larger scale treatments, treatment adjacent to a sensitive community (e.g. aquatic or plant communities deserving extra protection), or use of particularly mobile, toxic or persistent herbicides. The Forest may also want to consider groundwater monitoring in selected wells in close proximity to larger application sites.

Aquatic monitoring is an important element of an effective weed management program utilizing herbicides to validate that herbicide application protocols and environmental protection measures are effective in preventing herbicide transport to surface and ground waters. Such monitoring should increase public confidence that chemical contamination of surface waters does not occur. Herbicide presence in water can affect aquatic ecosystem function even when present at levels below human health standards. We do recommend that additional information be provided regarding monitoring for herbicides to validate effectiveness of environmental protection measures (see enclosure). The Forest may also want to consider monitoring for herbicide concentrations in soils, and soil microbiologic assays or assessments of soil fertility. 3.4 We also recommend that information be disclosed in the FEIS showing aquatic toxicity of the proposed herbicides for the fish species present in the areas to be treated. 3.5

The health of downstream domestic, agricultural and recreational water users and of the aquatic ecosystem should dictate some level of aquatics monitoring to document and verify that aqueous transport of herbicides does not occur. Picloram and clopyralid should be prioritzed for monitoring as they are highly soluble and mobile. Such monitoring will also verify that mitigation measures were effective in avoiding herbicide drift to streams and wetlands, and may increase public confidence that chemical contamination of surface waters did not occur. 3.6

EPA Rating

Based primarily on the lack of a monitoring and adaptive management program to assure that program objectives are met while

3.3 The DEIS includes an adaptive management and monitoring discussion for selecting the appropriate weed treatment method and for assessing weed treatment implementation and weed treatment effectiveness. Much of this discussion is presented in Chapter 1 in Section 1.4, *Proposed Action*, under the headings Section 1.4.3.2, *Monitoring and Restoration*, and Section 1.4.3.3, *Treatment Selection for Potential Future Infestations– Adaptive Approach*. The Decision Tree (Figure 1-3) and the Treatment Options Table (Appendix C) in the DEIS are cited as tools to be used in the adaptive approach to weed management to avoid or minimize risk to sensitive resources. Sections 2.3.6 and 2.3.7 in Chapter 2 contain extensive lists of management practices and mitigation measures that would be implemented to avoid or minimize the potential for adverse effects. Monitoring for the presence of herbicides as suggested by the EPA is discussed in the response to comment 3.4.

3.4 Appendix E of the Final EIS (FEIS) describes the monitoring program for the presence of herbicides that the W-CNF will establish and implement as an integral part of the proposed project.

We have chosen not to monitor the effects of herbicide applications on soil quality and/or condition. We concluded that our proposed use of herbicides is very unlikely to result in a reduction soil quality/productivity as measured by the ability of the soil to support native vegetation. For soil productivity to be diminished, over the long term, herbicides would need to be persistent within the soil year after year. Herbicide use, as proposed to occur on the W-CNF, will be conducted under methodology and rationale that minimizes the use of known persistent herbicides such as picloram or imazipur. The Decision Tree and other rationale directs us to use these agents only when less toxic and persistent agents are ineffective in controlling the target weed species. Also, unlike agricultural applications, herbicide treatments on the national forest are not likely to be repeated year after year. In this case, herbicides are not likely to persist at concentrations in the soil toxicity to plants for more than the growing season they are applied in. For more persistent herbicides, these are likely to be naturally attenuated and broken down into less harmful components well before the next herbicide application occurs. Finally, all herbicides will be applied at concentrations no greater than specified in their label, which further reduces the possibility of making the soil infertile from these applications.

3.5 The risk quotient analysis presented in Section 4.2.2.2 of the DEIS is based on aquatic toxicity data for all seven herbicides proposed for use on the W-CNF. Rainbow trout is the most commonly tested salmonid in aquatic toxicity tests and is considered an appropriate surrogate for cold-water species found within the project area. Analyzing the effects of the proposed herbicides on this representative cold-water species provides a method for equally weighing and comparing potential impacts of the proposed project on aquatic resources because the species response information is available for all proposed herbicides. Toxicity test results for the proposed herbicides were not available for any of the Forest Service Sensitive or Federally listed species on the W-CNF.

3.6 Please see the response to comment 3.4 and Appendix E of the FEIS regarding monitoring aquatic resources for the presence of herbicides.

protecting environmental resources and human health, EPA has issued a rating of EC-2 (Environmental Concerns - Insufficient Information). The "EC" rating indicates that the EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative, or application of mitigation measures or actions that can reduce these impacts. The "2" indicates that EPA has identified additional information, data, analyses or discussion should be included in the Final EIS. A full description of EPA's EIS rating system is enclosed.

We appreciate the opportunity to review this project. EPA's review of the Wasatch Cache National Forest Noxious and Invasive Weed Treatment Project is being coordinated by Phil Strobel (303 312-6704) of my staff.
Please feel free to contact Phil or me at (303) 312-6004 regarding these comments.

Sincerely,

/s/

Larry Svoboda
Director, NEPA Program
Office of Ecosystems Protection
and Remediation

Enclosure

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Section 2

Other Interested Parties

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Comment Letter No. 4

Melissa Blackwell/R4/USDAFS
04/17/2006 04:54 AM

To Julie Hubbard/R4/USDAFS@FSNOTES, Michael G Duncan/R4/USDAFS@FSNOTES, Wayne Padgett/R4/USDAFS@FSNOTES
cc
bcc
Subject Fw: public comment on wasatch cache national forest noxious weed treatment deis o

Just want to make sure you have the below comments on the Weed EIS.

Melissa Blackwell
Regional Natural Resource Planner
Intermountain Region

phone: 801-625-5275
e-mail: mblackwell@fs.fed.us

----- Forwarded by Melissa Blackwell/R4/USDAFS on 04/17/2006 06:54 AM -----

Bk1492@aol.com
04/15/2006 05:51 AM

To mblackwell@fs.fed.us, faye.kreuger@fs.fed.us, melissa.blackwell@fs.fed.us
cc rodney.frelinghuysen@mail.house.gov
Subject public comment on wasatch cache national forest noxious weed treatment deis o

for march 2006

the biggest noxious weed here is the propensity of the forest service to blanket u.s. national taxpayer owned property with toxic chemical poison. dont forget the chemical companies also told us agent orange didnt harm or injure people, but it does. the toxic chemical companies have done this over and over and washington bureaucrats are approving chemicals that should never be approved because of lots of lobbying money in corrupt washington. this influences what gets sold these days, not human health. the toxic chemical mfrs lie and decive on the toxicity of their products. forest service should not be taken in and poison americans. 4.1

The grazing that is being allowed also causes invasive weeds to proliferate and grazing must be stopped. letting national taxpayer owned land be leased for $1.25 per acre per year is such a ripoff of the national taxpayer, particularly in terms of the way the land is decimated from grazing. the cattle barons are doing a number on national taxpayers, ripping them off and decimating the land they own. 4.2

Birds/wildlife/butterflies,bees, etc. are harmed/killed with this toxic chemical spraying. 4.3

I oppose biological agents. I dont need to tell forest service abouit the endless invasive insects which were brought in and caused their own gigantic problems in the us. the moth brought in became a favorite food of mice, which then proliferated and cause hantavirus - all to be laid at the doorstep of those favoring biological treatments. it is clear we need to steer away from biological treatments since they are so subject to error. 4.4

the drought in this area for the past years is why growth is at l4%. wonder why drought has been left out of the equation and calculation of why growth is slow? 4.5

USDA, principal manager of the forest service, has allowed invasive beetles to enter the u.s. usda is

4.1 Your opposition to the use of chemicals for treating noxious weeds is noted. As described on page 2-14 of the DEIS, herbicides are extensively screened and tested before they are approved and registered for use by the U.S. Environmental Protection Agency (EPA). Such registrations typically require at least 120 tests over a 7- to 10-year period and can cost approximately $30 million to $50 million. Herbicide labels carry the force of laws governed by federal and state agencies. Labels contain information about the proper administration of each herbicide, including the following: a list of the ingredients; EPA registration number; precautionary statements (hazards to humans and domestic animals, personal protective equipment, user safety recommendations, first aid, and environmental hazards); directions for use, storage, and disposal; mixing and application rates; approved uses and inherent risks of use; limitations of remedies; and general information. Pages 2-22 through 2-26 of the DEIS describe BMPs and mitigation measures that are integral parts of the proposed project that would be followed to ensure the safe and proper use of herbicides on the W-CNF.

4.2 Appendix D of the DEIS presents noxious weed management guidance taken from Forest Service Manual 2080, Appendix III. This guidance includes a series of noxious weed prevention and control measures for domestic grazing activities (see Appendix D, pages III-6 and III-7) that are considered in the management of all grazing allotments on the W-CNF. Stopping grazing on National Forest lands, as you suggest, or modifying the livestock grazing program, including revisions of grazing permits, allotment management plans, and annual operating instructions, are beyond the scope of the Proposed Action and alternatives being analyzed in this EIS.

4.3 Pages 2-27 through 2-29 of the DEIS briefly summarize the potential effects of implementing the proposed project on biological resources, including vegetation, aquatic resources, wildlife resources, and ecosystem function and biodiversity. Neighboring pages of the DEIS summarize potential project effects on other resources (for example, soil and water). A detailed analysis of the potential effects on all resources from implementing the Proposed Action and alternatives is found in Chapter 4 of the DEIS. The analysis includes an examination of wildlife resources (DEIS pages 4-29 through 4-65), including birds, and assesses the likelihood of toxic effects of herbicides on representative species of wildlife and on ecosystem function and biodiversity. The analysis recognizes that BMPs and mitigation measures would be implemented as an integral part of the proposed project in order to protect the environment and individuals from the potentially harmful effects of herbicides if inadvertently misused or misapplied.

4.4 Your opposition to the use of biological agents is noted. Pages 2-12 and 2-13 of the DEIS describe measures that are followed to prevent the type of occurrence you reference. The U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) rigorously screens and tests new biological agents for impacts on agricultural plants and on threatened, endangered, and sensitive plant species. It then prepares environmental assessments on the possible impacts of releasing those agents. Before the prospective biological controls can be released, they are placed in quarantine under "eat or starve" conditions with a variety of plant species to determine if they are host-specific to the plants they are intended to control. For the proposed project, only APHIS-approved biological controls would be used on the W-CNF and would be released according to APHIS requirements or Forest Service policy, whichever is more restrictive.

4.5 Reference to 14 percent is the approximate average annual rate of weed spread in the natural environment (natural conditions). Rate of spread can be higher or lower depending on the species, as well as on regional and site-specific conditions.

supposed to keep out invasive beetles, but instead USDA caters to nursery businesses, which have been allowed to bring in products with no surveillance, no investigation. usda has been doing a lousy job of monitoring what comes into this country and has in fact been the cause of the invasive knapweed, purple loosestrife. all of these plants proliferated from being brought into this country by the nursery business. usda works for business and has no thought to the good of this country, and that has caused problems. i suggest we take budget money from usda to fight the problems they are causing for the u.s. taxpayer. 4.6

i think this plan should specify whether the grazed areas are the prime areas where invasive weeds are spreading. if so, the grazing should be stopped and we should file a suit against the cattlee barons. 4.7

the first priority of utah dept agriculture ánd usda should be to ban all invasive weeds and their accompanying insects that are causing havoc in our country. that should be the first priority. why are you looking for endless taxpayer dollars to wipe out what is here when the usda/ag profiteers are continually bringing in more problems without investigation as to their safety? 4.8

Logging should be stopped since it brings in invasive weeds. Stop the logging. 4.9

Mechanical pulling - well usda and its agribusiness contingent continually wants more and more illegal criminal aliens to come into the u.s to flout our laws and to work for wage busting low wages - maybe some of those workers can help mechanically pulling out the weeds that usda has caused. usda's budget should be tapped to pay for this since they are the ones clamoring for low wage busting illegal criminal immigrants to come into this country. this policy hurts every single american and in fact shows flouting of american laws, but then to agribusiness and usda - profits are everything. they care not how they hurt america. 4.10

b. sachau
15 elm st
florham park nj 07932

4.6 Please see the response to Comment 4.3 regarding the USDA APHIS role in screening and testing new biological agents for potential use in biological treatments. Your concerns regarding the relationship between the USDA and nursery businesses are beyond the scope of the Proposed Action and alternatives being analyzed in this EIS.

4.7 Pages 3-12 through 3-18 of the DEIS discuss potential vectors of weed spread. Weed occurrence on the W-CNF appears primarily associated with the presence of roads, trails, campgrounds, and other human use areas. Wildlife and livestock also can contribute to the spread of weeds. However, as noted in the response to Comment 4.2, stopping grazing on National Forest lands is beyond the scope of the Proposed Action and alternatives being analyzed in this EIS.

4.8 Appendix A of the DEIS contains the Integrated Weed Management (IWM) strategy for the W-CNF that is designed to prevent the introduction and spread of noxious weeds, and to control or contain noxious weeds where they have been introduced. Appendix D of the DEIS provides regional guidance from Forest Service Manual 2080 on noxious weed prevention and management on National Forest lands.

4.9 Appendix D of the DEIS presents noxious weed management guidance taken from Forest Service Manual 2080, Appendix III. This guidance includes minimizing the creation of sites for noxious weed establishment during timber harvest on the W-CNF by considering a series of forest management activities (see Appendix D, page III-7). Stopping logging on National Forest lands as you suggest is beyond the scope of the Proposed Action and alternatives being analyzed in this EIS.

4.10 Review and analysis of immigration policies is beyond the scope of the Proposed Action and alternatives being analyzed in this EIS.

Appendix H

Public Involvement

APPENDIX H

Public Involvement

This Final Environmental Impact Statement (FEIS) incorporates the Wasatch-Cache National Forest Noxious Weed Treatment Program Draft Environmental Impact Statement (DEIS) by reference. Appendix E, *Errata* addresses changes to the DEIS that, in addition to Appendices H and I, make up this FEIS. This FEIS incorporates by reference the entire Project Record (40 CFR 1502.21). The Project Record, including the Resource Specialist Reports, comprises the detailed data, methodologies, analyses, conclusions, maps, references, and technical documentation relied upon by the Resource Specialists to develop the DEIS and FEIS.

United States
Department of
Agriculture

Forest
Service

Intermountain
Region

March 2006

Wasatch-Cache National Forest Noxious Weed Treatment Program

Draft Environmental Impact Statement

Box Elder, Cache, Davis, Duchesne, Morgan, Rich, Salt Lake, Summit, Tooele, Wasatch, and Weber Counties, Utah

Uinta County, Wyoming

WASATCH-CACHE NATIONAL FOREST
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Box Elder, Cache, Davis, Duchesne, Morgan, Rich, Salt Lake, Summit, Tooele, Wasatch, and Weber Counties, Utah
Uinta County, Wyoming

March 2006

Lead Agency:	**USDA Forest Service**
Cooperating Agencies:	**N/A**
Responsible Officials:	**Faye Kreuger, Forest Supervisor**
For Information Contact:	**Mike Duncan**

Abstract: The U.S. Forest Service, Intermountain Region, proposes to treat noxious weeds on 1.2 million acres of Wilderness and non-Wilderness areas on the Wasatch-Cache National Forest (W-CNF). The project addresses existing and future potential noxious weed infestations. This Draft Environmental Impact Statement (EIS) describes and analyzes the effects, in detail, of the following three alternatives:

Alternative 1—No Action, is a continuation of current management; **Alternative 2—Proposed Action**, provides noxious weed treatment using the most effective methods available, balanced on a site-by-site basis with reducing potential impacts to sensitive resources; and **Alternative 3—Weed Treatment Excluding Herbicide Use**, provides noxious weed treatment using methods other than herbicides including mechanical, controlled grazing, and biological agents.

Reviewers should provide the Forest Service with their comments during the review and comment period for the Draft EIS. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the Final EIS, thus avoiding undue delay in the decision-making process. Comments on the Draft EIS should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3). The opportunity to comment ends 45 days following the date of publication of the Notice of Availability (NOA) of the DEIS in the Federal Register. The publication date in the Federal Register is the exclusive means for calculating the comment period for this analysis. Those wishing to comment should not rely upon dates or timeframes provided by any other source.

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EXECUTIVE SUMMARY

Introduction

This Draft Environmental Impact Statement (DEIS) was prepared pursuant to requirements of the National Environmental Policy Act (NEPA) for the Wasatch-Cache National Forest (W-CNF) Noxious Weed Treatment Program. The affected project area consists of three distinct geographic areas (also referred to as "ecoregions"): the Overthrust Mountains (Wasatch and Bear Mountain Ranges), the Uinta Mountains, and the Bonneville Basin (Stansbury Mountains).

The U.S. Forest Service (Forest Service) proposes to treat noxious weeds on 1.2 million acres of Wilderness and non-Wilderness areas on the W-CNF. The project addresses existing and future potential noxious weed infestations. Weed treatment is one element of an Integrated Weed Management (IWM) strategy that also includes prevention, education, survey, monitoring, and cooperative partnerships. This DEIS also includes pertinent management direction from the 2003 Revised Forest Plan (RFP) developed by the Forest Service, and outlines the decisions to be made based on this environmental analysis.

Without treatment, weeds increase approximately 14 percent a year under natural conditions. Invading weeds can alter ecosystem processes, including productivity, decomposition, hydrology, nutrient cycling, and natural disturbance patterns such as frequency and intensity of wild fires. Changing these processes can lead to displacement of native plant species, eventually impacting wildlife and native plant habitat, recreational opportunities, natural hydrologic processes, and scenic beauty.

This analysis addresses noxious weeds but not all invasive species. Noxious weeds are generally designated as such by the State of Utah because they have significant negative effects or a potential for negative effects on agriculture, economics, or ecosystems.

Project Purpose

The **purpose** of this proposal is to move forward in achieving the desired conditions, goals, and objectives of the 2003 RFP. Specifically the purpose of this proposal is to:

- Eradicate noxious weed infestations that are relatively small, on a limited number of sites, and have high potential for rapid spread.
- Eradicate noxious weed infestations regardless of size and number of sites that threaten areas with high resource values.
- Contain and control noxious weed infestations that are large and/or well-established.

Project Need

The **need** for this proposal is evident by reviewing maps of known infestations of noxious weeds within the W-CNF. The number of infestations and species grows annually.

Documentation of known infestations is currently ongoing, with mapping tied to information about weed species, population size, and relative canopy cover of weeds. A Forest Service inventory (though incomplete) documents 21 noxious weed species on approximately 603 sites covering a total of about 29,544 acres (3,643 acres of actual weed cover) within the W-CNF. Additional mapping undertaken during summer 2005 indicates additional infestations were discovered.

The W-CNF has a need to implement an aggressive, effective, and interdisciplinary noxious weed program. The location of National Forest lands (including Wilderness areas) adjacent to cities, towns, and other developed areas means there is abundant seed source and vectors for noxious weed spread on the W-CNF.

Integrated Weed Management (IWM) Strategy

Our Proposed Action assumes an IWM strategy. IWM is based on ecological factors and includes consideration of site conditions, other resource values, resource uses, noxious weed characteristics, and the potential effectiveness of control measures for specific circumstances. IWM typically includes both treatment and non-treatment practices: strategies for awareness and **education**; early detection and proactive **prevention** of noxious weeds; the use of all **treatment** "tools" such as chemical, mechanical, biological, and controlled grazing management practices; treatment followed by **restoration** and revegetation (as appropriate), as well as **monitoring** of weed-impacted lands; and close coordination across jurisdictional boundaries through **cooperative partnerships**.

Factors in Weed Treatment

Seven sensitive condition factors were used to select the most appropriate treatment depending upon whether the infestation occurs within or outside of the following:

- Parleys and City Creek Sixth code Hydrologic Unit boundaries.
- A riparian area (defined as stated in the RFP).
- Proximity to public water supply source (defined as within 1,500 feet of any public water supply point of diversion).
- The vicinity of an at-risk plant species (defined as within a one-half acre radius of a mapped, at-risk plant species).
- A Wilderness or Recommended Wilderness area (as defined in Section 1.1-5, Management Prescriptions in the RFP).
- An area that is very steep and/or inaccessible (defined as >50 percent slope and >one-quarter mile from a road).
- In the vicinity of a potential or known archaeological/historic site, and requiring ground disturbance for treatment.

Every sensitive condition factor must be reviewed and considered prior to selection of a treatment method. Treatments must be tailored to mitigate for sensitive conditions of the site.

Alternatives

This DEIS analyzes, in detail, the following three alternatives:

1) No Action (continuation of current management)

2) Proposed Action (noxious weed treatment using the most effective methods available, balanced on a site-by-site basis with reducing potential impacts to sensitive resources)

3) Weed Treatment Excluding Herbicide Use (noxious weed treatment using methods other than herbicides including mechanical [hand pulling/digging], controlled grazing, and biological agents)

Alternative 1–No Action Alternative (Continuation of Current Management)

Continuation of current management would consist of very limited treatment of noxious weeds in areas identified through past project activities and treated primarily through spot treatment with herbicides or hand-pulling. Traditionally, the weed program for the W-CNF has been associated with other activities and areas easily accessed while performing other work. There has been no systematic approach Forest-wide, to either weed mapping or assignment of treatment objectives and priority setting. Priority ratings have been assigned to weed species represented in Table ES-1 for the purposes of comparison with the Action Alternatives that follow. Continuation of current management would consist of treatment levels and weed species similar to this. All herbicide applications are in accordance with label instructions. Application is conducted or supervised by state-certified employees. The No Action Alternative does not include the Objectives and Prioritization from the Forest Weed Strategy; it does, however, include the non-treatment elements of an IWM Strategy described previously.

TABLE ES-1
Alternative 1–Continue Current Management Treatment of Infested Acres

	Chemical				Mechanical			
	Ground Based		Aerial					
Priority	**Spot**	**Block**	**Spot**	**Block**	**Cutting**	**Hand Pulling/ Digging**	**Grazing**	**Biological**
Overthrust Mountains								
1A	0.03							
1B	0.13							
3A	91							
3B	3.79							
3C						1.04		
Total	**94.92**					**2.54**	**12**	
Bonneville Basin								
N/A								

TABLE ES-1
Alternative 1–Continue Current Management Treatment of Infested Acres

	Chemical				Mechanical			
	Ground Based		Aerial					
Priority	Spot	Block	Spot	Block	Cutting	Hand Pulling/ Digging	Grazing	Biological
Uinta Mountains								
1A	0.16							
3B	14.36							
3C	1.5							
Total	**16.02**							
Grand Total	**110.94**					**2.54**	**12**	

Note: 110.94 acres treated with chemical @ $300 = $33,282 + 2.54 acres treated by hand @$2,000 = $5,080 + 12 acres treated with grazing @ $500 = $6,000 for a total of $44,362.

Alternative 2—Proposed Action

The focus of this Proposed Action and environmental analysis is on treatments planned for existing, known weed infestations, and anticipated treatments for future potential invasions of weeds under various conditions. This adaptive approach is necessary because invasive plant infestation sizes and locations, as well as most appropriate treatments, can change over time. During the time it would take to complete an environmental analysis for each change, new and/or growing weed infestations could become much less practical to manage.

The proposed treatment of weed infestations is based on the objectives of eradicating small and new infestations while containing or controlling existing larger infestations. Estimated treatments were projected using current gross acres to represent future infested acres and by selecting the highest priority infestations, taking into account sensitive resource factors, and then selecting the treatment practice most effective for that weed species infestation, and that which takes into account sensitive resources. As new infestations are detected and treated, the relative proportions of the various priority classes treated would shift but the total acres to be treated with a given method is expected to be similar to those represented here. Table ES-2 summarizes the results for the Proposed Action.

TABLE ES-2
Alternative 2–Proposed Action Treatment of Infested Acres (current plus future)

Priority	Chemical				Mechanical		Grazing	Biological
	Ground Based		Aerial		Cutting	Hand Pulling/ Digging		
	Spot	Block	Spot	Block				
Overthrust Mountains								
1A	5				0.2	0.3		
1B	5							
1C						1		
3A	311	9	7			4	70	77
Total	**321**	**9**	**7**		**0.2**	**5.3**	**70**	**77**
Bonneville Basin								
2A	918	47	112					
Total	**918**	**47**	**112**					
Uinta Mountains								
1A	3	11				0.5		
2A	3	2						
Total	**6**	**13**				**0.5**		
Grand Total	**1,245**	**69**	**119**		**0.2**	**5.8**	**70**	**77**

Note: 1,433 acres chemical @$300 = $429,900 + 6 acres hand pulling @ $2,000= $12,000 + 147 acres biological and grazing @$500 = $73,500 for a total of $515,400.

Alternative 3–Weed Treatment Excluding Herbicide Use

Alternative 3 responds to concerns about potential effects of herbicides by excluding chemical treatments from the options available for treatment. Estimated treatments were projected using current gross acres to represent future infested acres and by selecting the highest priority infestations, taking into account sensitive resource factors, and then selecting the treatment practice most effective for that weed species infestation, and that which takes into account sensitive resources, but excluding herbicide use. A cost cap equal to the total costs for treatment in the Proposed Action was used as the cutoff of total acres to be treated. This allows for ease of comparison between the two Action Alternatives. Table ES-3 summarizes the results for Alternative 3.

TABLE ES-3
Alternative 3–Treatment Excluding Herbicide Use Treatment Acres*

Priority	Chemical				Mechanical		Grazing	Biological
	Ground Based		Aerial		Cutting	Hand Pulling/ Digging		
	Spot	Block	Spot	Block				
Overthrust Mountains								
1A						5	0.18	
1B						5		
1C						1		
3A						9	233	233
Total						**20**	**233.18**	**233**
Bonneville Basin								
2A							443	
Total							**443**	
Uinta Mountains								
1A						6	9	
2A						1	4	
Total						**7**	**13**	
Grand Total						**27**	**689.18**	**233**

Note: 27 acres hand pulling @ $2,000 = $54,000 + 922 acres biological and grazing @ $500 = $461,000 for a total of $515,000.

Comparison of the Alternatives

Table ES-4 summarizes and compares the potential environmental benefits and impacts of the No Action Alternative, Proposed Action, and Alternative 3 for each resource area. The Proposed Action followed by Alternative 3, would be the most effective of the alternatives evaluated in eradicating, controlling, and containing noxious weeds within the W-CNF and in benefiting a broad range of Forest resources. The No Action Alternative (Continuation of Current Management) would be the least effective of the alternatives evaluated in treating weeds and in benefiting most W-CNF resources because of the comparatively few acres of weeds that would be treated each year.

TABLE ES-4

Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Biological Resources			
Vegetation Resources and Noxious Weeds Indicator: ▪ Relative amount of weed treatment areas that will be in occupied W-CNF plant species at-risk habitat	Up to 126 acres treated annually, with up to 111 of these acres treated with herbicides. Greatest impacts to at-risk plant species are likely to result from indirect impacts caused by the continued spread of weeds.	Would cover more acreage and could potentially be more detrimental to at-risk plant species occurring in weed-infested areas. Indirect impacts are expected to be less than those under any other alternative because the curtailment of weed spread and control of current weed populations would be highest under this alternative.	No potential for adverse direct effects on native vegetation, at-risk plant species, and wildlife habitat integrity. Large acreages on the W-CNF would be difficult to treat except with biological controls
Aquatic Resources Indicators: ▪ Estimated concentration of herbicides in receiving waters ▪ Ability to meet state water quality standards for cold water fisheries	No data or reported instances indicate that any of the weed treatment activities on the W-CNF have or have not impacted aquatic resources and, therefore, they would not be expected to do so under the No Action Alternative. However, even the very limited spot treatment of weeds using herbicides in Forest management as proposed under the No Action Alternative could inadvertently result in the chemical contamination of aquatic habitat through an accidental spill of an herbicide. Unlikely that state water quality standards related to cold water fisheries would be exceeded under the No Action Alternative because 1) only up to 111 acres of the W-CNF would be chemically spot-treated annually; 2) most of the treated areas are associated with roadways and timber sales, and treatments generally occur on uplands; 3) herbicide spot applications would be according to label instructions and conducted or supervised by state-certified employees using hand application methods; and 4) continued use of currently applied Forest-wide Standards and Guidelines would minimize the risk of chemical contamination.	Each of the treatment methods can vary by weed species in effectiveness. The potential for adverse direct and indirect effects resulting from the proposed use of aerial and ground application treatments on the W-CNF is minimized by the numerous BMPs and mitigation measures that would be applied. Expanded use of chemicals would be accompanied by an increased potential risk to exceed water quality standards for coldwater fisheries under worst-case situations. The implementation of BMPs and mitigation measures would minimize the potential for chemical contamination from both ground-based and aerial herbicide applications.	No risk of herbicides affecting aquatic resources. No risk of herbicides affecting existing water quality standards for cold water fisheries or aquatic resources

TABLE ES-4

Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Wildlife Resources Indicators: ▪ Percent of total and distribution of TES species' habitats lost to or modified by treatment ▪ Percent of total and distribution of neotropical migratory bird habitats lost to or modified by treatment ▪ Percent of total and distribution of MIS habitats lost to or modified by treatment ▪ Percent of total and distribution of big game winter ranges lost to or modified by treatment	All of the direct and indirect effects of weed infestation on wildlife habitat are especially problematic for TES species because these species generally occur at low densities and they have already suffered habitat loss, degradation, and fragmentation from a variety of other sources. Reduction of forage on big game winter range because of weed expansion would severely reduce the carrying capacity of the winter range. This would result in big game mortality, particularly during severe winters, when forage is not available in sufficient quantity to support winter herds. It would also place more stress on big game winter ranges that are not weed infested.	All of the TES/MIS species would benefit from the aggressive weed treatment and restoration of habitat (where appropriate) following treatment because of a reduction in the rate of loss of native plant community productivity from weed expansion. Analysis of herbicide toxicity also applies to TES/MIS species and indicates no adverse effects would result from herbicide application other than possibly brief displacement during application. At the Proposed Action's rate of treatment, the W-CNF would substantially slow and eventually reverse the rates of weed spread and degradation of big game winter range compared to the No Action Alternative. Potential effects on big game resulting from herbicide dermal exposure or ingestion were determined to be insignificant.	Because the actual acres of weed infestations occur over a much larger area, both target and non-target plants would certainly be grazed, degrading TES/MIS habitat values. Weed infestations are likely to continue to spread at a fairly rapid rate, degrading TES/MIS habitat values and further reducing populations of these species. The lack of substantial weed control and weed infestations are likely to continue to spread at a fairly rapid rate, further degrading big game winter range. This would result in increased big game mortality, particularly during severe winters, when forage is not available in sufficient quantity to support winter herds. It would also place more stress on big game winter ranges that are not weed infested. No potential effects on big game from herbicide dermal exposure or from ingestion would occur under this alternative.

TABLE ES-4

Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Ecosystem Function and Biodiversity Indicators: ▪ Amount of at-risk plant species habitats infested by noxious weeds ▪ Amount of big game winter range lost to or modified by noxious weeds ▪ Amount of native vegetation by cover type infested by noxious weeds ▪ Amount of habitat (and percent of total available) by wildlife/cover type groupings lost to or modified by noxious weeds ▪ Amount of habitat within 300 feet on each side of streams containing noxious weed infestations	Ecosystem function would experience little to no impact from treatment of noxious weeds, but ecosystem function would be adversely affected by weed population expansion. As weed populations expand under the No Action Alternative, the hydrologic cycle would be disrupted. Weed expansion also has a detrimental effect on the food chain, which could impact the food web throughout the W-CNF. Food web stability, structure, and complexity can decline. Biodiversity and plant species richness for native vegetation and plant communities, wildlife habitat values, and sensitive species populations are likely to be severely compromised by the unchecked invasion of weeds. Likewise, these same vegetation resources can be compromised by unconstrained weed treatment efforts as well. Noxious weeds would continue to displace native vegetation at the same or higher rates than currently exist. This would mean continued declines in plant diversity and species richness across native plant communities. Declines in natural vegetative communities would result in declines in the quality of wildlife habitats as well.	Weeds would be aggressively eradicated, controlled, or contained using a variety of methods, and, where appropriate, treatment sites would be restored to native vegetation following treatment. Loss of native plant communities to weed infestations would decrease over time as weed populations are reduced and/or eliminated. As weed populations decline, the hydrologic cycle (where currently altered) would return to operating within normal parameters for the W-CNF. Food web support would be higher under the Proposed Action than with other alternatives because weed management is the most aggressive. it is unlikely that the combination of mechanical, biological, controlled grazing, and chemical treatments on 1,586 acres of weeds—where appropriate— would adversely affect native vegetation on the W-CNF to a great degree, although there is potentially more risk from direct effects of treatment under this alternative than Alternatives 1 or 3 simply because of the additional acres that would be treated and the number of acres treated by herbicide.	Direct and indirect effects on ecosystem function would be similar to those described for the Proposed Action, but would occur at a much slower pace because of no herbicide application. Indirect impacts on native plant diversity are likely to be greater under this alternative than the Proposed Action because weed expansion is more likely to occur without the use of herbicides and thereby impact diversity.
Physical Resources			
Soil and Geology Indicator: ▪ None were identified during scoping	The No Action Alternative could cause adverse effects on soil through increased erosion from weed-infested sites and, possibly, from erosion of disturbed and/or barren weed treatment areas.	The Proposed Action would benefit soil resources because of increased levels of weed control and eradication, slower weed population spread, and less total weed-infested acreage compared to existing conditions. This would result in improved soil protection in treated areas and reduced erosion both on and off the W-CNF.	A slightly increased use of mechanical weed treatments and associated soil disturbance under Alternative 3 would cause more negative impacts than the Proposed Action.

TABLE ES-4

Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Surface Water and Groundwater Quality Indicator: ▪ Estimated concentration of herbicides in receiving waters (surface water and groundwater)	The estimated concentration of herbicides in receiving waters, the ability to meet state water quality standards, and the potential effects on human health would not be expected to change from current conditions. However, even the very limited spot treatment of weeds using herbicides in Forest management as proposed under the No Action Alternative could inadvertently result in the chemical contamination of aquatic habitat through an accidental spill of an herbicide.	Weed treatment practices that would be used under the Proposed Action include the ground-based and aerial application of herbicides, mechanical weed treatment, biological controls, controlled livestock grazing, and combinations of these treatments. The likelihood of increased erosion, surface runoff, and sediment delivery to drainages—possibly resulting in water quality degradation—would decline as weed-infested areas are treated and reclaimed. The direct and indirect effects of chemical treatments under the Proposed Action would be expected to result in long-term improved streambank, riparian habitat conditions, and water quality. However, short-term disturbances may occur from vegetation removal and may have a slight negative effect on either water quality or aquatic resources in specific areas.	There would be no risk of herbicides contaminating the surface or groundwater resources of the W-CNF with this alternative. Approximately 949 acres of weeds would be treated annually under this alternative, compared to 1,586 acres under the Proposed Action. Because fewer treatment methods are available for treating weeds under Alternative 3, fewer acres would be treated annually, and it would take longer to achieve lesser levels of weed treatment success. It would take longer to realize some benefits to aquatic and riparian resources resulting from reduced erosion and sediment delivery at weed-infested sites to drainages. Because Alternative 3 does not include the use of herbicides, there would be no potential for the occurrence of any of the worst-case situations involving herbicide application.
Air Quality Indicator: ▪ None were identified during scoping	One effect would be potential drift from herbicide spraying onto non-target areas. Spot spraying would result in little drift because applications are made close to the ground's surface. A chemical odor may persist at spray sites for several hours following ground-based application. Other direct effects on air quality would include dust from spray vehicles and mechanical weed control efforts. Indirect effects on air quality from successful weed treatment would include localized reductions in airborne pollen from weeds and allergens at certain times of the year. It is anticipated that pollen levels across the W-CNF would gradually increase with the steady spread of weeds under this alternative.	A potential short-term direct effect on air quality is herbicide drift to non-target areas during aerial spraying. Chemical odor may persist at spray sites for several hours following ground-based or aerial application. Other direct effects would include increased dust and pollen from vehicles or mechanical treatments. Short-term mechanical treatments may lead to a small increase in smoke or haze in the immediate vicinity of the treatment area. None of the herbicides currently registered for wildland weed control are known to produce airborne by-products from burning treated vegetation in amounts that affect air quality. Because the Proposed Action would provide the greatest level of weed control compared to the other alternatives, it would result in the greatest reduction in airborne weed pollen and allergens in the affected area in the long term.	Short-term effects on air quality from herbicide application would not occur under this alternative because no chemicals would be used. The slightly more extensive use of mechanical treatments may result in localized increases in dust levels and temporary, but repeated, instances of air quality degradation. Temporarily increased dust levels from mechanical treatments, at least in localized areas, may extend over a long period of time. Beneficial effects of reduced weed pollen and allergens on any particular site would occur if weeds are reduced on that site. Individually, these effects may be too small to substantially benefit local air quality.

TABLE ES-4

Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Fire/Fuels Management Indicators: ▪ Acres of noxious weed treatments resulting in a change in fuel loading ▪ Acres not available for wildland fire use and prescribed fire because of weed infestations	The area of noxious weed establishment and spread is expected to increase steadily over time under the No Action Alternative. As the infested acres steadily increase, the area available for prescribed or wildland fire use would steadily decrease.	Each year under the Proposed Action, up to 1,433 acres of weeds would be treated with herbicides; up to 6 acres by hand; up to 70 acres by controlled livestock grazing; and up to 77 acres using biological controls. Reduction in fuel loading on these 1,586 acres of weeds would help to reduce the potential for rapid fire spread on these lands. The emphasis on chemicals also would help prevent re-growth of weeds in treated areas, ensuring that the fuel load reduction is sustained.	This alternative would treat up to 949 acres of weeds annually, or about 823 acres more than the No Action Alternative and 637 acres less than the Proposed Action. Fine fuels in areas not having successful or delayed weed control would increase, followed by an increase in the danger of fire ignition and rapid fire spread.
Economic and Social Resources			
Economics Indicator: ▪ Cost of a particular combination of treatments in an alternative relative to the benefit that would be derived from the alternative	If all susceptible acres became infested with noxious weeds, as may eventually occur under this alternative, a conservative estimate of the impact to the local economy would be at least the $3.95 per infested acre times the highly susceptible acres, or 404,300 acres. This loss to the local economies—both urban and rural—may total more than $1,597,000 annually, a conservative estimate (given the use of 1996 values).	A conservative estimate of the impact to the local economy would be the savings of currently infested, highly susceptible, wildland acreage (less than 2,800 acres), which amounts to approximately $11,000 (that is, $3.95 x 2,800 acres). In addition, the highly susceptible acres (404,300) that could potentially be treated to control or prevent future infestations amounts to a savings of more than $515,400 annually.	Second most aggressive approach to treating current and future infestations of noxious weeds within the W-CNF by treating the second highest number of acres (949) annually, but by limiting the treatment flexibility to non-chemical treatment methods. A conservative estimate of the impact to the local economy would be the savings of currently infested, highly susceptible, wildland acreage (less than 2,800 acres), which amounts to approximately $11,000. In addition, the highly susceptible acres (404,300 acres) that could potentially be treated to prevent future infestations would amount to less savings than the Proposed Action.

TABLE ES-4

Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Recreation and Visual Resources Indicators: ▪ Loss of recreation opportunity or a visual impact because of recreation area closure or warnings for treatment according to chemical label directions from treatment activities ▪ Loss of recreation opportunity or a visual impact because of weed infestations that create physical barriers (such as yellow starthistle, musk thistle, scotch thistle, and puncture vine on trails)	Weed treatments can adversely impact recreation opportunities during summer when treatment would occur. Visitors may have their access to certain areas temporarily limited, and their ability to participate in and enjoy their desired recreation activity may be restricted. This may occur to a limited extent as a result of chemical, ground-based spot treatments on up to 111 acres per year Noxious weeds are expected to continue to grow and spread at a rate faster than they are removed, reducing or possibly eliminating access to those areas by creating physical barriers; noxious weeds also would affect recreationists' abilities to participate in and enjoy recreation activities on the W-CNF. This is considered an adverse effect on those recreationists and recreation opportunities.	The range of weed treatment options available and treatment of up to 1,586 acres of weeds each year is expected to be adequate for successfully managing existing and potential future weed introductions to W-CNF recreation areas. By improving access to areas used for recreation that are currently blocked by noxious weeds, recreationists' abilities to participate in and enjoy recreation activities on the W-CNF would improve. Potential impacts on scenic resources during weed management activities would be short-term in any given location and would include dust from some weed treatment activities (for example, some mechanical treatments) and the presence and activities of personnel, vehicles, and equipment.	Fewer types of weed treatments (no herbicide application), would only treat up to 949 acres of weeds per year (approximately 0.08 percent of the W-CNF), and would require a greater use of controlled livestock grazing, biological treatments, and mechanical treatment. Treatment-related effects on recreation and visual resources would generally be the same as for the Proposed Action, but at a lesser degree with fewer acres being treated and no aerial or ground-based spray equipment being used.
Wilderness Resources Indicators: ▪ Areas infested within designated and recommended Wilderness areas (RFP Management Prescriptions 1.1, 1.2, 1.3, and 1.5) ▪ Location, timing, and duration of treatment activity within Wilderness areas	No more than 126 acres (on 300,000 acres of Wilderness Areas) of weed infestations on the W-CNF would be treated annually, consisting primarily of chemical spot treatments (up to 111 acres), controlled livestock grazing (12 acres), and hand pulling or digging weeds (3 acres).	The range of weed treatment options available and treatment of up to 1,586 acres (on 300,000 acres of Wilderness Areas) of weeds each year is expected to be adequate for successfully managing existing and potential future weed introductions to W-CNF Wilderness areas.	A combination of primarily controlled livestock grazing and biological treatments, and a lesser amount of mechanical treatment, would be applied on up to 949 acres annually (on 300,000 acres of Wilderness areas) of weed infestations on the W-CNF.
Roads and Roadless Areas Indicators: ▪ No significant issues or specific issues of concern were identified during scoping	No more than 126 acres of weed infestations would be treated. This treatment level would likely be far less than is needed to successfully manage existing and potential future weed infestations along the more than 1,000 miles of roads present on W-CNF management areas.	Range of weed treatment options available and treatment of up to 1,586 acres of weeds each year is expected to be adequate for eradicating, controlling, and/or containing existing and potential future weed introductions along W-CNF roads. This also would contribute to the successful management of existing weed infestations and prevention of new weed infestations in roadless areas.	A combination of primarily controlled livestock grazing and biological treatments, and a lesser amount of mechanical treatment, would be applied on up to 949 acres annually of weed infestations on the W-CNF.

TABLE ES-4

Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Human Health and Safety Indicators: ▪ Pounds of active ingredient applied by workers ▪ Acres treated and pounds of active ingredient applied and the intensity of use by visitors on those areas	Acute worker or visitor exposures through inhalation, incidental ingestion, and dermal contact are possible, though potential for effects is low. It would be reasonable to expect that cumulative human health risk from herbicide applications and immediately adjacent areas would be very low to nonexistent.	Direct and indirect effects as indicated under the No Action Alternative heading also apply to this alternative, but would have a greater probability of occurring given the larger area to which herbicides would be applied.	No exposure pathways where workers or visitors could be exposed to herbicides.
Cultural Resources/ Indian Trust Assets/ Treaty Rights Indicators: ▪ Amount of known cultural resource sites infested and/or treated.	Slight potential to impact cultural resources because of localized ground disturbing activities from very limited hand pulling and chemical treatment of weeds, resulting in potential adverse effects if the roots of weeds are attached to archaeological deposits. It is anticipated that these activities would result in no adverse effects on cultural resources because site-specific reviews by the Cultural Resources Specialist would occur before weed treatment activities commence.	Compliance with ARPA would be met through the identification of areas of concern for historic preservation and Native American issues and consultation with the Idaho SHPO and Tribes.	Would employ the same or similar actions as the Proposed Action, using identification and consultation to avoid adverse impacts.
Environmental Justice Indicators: ▪ No significant issues or indicators associated with environmental justice were identified during public scoping	Not applicable.	Not applicable.	Not applicable.

Potential risks to some W-CNF resources were identified for those alternatives that would use herbicides to treat weeds. These include aerial and ground-based herbicide applications under the Proposed Action and ground-based herbicide applications under the No Action Alternative. Such risks would be limited under the No Action Alternative because no more than 111 acres would be spot-treated chemically each year and non-existent under Alternative 3. In all instances involving herbicide and other potential risks, Best Management Practices (BMPs) and mitigation measures would be implemented to avoid or minimize the potential for adverse effects to occur. In addition, the Proposed Action and Alternative 3 include the use of a site-specific implementation process and a decision tree, a minimum tool approach, and an adaptive strategy. These management tools are designed to consider site-specific resource conditions that result in the selection of a treatment option that achieves weed management goals with the least impact on W-CNF resources. The protection of worker health and safety and public health and safety in selecting and implementing a site-specific treatment option would receive the very highest priority.

Selection of the Preferred Alternative

The Forest Service has not selected a preferred alternative.

Public Involvement, Consultation, and Coordination

The Notice of Intent (NOI) to prepare an EIS was published in the Federal Register on November 3, 2004 (Vol. 69, No. 212). The NOI asked for public comment on the proposal by November 23, 2004.

Significant Issues

Using the comments from the public, other agencies, and Tribal Nations, the Forest Service Interdisciplinary Team (IDT) developed a list of significant issues (Table ES-5). Significant issues were defined as those directly or indirectly caused by implementing the Proposed Action. Significant issues are issues used to formulate alternatives to the Proposed Action, prescribe mitigation measures, or analyze environmental effects. The significant issues are summarized as follows:

- **Issue 1:** Effects of weed treatment on plant species at risk.
- **Issue 2:** Effects of weed treatment on aquatic and semi-aquatic species.
- **Issue 3:** Effects of weed treatment on terrestrial wildlife species.
- **Issue 4:** Loss of diversity of native vegetation and loss of wildlife habitat from noxious weed infestations.
- **Issue 5:** Effects of weed treatment on water protected for domestic purposes.

- **Issue 6:** Effects of noxious weed infestations and treatment on fire/fuels management.
- **Issue 7:** Effects of weed treatment on human health.

TABLE ES-5
Issues Identified as Significant During Scoping*

Issue/Environmental Component	Indicators	Effects
Issue 1—Vegetation. Effects of weed treatment on plant species at risk.	Relative amount of weed treatment areas that will be in occupied W-CNF plant species at-risk habitat.	Direct and indirect effects of weed treatment on plant species at-risk habitat.
Issue 2—Aquatic & Semi-Aquatic Species. Effects of weed treatment on aquatic and semi-aquatic species (fish and amphibians) including threatened, endangered, and sensitive species.	Estimated concentration of herbicides in receiving waters. Ability to meet state water quality standards for cold water fisheries.	Risk of chemical contamination, accidental spills, wind drift, and effects on fish, amphibians, and macroinvertebrates based on a risk analysis. Ability to meet state water quality standards for cold water fisheries.
Issue 3—Wildlife Resources. Effects of weed treatment on terrestrial wildlife species including threatened, endangered, sensitive, big game, neotropical migratory bird, and management indicator species.	Percent of total and distribution of threatened, endangered, and sensitive species habitats lost to or modified by treatment. Percent of total and distribution of neotropical migratory bird habitats lost to or modified by treatment. Percent of total and distribution of management indicator species habitats lost to or modified by treatment. Percent of total and distribution of big game winter ranges lost to or modified by treatment.	Direct and indirect effects of weed treatment on selected wildlife habitats and the relative amounts and distribution of unaffected habitats available.
Issue 4—Biodiversity. Loss of diversity of native vegetation and loss of wildlife habitat from noxious weed infestations.	Amount of at-risk plant species habitats infested by noxious weeds. Amount of big game winter range lost to or modified by noxious weeds. Amount of native vegetation by cover type infested by noxious weeds. Amount of habitat (and percent of total available) by wildlife/cover type groupings lost to or modified by noxious weeds. Amount of habitat within 300 feet on each side of streams containing noxious weed infestations.	Effects of noxious weed infestations on native plant diversity including plant species at risk. Effects of noxious weed infestations on wildlife habitats.
Issue 5—Water Quality. Effects of weed treatment on water protected for domestic purposes.	Estimated concentration of herbicides in receiving waters.	Potential for chemical contamination of surface waters and its effects on human health. Ability to meet state water quality standards for water protected for domestic purposes.

TABLE ES-5
Issues Identified as Significant During Scoping*

Issue/Environmental Component	Indicators	Effects
Issue 6—Fire/Fuels Management. Effects of noxious weed infestations and treatment on fire/fuels management.	Acres of noxious weed treatments resulting in a change in fuel loading. Acres not available for wildland fire use and prescribed fire because of weed infestations.	Effects of weed treatment on fuel loading, and potential fire behavior (particularly in the Wildland/Urban interface). Effects of weed infestations on vegetation/fuels management options.
Issue 7—Human Health. Effects of weed treatment on human health.	Pounds of active ingredient applied by workers. Acres treated and pounds of active ingredient applied and the intensity of use by visitors on those areas.	Potential for health effects to workers during ground and aerial applications of herbicides. Potential for health effects to visitors to the National Forest from herbicide residuals following application.

*Identified by the Forest Service.

In addition to the issues identified as significant (and shown in Table ES-4), concerns about effects on other resources were identified during public scoping, but did not rise to the level of a significant issue (Table ES-6).

TABLE ES-6
Resource Issues of Concern, but Not Significant

Environmental Component	Indicators	Effects
Recreation—Effects of weed infestations and treatment on recreation activities.	Loss of recreation opportunity or a visual impact because of recreation area closure or warnings for treatment according to chemical label directions. Loss of recreation opportunity or a visual impact because of weed infestations that create physical barriers (such as yellow starthistle, musk thistle, scotch thistle, and puncture vine on trails).	Effects on scenic values from weed treatment and the ability to maintain a naturally appearing setting. Effects of treatment and infestations on recreation activities (access to areas, ability to participate and enjoy activity).
Wilderness—Effects of weed infestations and treatment on wilderness resources.	Acres infested within designated and recommended Wilderness (RFP Management Prescriptions 1.1-1.3, 1.5). Location, timing, and duration of treatment activity within wilderness.	Effects on wilderness values (solitude, remoteness, primitive recreation opportunities, natural appearance).
Cultural Resources—Effects of weed infestations and treatment on cultural resources.	Acres of known cultural resources sites infested and/or treated.	Risk of effects to cultural resource sites.

Soil resources did not represent a significant issue nor were they a resource of concern. The rationale for this is because it was determined that soil productivity would be protected and enhanced through implementation of site restoration after treatment. Potential changes in soil productivity under the various alternatives were considered too speculative to be addressed in this analysis. The IDT determined that no significant impacts would result from implementation of treatment alternatives and therefore the issue is not considered significant.

Decisions to be Made

The W-CNF Forest Supervisor will decide whether or not to treat noxious weeds within the W-CNF, and if so, then where, how, and by applying which BMPs and mitigation measures for both existing and potential future noxious weed infestations in the Forest. In addition, the Forest Supervisor will decide whether or not to use non-herbicide treatments on noxious weeds inside designated Wilderness areas.

CHAPTER 1. PURPOSE AND NEED

1.1 Introduction

The U.S. Forest Service (Forest Service) proposes to treat noxious weeds on 1.2 million acres of Wilderness and non-Wilderness areas on the Wasatch-Cache National Forest (W-CNF). The project addresses existing and future potential noxious weed infestations (see Figure 1-1). Weed treatment is one element of an Integrated Weed Management (IWM) strategy that also includes prevention, education, survey, monitoring, and cooperative partnerships. These other elements do not require environmental analysis but are integral to an effective program and will be discussed in context in this Draft Environmental Impact Statement (DEIS).

Results of uncontrolled weed spread are well documented in literature (Sheley et al. 1999a, Rice 2001, Tu et al. 2001). Without treatment, weeds increase approximately 14 percent a year under natural conditions (Forest Service 1991, Forest Service 1996a). The spread of weeds can be primarily attributed to human activities associated with vehicles and roads (Roche and Roche 1991), trails, contaminated livestock feed, contaminated seed, and ineffective revegetation practices on disturbed lands). Wind, water, birds, wildlife, and livestock also contribute to weed spread. According to a scientific assessment of the Interior Columbia River Basin, invading weeds can alter ecosystem processes, including productivity, decomposition, hydrology, nutrient cycling, and natural disturbance patterns such as frequency and intensity of wild fires (Quigley and Arbelbide 1997). Changing these processes can lead to displacement of native plant species, eventually impacting wildlife and native plant habitat, recreational opportunities, natural hydrologic processes, and scenic beauty.

This analysis addresses noxious weeds but not all invasive species. Noxious weeds are defined as plants listed as noxious by the federal government in the U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS), by the state, or by the county. Noxious weeds are generally designated as such because they have significant negative effects or a potential for negative effects on agriculture, economics, or ecosystems. As described in Executive Order 13112, invasive species—the broader and more inclusive term—”…includes any organism (plant, animal, or microbe) that spreads or has the potential to spread beyond its native range, resulting in negative environmental or economic effects on the invaded area or human health.”

Chapter 1 of this DEIS explains the **purpose** and **need** to treat noxious weeds, describes the problems caused by noxious weeds, and summarizes the Proposed Action (Alternative 2). It also includes pertinent management direction from the 2003 Revised Forest Plan (RFP) (Forest Service 2003a) and outlines the decisions to be made based on this environmental analysis.

1.2 Purpose and Need for Action

The **purpose** of this proposal is to move forward in achieving the desired conditions, goals, and objectives of the 2003 RFP. Specifically the purpose of this proposal is to:

- Eradicate noxious weed infestations that are relatively small, on a limited number of sites, and have high potential for rapid spread.
- Eradicate noxious weed infestations regardless of size and number of sites that threaten areas with high resource values.
- Contain and control noxious weed infestations that are large and/or well-established.

The **need** for this proposal is evident by reviewing maps of known infestations of noxious weeds within the W-CNF (Figure 1-2). The number of infestations and species grows annually. Documentation of known infestations is currently ongoing, with mapping tied to information about weed species, population size, and relative canopy cover of weeds. Although we know our inventory is incomplete, it does document 21 species (Table 1-1) on approximately 603 sites covering a total of about 29,544 acres (3,643 acres of actual weed cover) within the W-CNF (Figure 1-2). Additional mapping undertaken during summer 2005 indicates additional infestations were discovered.

The W-CNF has a need to implement an aggressive, effective, and interdisciplinary noxious weed program. The location of National Forest lands (including Wilderness areas) adjacent to cities, towns, and other developed areas means there is abundant seed source and vectors for noxious weed spread on the W-CNF. Several species, such as Dyer's woad (*Isatis tinctora*), musk thistle (*Carduus nutans*), leafy spurge (*Euphorbia esula*), and knapweeds (*Centaurea spp*.) are aggressive and are now established on the Forest.

1.3 Proposed Action Context and Development

This section summarizes the W-CNF IWM strategy. The status of known W-CNF weed infestations is presented. These form the context for the Proposed Action. Next, a rating system to prioritize and set treatment objectives for infestations is described. An explanation of the approach used to select weed treatments for the Action Alternatives—which are described in Chapter 2—follows.

1.3.1 Integrated Weed Management

Our Proposed Action assumes an IWM strategy. IWM is based on ecological factors and includes consideration of site conditions, other resource values, resource uses, noxious weed characteristics, and the potential effectiveness of control measures for specific circumstances. IWM typically includes both treatment and non-treatment practices: strategies for awareness and **education**; early detection and proactive

Click here to view Figure 1-1 (0.5 MB)

Click here to view Figure 1-2 (0.9 MB)

prevention of noxious weeds; the use of all **treatment** “tools” such as chemical, mechanical, biological, and controlled grazing management practices; treatment followed by **restoration** and revegetation (as appropriate), as well as **monitoring** of weed-impacted lands; and close coordination across jurisdictional boundaries through **cooperative partnerships**.

During 2004, the W-CNF Forest Leadership Team established an interdisciplinary Forest Weed Board with representatives from each Ranger District. This Board developed the W-CNF IWM Strategy, which contains pertinent Revised Forest Plan direction; weed management goals, objectives, and prioritization for weed management; and recommended actions to move forward with IWM on the Forest. The W-CNF IWM Strategy forms the basis for the noxious weed management program and is included as Appendix A of this DEIS.

The non-treatment elements (education, prevention) of this IWM Strategy must be understood as complementary to our Proposed Action of treatment elements. Some of these non-treatment elements—such as education programs—do not require environmental analysis under NEPA and therefore are not analyzed except as context in this DEIS. Others, such as prevention through changes in management of travel access or livestock grazing are more appropriately addressed through other planning efforts such as travel management plans or allotment management plans and are, therefore, not analyzed in this DEIS.

1.4 Proposed Action

The focus of this Proposed Action and environmental analysis is on treatments planned for existing, known weed infestations, and anticipated treatments for future potential invasions of weeds under various conditions. This adaptive approach is necessary because invasive plant infestation sizes and locations, as well as most appropriate treatments, can change over time. During the time it would take to complete an environmental analysis for each change, new and/or growing weed infestations could become much less practical to manage.

1.4.1 W-CNF Known Weed Infestation Status

Mapped weed infestations provide the primary focus for this Proposed Action with acknowledgement that mapping is an ongoing process and weed infestations are not static. Recorded information[1] about weed infestations is summarized in Table 1-1 and on the attached map (Figure 1-2). Note that two measures of noxious weed infestations—”gross” and “infested” acres—are used. This is because weeds generally do not cover 100 percent of a given area. Their density among other plant species depends on both their particular growth form (rhizomatous or not) and site conditions. They may be very thick and dominant across a site, scattered individually across a broad area, or they may be found in clumps. The gross acres are those included if a line

[1] Note that significant work has been completed on retrieving and consolidating existing weed location data since the time of the October 2004 Scoping Document. Thus, the numbers are different than those presented at that time.

is drawn around the entire area inhabited by weeds, while the infested acres are those estimated to actually have a canopy cover of weeds within the broader area.

TABLE 1-1
Recorded Weed Infestations on the W-CNF

Ecological Section	No. of Weed Species	No. of Sites	Gross Acres	Infested Acres	Size Range Gross Acres
Bonneville Basin	1	10	1,077	49	0.1 - 482
Uinta Mountains	6	105	369	23	0.1 - 60
Overthrust Mountains	21	488	28,098	3,571	0.1 - 10,000
Forest Total	**21***	**603**	**29,544**	**3,643**	**0.1-10,000**

Species in the Bonneville Basin and in the Uinta Mountains are also recorded in the Overthrust Mountains.

1.4.2 Priorities and Objectives for Treatment

Forest Service Manual 2080 (FSM 2080) for noxious weed management prioritizes prevention and control measures such that the first priority is **prevention** of new invaders, the second priority is **early detection and treatment of new infestations**, and the third priority is to **contain and control** established infestations. The IWM Strategy builds on this and provides further guidance based on both the number and size of known infestations and the aggressiveness (invasiveness) of the particular species. In order to assign weed management objectives and priorities for treatment to infestations on the W-CNF, we developed a two-tiered rating system that incorporates infestation sizes/numbers (Tier 1) and potential invasiveness on W-CNF areas (Tier 2).

The W-CNF occurs in three distinct ecoregions: the Bonneville Basin, the Overthrust Mountains, and the Uinta Mountains. Within each ecoregion, weeds become established at different rates in different areas. For example, Dyer's woad is just becoming established in the Uinta Mountains and could likely be eradicated if treatment is made a high priority. In the Overthrust Mountains, Dyer's woad is already extensive and well-established, making control and containment the logical objective. Its treatment is a lower priority than infestations of other species that are still small and limited. Because of this, infestations are being evaluated separately for each of the three ecoregions.

1.4.2.1 Priority Setting

1.4.2.1.1 Tier 1—Number/Extent of Infestations (by Ecological Section)

Noxious weeds were first grouped based on the number and size of mapped infestations in each ecoregion. As described previously, a weed species may have numerous infestations in one ecoregion while it may still be possible to prevent or eradicate the same weed species in another ecoregion.

Group 0: potential invaders; no known infestations.

Group 1: <10 known infestation sites. These are species for whom eradication is most likely, and whose elimination is likely to be most cost-effective in the long term.

The objective for treatment is to eradicate these presumably new populations, including all viable seeds and vegetative reproduction segments.

Group 2: 10–20 known infestation sites. These are the next priority because it is still economically feasible to expect eradication of these infestations. Treating these infestations is likely to be most effective in halting the spread of noxious weeds into weed-free areas.

Group 3: >20 known infestation sites or relatively large established populations. The treatment objective is to hold existing populations to their current size and reduce, over time, existing populations through a containment and control strategy. Containment is defined to collectively include preventing weeds from expanding beyond the perimeter of the infestation; perhaps providing only limited treatment within the infestation; and treating to eradicate or control the weed outside the perimeter of the infestation. Control is defined to collectively include preventing seed production throughout the target area; decreasing the area coverage of the weed over time; and preventing the weed from dominating an area's vegetation, but accepting low levels of the weed in the original area if elimination is not feasible. Determination that a noxious weed species is in Group 3 should be coordinated with weed management partners.

In a few cases, an eradicate objective (rather than contain/control) was applied to weed infestations in Group 3. These infestations are located in areas with high resource values such as Wilderness, Recommended Wilderness, or the Salt Lake City watersheds.

1.4.2.1.2 Tier 2—Invasiveness

The second tier of weed categorization considers the biological threat of the weed in question for this particular forest and considers how aggressive and invasive the weed is likely to be in existing native plant communities. Invasiveness category was assigned based on local professional knowledge. A letter designation for invasiveness category was assigned to the individual weed species:

A: highly invasive
B: moderately invasive
C: invasive

Thus, each weed in each ecoregion is given a number-letter combination—for example, 2A—to describe its abundance and potential aggressiveness for that ecoregion. This rating is then used to establish the treatment objective and priority as follows.

1.4.2.2 Weed Management Objectives

1.4.2.2.1 Non-Treatment Objective Prevention

Weeds rated as 0A, 0B, and 0C—in that order—are the highest priority for prevention. These are the potential invaders or species that are currently not present on the Forest, but are known to occur nearby, or are listed in neighboring states or counties.

1.4.2.2.2 Treatment Objectives

Eradication

Weeds rated 1A and 2A are the highest priority for treatment because it is still possible to eradicate these infestations and they have the highest potential for rapid spread (highly invasive).

1B and 1C infestations are the next highest priority for treatment because of their sparse nature and the high probability of success in eradication.

2B and 2C infestations are assessed based on resources at risk and potential for spread.

3A and 3B infestations that are located in Wilderness, Recommended Wilderness, and Salt Lake City watersheds, and where high resource values are threatened, will also be assigned an objective of eradication.

Containment and Control

For well-established weeds, infestations classified as 3A are highest priority for containment and control because of their invasive nature, followed by 3B and 3C. Exceptions to this classification are infestations in special areas as described in the previous paragraph.

1.4.3 Treatment Options

Treatment practices available for use in eradicating, controlling, and/or containing noxious weeds include mechanical, biological, controlled grazing, chemical (aerial and ground-based), or combinations of these treatments. Selection of the most appropriate treatment practice depends on numerous factors, including the risk of weed expansion, weed species biology, environmental setting, and management objective. Chapter 2 provides additional detail for each of the treatment options, and how these will be applied to specific weed infestations in the W-CNF. Appendix 4 of the IWM Strategy (Appendix A to this DEIS) provides a tabular display of treatment options known to be effective (as well as limitations of these) for each of the established and potential invaders of the W-CNF.

1.4.3.1 Treatment Selection for Known Infestations

Once management objectives and priority ratings were determined (see Table 1-2), an array of potential treatments, combined with consideration of sensitive conditions, was used to select the proposed treatment for each known infestation (see *Appendix B, Treatment Options Table*).

The Interdisciplinary Team reworked the generic Decision Tree originally presented in the October 2004 Scoping Document to reflect W-CNF specific sensitive condition factors (see Figure 1-3). The seven sensitive condition factors (Figure 1-3, left column) used to select the most appropriate treatment depend upon whether the infestation occurs within or outside of the following:

- A Salt Lake City watershed (defined as Little Cottonwood, Big Cottonwood, Parleys, and City Creek sixth code hydrologic unit boundaries).
- A riparian area (defined as stated in the RFP).
- Proximity to public water supply source (defined as within 1,500 feet of any public water supply point of diversion).
- The vicinity of an at-risk plant species (defined as within a one-half acre radius of a mapped, at-risk plant species).
- A Wilderness or Recommended Wilderness area (as defined in Section 1.1-5, Management Prescriptions in the RFP).
- An area that is very steep and/or inaccessible (defined as >50 percent slope and >one-quarter mile from a road).
- In the vicinity of a potential or known archaeological/historic site, and requiring ground disturbance for treatment.

Use of the Decision Tree requires that each and every sensitive condition factor be reviewed and considered prior to selection of a treatment method. Treatments must be tailored (Decision Tree right column) to mitigate for sensitive conditions of the site. The most limiting of these factors was used to select the proposed treatments displayed in Action Alternatives sections in Chapter 2.

TABLE 1-2
W-CNF Weed Prioritization and Objectives

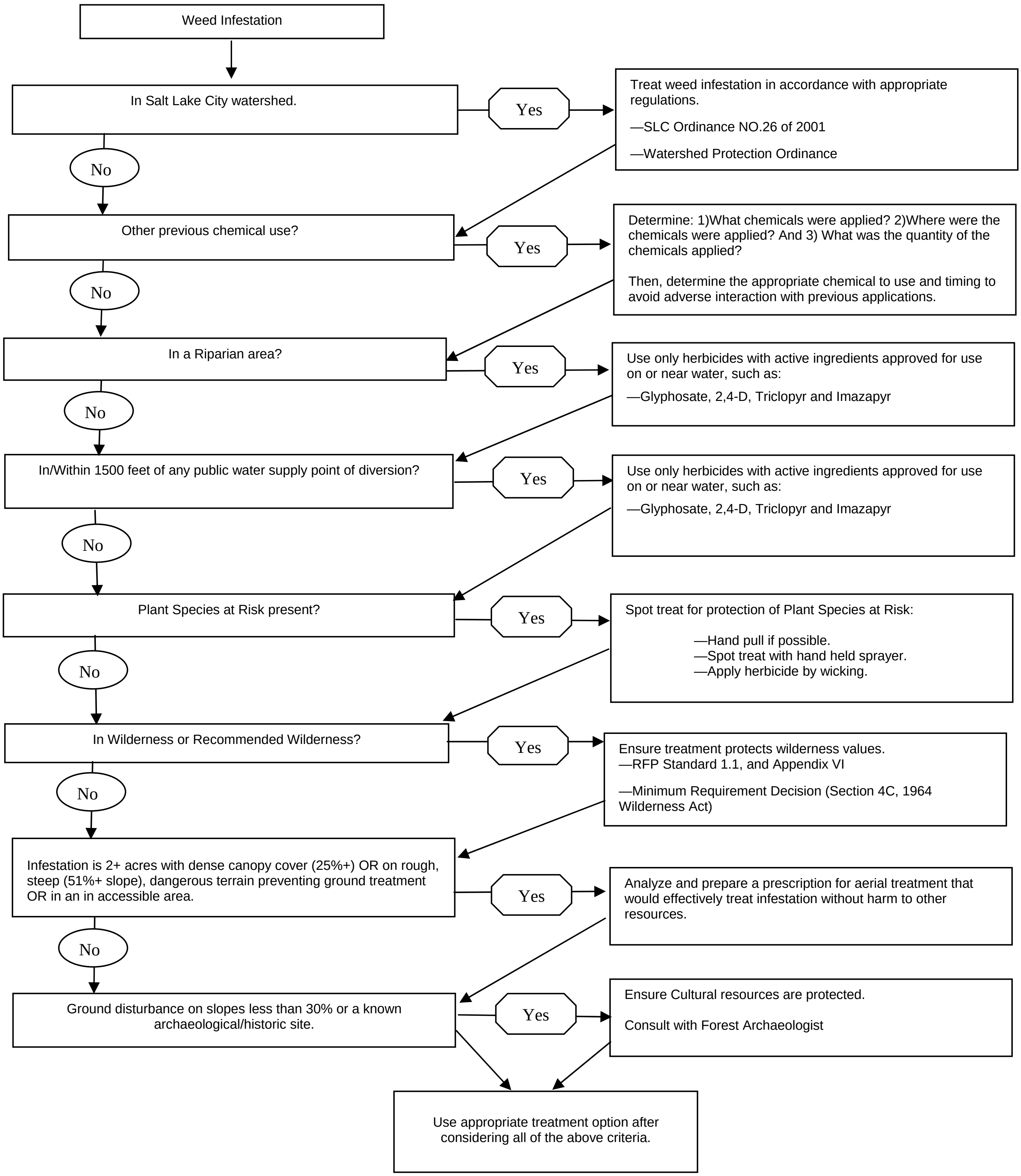
Priority	Objective	Ecological Section	Weed Name	# of Mapped Sites	Mapped Gross Acres	Mapped Infested Acres
1A	E	Overthrust Mountains	Myrtle spurge	2	0.53	0.01
1A	E	Overthrust Mountains	Perennial pepperweed	1	0.11	0.01
1A	E	Overthrust Mountains	Purple loosestrife	2	0.40	0.15
1A	E	Overthrust Mountains	Saltcedar	1	0.17	0.01
1A	E	Overthrust Mountains	Scotch thistle	2	0.30	0.01
1A	E	Overthrust Mountains	Spotted knapweed	4	2.86	0.10
1A	E	Overthrust Mountains	Whitetop	5	0.70	0.02
1A	E	Overthrust Mountains	Yellow starthistle	2	0.20	0.01
1A	E	Uinta Mountains	Dalmation toadflax	2	0.20	0.01
1A	E	Uinta Mountains	Whitetop	6	0.60	0.02
1A	E	Uinta Mountains	Dyer's woad	2	13.74	2.05
1A Total				**29**	**19.81**	**2.4**

TABLE 1-2
W-CNF Weed Prioritization and Objectives

Priority	Objective	Ecological Section	Weed Name	# of Mapped Sites	Mapped Gross Acres	Mapped Infested Acres
2A	E	Bonneville Basin	Whitetop	10	1,077.14	48.79
2A	E	Uinta Mountains	Spotted knapweed	11	5.15	2.02
2A Total				**21**	**1,082.29**	**50.81**
1B	E	Overthrust Mountains	Jointed goatgrass	1	0.10	0.01
1B	E	Overthrust Mountains	St. Johnswort	1	5.00	0.13
1B Total				**2**	**5.1**	**0.14**
1C	E	Overthrust Mountains	Wand mullein	1	1.00	0.01
1C Total				**1**	**1**	**0.01**
3A	E	Overthrust Mountains	Dalmation toadflax	3*	645.9	3.20
3A	CC	Overthrust Mountains	Dalmation toadflax	7*	662.14	3.36
3A	CC	Overthrust Mountains	Dyer's woad	155	22,920.79	3,423.05
3A	E	Overthrust Mountains	Dyer's woad	16	409.10	61.10
3A	CC	Overthrust Mountains	Leafy spurge	3	1.33	.56
3A	E	Overthrust Mountains	Leafy spurge	45	23	8.1
3A Total				**229**	**24,662.26**	**3,499.37**
3B	CC	Overthrust Mountains	Canada thistle	132	1,696.07	57.87
3B	E	Overthrust Mountains	Canada thistle	1	0.10	0.10
3B	CC	Overthrust Mountains	Musk thistle	30	47.12	3.43
3B	CC	Uinta Mountains	Canada thistle	55	75.15	14.71
3B	E	Uinta Mountains	Canada thistle	1	1	0.10
3B	CC	Uinta Mountains	Musk thistle	28	273.55	4.49
3B Total				**247**	**2,092.99**	**80.70**
3C	CC	Overthrust Mountains	Black henbane	11*	2.10	0.05
3C	CC	Overthrust Mountains	Burdock	1*	23.59	0.59
3C	CC	Overthrust Mountains	Field bindweed	1*	0.10	0.01
3C	CC	Overthrust Mountains	Houndstongue	57	23.81	0.48
3C	CC	Overthrust Mountains	Poison hemlock	4	1,631.48	8.59
3C Total				**74**	**1,681.08**	**9.72**
Grand Total				**603**	**29,544.53**	**3,643.15**

*More than 20 infestations are known to exist, but they are not all mapped at this time.
Note: E = Eradicate CC = Contain and Control

FIGURE 1-3
Decision Tree: Sensitive Condition Factors are located on the left side; W-CNF responses to each factor are located on the right side. Each condition factor will be addressed independently and the course of action will follow the most appropriate response.



1.4.3.2 Monitoring and Restoration

Implementation monitoring would be performed during treatment and results recorded on a pesticide application report to indicate that the appropriate treatment application standards and mitigation measures were followed. Samples of treated sites and all restored sites would be monitored for effectiveness through field checks to determine the following: 1) whether the desired management objectives of eradicating, controlling, or containing aggressive weeds were achieved, and if not, what follow-up treatments would be necessary to achieve the objective; 2) whether site restoration techniques have resulted in the re-establishment of native plants, and if not, what follow-up treatments would be necessary to achieve establishment; and 3) whether the native vegetation has adequately responded in non-restored treatment areas to provide for adequate site protection, and if not, what follow-up restoration treatments would be necessary. Treatment method and date, target species, and monitoring results would be recorded for each monitored treatment site to compile a long-term database on treatment effectiveness under various conditions.

Restoration consists of restoring treated areas with desired vegetation. Objectives include revegetating sites after weeds have been eradicated, controlled, or contained; preventing future weed infestations or re-infestations; and slowing the expansion of existing adjacent weed infestations. The W-CNF wants to encourage natural regeneration where possible and will only consider restoration where the degree of disturbance and physical and biological characteristics dictate restoration is necessary.

1.4.3.3 Treatment Selection for Potential Future Infestations–Adaptive Approach

In the future, the following steps will be taken to implement weed treatments for new infestations consistent with the process already applied to known infestations in the Proposed Action.

1. A weed infestation is detected, and sensitive condition factors are noted.
2. The infestation is assigned a treatment objective and priority.
3. The Decision Tree (Figure 1-3) is used along with the Treatment Options Table (Appendix B) to determine the appropriate treatment for the infestation.

The site-specific implementation process described above—including monitoring, learning from that monitoring, and adjusting future actions accordingly—would form the basis of an adaptive approach for future weed infestations.

1.4.3.4 Management Practices and Mitigation Measures

Noxious weed management guidance is included in Appendix III of the 2003 W-CNF RFP (Forest Service 2003a) and in Appendix D of this DEIS. The Proposed Action assumes continued improvement in application of these practices. Mitigation measures including relevant Forest-wide Standards and Guidelines, to be included are listed in Chapter 2, Section 2.3.6 *Management Practices and Mitigation Measures for All Alternatives*.

1.5 Forest Plan Direction

Forest Plans establish guidance for project level decisions. The W-CNF RFP was completed in March 1 of 2003. The Interdisciplinary Team has incorporated management direction, standards, and guidelines from the RFP into the Proposed Action and alternatives for this DEIS. To clarify the purpose and need for action, the following text contains the Forest-wide desired conditions, goals and subgoals, objectives, and management prescriptions that apply to this project.

1.5.1 Forest-wide Desired Conditions—Non-Native Plants[2]

"Established noxious weed infestations are not increasing or are reduced to low densities. New invader species are not becoming established. New infestations of species are contained or reduced. New populations of existing noxious weeds are eradicated or reduced in highly susceptible, often disturbed areas. Native plants dominate most landscapes that have been rehabilitated."

1.5.2 Forest-wide Goals

- Forest-wide Goal 2—Watershed Health: Maintain and/or restore overall watershed health (proper functioning of physical, biological and chemical conditions). Provide for long-term soil productivity. Watershed health should be addressed across administrative and political boundaries.
- Forest-wide Goal 3—Biodiversity and Viability: Provide for sustained diversity of species at the genetic, populations, community and ecosystem levels. Maintain communities within their historic range of variation that sustains habitats for viable populations of species. Restore or maintain hydrologic functions. Reduce potential for uncharacteristic high-intensity wildfires, and insect epidemics.

  To achieve sustainable ecosystems, meet properly functioning condition (PFC) criteria for all vegetation types that occur in the Wasatch–Cache National Forest. Focus on approximating natural disturbances and processes by restoring composition, age class diversity, patch sizes, and patterns for all vegetation types.
- Forest-wide Goal 4—Fire and Fuels Management: Wildlife fire use and prescribed fire provide for ecosystem maintenance and restoration consistent with land uses and historic fire regimes. Fire suppression provides for public and firefighter safety and protection of other federal, state and private property and natural resources. Fuels are managed to reduce risk of property damage and uncharacteristic fires.
- Forest-wide Goal 5—Road/Trail and Access Management: Provide a road and trail system that is safe, responsive to public and agency needs and desires, affordable and efficiently managed. Provide an access system that minimizes negative ecological effects and is in balance with available funding. Focus on

[2] The Proposed Action would amend the Revised Forest Plan Forest-wide Desired Conditions to make them consistent with the more recent Forest Noxious Weed Strategy.

achieving an integrated transportation system that serves multiple functions and is consistent with desired future conditions for a given area.

- Forest-wide Goal 6—Recreation: Manage for an array of recreation opportunities and settings to improve the quality of life for a variety of Forest recreation users. Balance growth and expansion of recreation by managing within the capability of sustainable ecosystems found on the Forest for today and the future.
- Forest-wide Goal 9—Heritage Resources: Inventory, evaluate, protect and enhance heritage sites and landscapes.
- Forest-wide Goal 10—Social/Economic Contributions: Contribute to the social and economic well-being of local communities by promoting sustainable use of renewable natural resources and by participating in efforts to devise creative solutions for economic health (diversity and resiliency). Provide timber for commercial harvest, forage for livestock grazing, exploration and development opportunities for mineral resources, and settings for recreation consistent with goals for watershed health, sustainable ecosystems, biodiversity and viability, and scenic/recreation opportunities.
- Forest-wide Goal 13—Designated Wilderness: Maintain Wilderness ecosystems and character, primarily influenced by the forces of nature, to provide opportunities for public use, enjoyment, and understanding of Wilderness, and to preserve a high quality Wilderness resource for present and future generations. Manage Wilderness to sustain wild ecosystems for values other than those directly related to human uses.

1.5.3 Forest-wide Subgoals—Noxious Weed Control

Subgoal 3s—“Greatly reduce known infestations of noxious weeds and rigorously prevent their introduction and/or spread.”

Subgoal 3t—“Improve Forest users’ awareness of what noxious weeds are and how they spread, and increase Forest users’ active participation in reducing and preventing infestations.”

1.5.4 Forest-wide Objectives

“Develop key messages for focus areas within 1 year and set measurable education/ enforcement goals. Focus areas are: OHV use recreation user ethics, role of fire and fuels hazards, noxious weeds, and watershed health. Assess and prioritize noxious weed infestations for appropriate treatment within 1 year.”

1.5.5 Management Area Desired Future Conditions

1.5.5.1 Bear Management Area

Integrated pest management will be successfully employed to control priority noxious weed infestations. Habitats where rare plants exist will be emphasized. The extent of

other weedy invasive species will be reduced to endemic levels where efforts can be coordinated with noxious weed control.

1.5.5.2 Cache-Box Elder Management Area

Integrated pest management will be successfully employed to control priority noxious weed infestations. Minimum tools for pest management will be used in designated and recommended Wilderness. Habitats where rare plants exist will be emphasized. The extent of other weedy invasive species will be reduced where efforts can be coordinated with noxious week control.

1.5.5.3 North Wasatch Ogden Valley Management Area

Integrated pest management will be successfully employed to significantly reduce noxious weeds, with a priority on protecting the forest boundary, habitats where rare plants exist, and limiting further invasive spread of weeds. There will be full, active coordination with counties and the State for cooperative management of priority areas for weed control.

1.5.5.4 Central Wasatch Management Area

Integrated pest management will be successfully employed to reduce noxious weeds. Active management will be a priority along travel routes, in designated and recommended Wilderness, and in habitats where rare plants exist. The extent of other weedy species, such as those introduced through various planting programs, will be reduced where efforts can be coordinated with noxious weed control.

1.5.5.5 Stansbury Management Area

Integrated pest management will be successfully employed to keep noxious weed populations at a minimum, with emphasis along travel ways.

1.5.5.6 Western Uintas Management Area

Integrated pest management will be successfully employed to greatly reduce noxious weeds with a priority on preventing infestations in recommended wilderness and in habitats where rare plants exist.

1.5.5.7 Eastern Uintas Management Area

Desired future vegetation conditions for this management area do not specifically mention noxious weeds, but instead discuss management and maintenance of native vegetation communities.

1.5.6 Management Prescriptions

All Management Prescriptions allow for treatment of noxious weed (see RFP errata dated 11/26/03). Treatment *methods* (such as those employing motorized or mechanized equipment) are restricted as shown in Management Prescriptions for

Wilderness areas (MP 1.1 through 1.4 in the RFP) and Recommended Wilderness (MP 1.5 in the RFP).

1.6 Decisions to be Made

The W-CNF Forest Supervisor will decide whether or not to treat noxious weeds within the W-CNF, and if so, then where, how, and by applying which mitigation measures for both existing and potential future noxious weed infestations in the Forest. In addition, the Forest Supervisor will decide whether or not to use non-herbicide treatments on noxious weeds inside designated Wilderness areas.

CHAPTER 2. ALTERNATIVES

This chapter describes the public comment, issue identification, and alternatives for the proposed Wasatch-Cache National Forest (W-CNF) treatment of noxious weeds. It also describes alternatives that were considered but eliminated from detailed analysis, as well as the reasons for their elimination. This chapter also discusses, in detail, each of the alternatives and proposed mitigation measures, and describes the components of the Integrated Weed Management (IWM) Strategy that form the context of each alternative.

2.1 Public Involvement and Public Comments

The U.S. Forest Service (Forest Service) proposes to treat noxious weeds on 1.2 million acres of wilderness and non-wilderness areas on the W-CNF. On October 26, 2004, the Scoping Document outlining the Purpose and Need for Action and the Proposed Action was provided to about 400 individuals and organizations for comment. Twelve letters and several phone calls were received with comments on the Proposal. In general, there was support for action to treat noxious weeds in the Forest; however, there were concerns that treatment alone, without a strong emphasis on identification of causes and active prevention, would miss the mark. A number of comments were concerned with potential effects of treatments with herbicides. The following sections contain key points made in public comments (in *italics*, and paraphrased for brevity) and how they are being addressed in this analysis. The comments are categorized in the following ways:

- Comments related to Action Alternatives and mitigation measures
- Comments related to environmental effects
- Comments already addressed by the Forest Service's IWM Strategy
- Comments to be addressed in other planning efforts
- Comments outside Forest Service jurisdiction

2.1.1 Comments Related to Action Alternatives and Mitigation Measures

Comment*: Should not use chemicals because they are not regulated and they kill humans, wildlife, and birds.*

Response: The Alternatives description later in Chapter 2 includes a description of chemicals, how thoroughly they are regulated, and the mitigation measures that will be employed to ensure safety. Alternative 3–Weed Treatment Excluding Herbicide Use was developed to respond to concerns about herbicide use.

Comment: *Methods in wilderness should be effective and appropriately restricted.*

Response: The Action Alternatives apply the Decision Tree (Figure 1-3 in Chapter 1), which includes guidance for mitigation when infestations to be treated occur in designated or recommended wilderness.

Comment: *Explore uses of natural substances (Waipuna™ hot foam system) instead of herbicide.*

Response*:* The referenced source (*Waipuna*™) has been evaluated. We have concluded that this approach would not be a cost-effective or feasible treatment for wildland settings because the terrain is not conducive to the required equipment.

Comment: *Use of herbicides within Salt Lake City's protected drinking water supply watershed areas (Big Cottonwood, Little Cottonwood, Parleys and City Creek Canyons) must comply with Salt Lake City Ordinance 17.04.371 "Watershed Ordinance."*

Response: Requirements of this Ordinance have been incorporated into the Decision Tree (Figure 1-3 in Chapter 1) and the mitigation measures for Action Alternatives. The Forest Service will emphasize continuing review and coordination with the Salt Lake City Department of Public Utilities throughout this planning process and during implementation of any decision.

Comment: *The treatment of weeds should not create new vectors for weed establishment and/or other forms of environmental degradation.*

Response: The selection of specific treatments for each weed infestation is based on consideration of which effective treatment options are available, given the environmental factors highlighted in the Decision Tree. Treatments are selected to prevent potential impacts, including creation of new vectors and environmental degradation.

2.1.2 Comments Related to Environmental Effects

Comment: *Issues should be developed related to specific impacts on specific elements of the environment and carried forward in the analysis*.

Response: The environmental effects analysis in Chapter 4 of this Draft Environmental Impact Statement (DEIS) addresses specific elements of the environment and the potential effects of noxious weed treatment on each. During development of the Decision Tree (Figure 1-3 in Chapter 1), elements of the environment with special concerns related to potential effects of herbicide or other types of weed treatment were identified. These include municipal watersheds, riparian areas (including water and associated aquatic species), public water supplies, rare plants, Wilderness and Recommended Wilderness, and cultural resources.

Comment: *Science-based documentation of decisions for the use of various treatments should be clearly displayed*.

Response: In this chapter, the description of treatments includes scientific references for treatments and the environmental effects analysis includes scientific references and the scientific basis for conclusions.

Comment: *Grazing reduces the ability of the environment to withstand weed invasions.*

Response: The effects of grazing on weed invasion are addressed in both *Chapter 3, Affected Environment,* and *Chapter 4, Effects Analysis*, of this DEIS.

Comment: *The Forest must be able to support, scientifically, whether or not grazing is a tool that can be used to treat weeds*.

Response: The environmental effects analysis includes scientific references that form the basis for effects disclosure and conclusions regarding use of controlled grazing as a weed treatment method.

Comment: *Biocontrol has not been proven to be effective long term nor has it been proven to be safe to native species. Biological controls must be thoroughly examined before they are used. They must not be detrimental to another species.*

Response: The environmental effects analysis includes scientific references that form the basis for effects disclosure and conclusions regarding use of biological agents as a weed treatment method.

Comment: *Broaden the category of fisheries to incorporate aquatic species, including macro-invertebrates*.

Response: The environmental effects analysis addresses all aquatic species, not just fish.

2.1.3 Comments Already Addressed in the Integrated Weed Management Strategy

Comment: *Invasive species list does not include cheatgrass and other invasive species.*

Response: The IWM Strategy (Appendix A) provides definitions of noxious versus invasive species and an explanation of why this effort focuses on noxious species and excludes invasive species.

Comment: *Management activities should be altered to focus on the prevention of the spread of noxious weeds (logging activities).*

Response: Agreed. The IWM Strategy addresses this under Goal 4.

Comment: *Controlling weeds is more important than simply inventorying weeds.*

Response: We agree with this statement and the IWM Strategy emphasizes all elements of integrated weed management, of which inventory is only a small but essential part.

2.1.4 Comments to be Addressed in Other Planning Efforts

Comment: *Change management to reduce or eliminate the source of weed infestations (by eliminating livestock grazing, closing roads and trails, or not constructing roads or trails).*

Response: The Scoping Document highlighted the fact that weed treatment is one element of an IWM Strategy that also includes prevention, education, survey, monitoring, and cooperative partnerships. It stated that these other elements do not require environmental analysis and would be discussed as context in this analysis. In the Scoping Document for this project, the Purpose and Need for Action includes text that states: "Prevent or limit the spread of established weeds into areas containing little or no infestation while meeting multiple use objectives." Public comments identified a number of potential actions (changes in current management) that could affect weed establishment and spread through prevention, which involve decisions generally made in other planning efforts such as forest planning, travel management planning, and allotment management planning. Some of these have recently been completed, such as the Wasatch-Cache National Forest 2003 Revised Forest Plan (RFP) (Forest Service 2003a) and the North Rich Allotment Plan (Forest Service 2004b), while others are on-going, such as the Ogden Ranger District Travel Plan (Forest Service 2004c). It is acknowledged that weed management must inherently be addressed within each of these other planning efforts to be effective. We disagree that decisions regarding each of these activities are an appropriate part of *this* analysis on weed treatment. To address actions as complex and far reaching as forest-wide travel management or forest-wide livestock grazing within this analysis would be extremely cumbersome and unreasonable; therefore, the Forest Service intends to continue with the focus of this analysis on treatment options for weeds, while committing to include weed management implications within the analyses that appropriately address each of the other potential activities. The IWM Strategy articulates this commitment under Goal 4. The Purpose and Need for Action statement in the Scoping Document has been modified in Chapter 1 of this DEIS *(Section 1.2 Purpose and Need for Action)* (Chapter 1, Section 1.2) to clarify that this project is for active weed treatment that prevents or limits the spread of established weeds. Other forms of prevention will be addressed through other avenues.

Comment: *Protect roadless areas from new weed invasions.*

Response: The 2003 RFP established direction for management of inventoried roadless areas. Where that direction does not allow road construction and/or trail construction, a major source of new weed infestation is eliminated. Where that direction does allow road and/or trail construction, site-specific environmental

analysis is required prior to any new construction. Consistent with the IWM Strategy, these proposals must include assessment of risk for potential weed establishment and spread and must address prevention and control measures as part of the project decision.

Comment: *Public has not been "privy" to what desired condition is.*

Response: The Scoping Document stated that the purpose of this proposal is to move forward in achieving the desired conditions, goals, and objectives of the 2003 RFP. Desired conditions referred to in the Scoping Document are included in Chapter 1 of this DEIS.

2.1.5 Comments on Topics Outside Forest Service Jurisdiction

Comment: *Moratorium on this project until state and federal laws eliminate the sale of noxious weeds by nurseries.*

Response: The State of Utah Department of Agriculture regulates operation and management of nurseries (http://ag.utah.gov/plantid/nursery.html).

2.2 Issues

In response to the comments in the previous text, the interdisciplinary team (IDT) identified seven issues (Table 2-1), which can be summarized as follows:

- **Issue 1:** Effects of weed treatment on plant species at risk.
- **Issue 2:** Effects of weed treatment on aquatic and semi-aquatic species.
- **Issue 3:** Effects of weed treatment on terrestrial wildlife species.
- **Issue 4:** Loss of diversity of native vegetation and loss of wildlife habitat from noxious weed infestations.
- **Issue 5:** Effects of weed treatment on water protected for domestic purposes.
- **Issue 6:** Effects of noxious weed infestations and treatment on fire/fuels management.
- **Issue 7:** Effects of weed treatment on human health.

TABLE 2-1
Issues Identified as Significant During Scoping[a]

Issue	Indicators	Effects
Issue 1—Vegetation. Effects of weed treatment on plant species at risk.	Relative amount of weed treatment areas that will be in occupied W-CNF plant species at-risk habitat.	Direct and indirect effects of weed treatment on plant species at-risk habitat.
Issue 2—Aquatic & Semi-Aquatic Species. Effects of weed treatment on aquatic and semi-aquatic species (fish and amphibians) including threatened, endangered, and sensitive species.	Estimated concentration of herbicides in receiving waters. Ability to meet state water quality standards for cold water fisheries.	Risk of chemical contamination, accidental spills, wind drift, and effects on fish, amphibians, and macroinvertebrates based on a risk analysis. Ability to meet state water quality standards for cold water fisheries.
Issue 3—Wildlife Resources. Effects of weed treatment on terrestrial wildlife species including threatened, endangered, sensitive, big game, neotropical migratory bird, and management indicator species.	Percent of total and distribution of threatened, endangered, and sensitive species habitats lost to or modified by treatment. Percent of total and distribution of neotropical migratory bird habitats lost to or modified by treatment. Percent of total and distribution of management indicator species habitats lost to or modified by treatment. Percent of total and distribution of big game winter ranges lost to or modified by treatment.	Direct and indirect effects of weed treatment on selected wildlife habitats and the relative amounts and distribution of unaffected habitats available.
Issue 4—Biodiversity. Loss of diversity of native vegetation and loss of wildlife habitat from noxious weed infestations.	Amount of at-risk plant species habitats infested by noxious weeds. Amount of big game winter range lost to or modified by noxious weeds. Amount of native vegetation by cover type infested by noxious weeds. Amount of habitat (and percent of total available) by wildlife/cover type groupings lost to or modified by noxious weeds. Amount of habitat within 300 feet on each side of streams containing noxious weed infestations.	Effects of noxious weed infestations on native plant diversity including plant species at risk. Effects of noxious weed infestations on wildlife habitats.
Issue 5—Water Quality. Effects of weed treatment on water protected for domestic purposes.	Estimated concentration of herbicides in receiving waters.	Potential for chemical contamination of surface waters and its effects on human health. Ability to meet state water quality standards for water protected for domestic purposes.

TABLE 2-1
Issues Identified as Significant During Scoping[a]

Issue	Indicators	Effects
Issue 6—Fire/Fuels Management. Effects of noxious weed infestations and treatment on fire/fuels management.	Acres of noxious weed treatments resulting in a change in fuel loading. Acres not available for wildland fire use and prescribed fire because of weed infestations.	Effects of weed treatment on fuel loading, and potential fire behavior (particularly in the Wildland/Urban interface). Effects of weed infestations on vegetation/fuels management options.
Issue 7—Human Health. Effects of weed treatment on human health.	Potential for health effects to workers from acute herbicide exposures during ground and aerial applications. Potential for health effects to visitors on the W-CNF from chronic and/or acute herbicide exposure to herbicide residuals.	Acute herbicide exposure to workers during herbicide applications. Acute herbicide exposure to visitors to the National Forest from herbicide residuals following application.

[a] Identified by the Forest Service.

In addition to the issues identified as significant (and shown in Table 2-1), concerns about effects on other resources were identified during public scoping, but did not rise to the level of a significant issue (Table 2-2).

TABLE 2-2
Resource Issues of Concern, but Not Significant

Environmental Component	Indicators	Effects
Recreation—Effects of weed infestations and treatment on recreation activities and scenic quality.	Loss of recreation opportunity because of recreation area closure or warnings for treatment according to chemical label directions. Loss of recreation opportunity because of weed infestations that create physical barriers (such as yellow starthistle, musk thistle, scotch thistle, and puncture vine on trails). Loss of scenic quality because of weed infestations and weed treatments.	Effects of treatment and infestations on recreation activities (access to areas, ability to participate and enjoy activity). Effects on scenic values from weed infestations and treatment and the ability to maintain a naturally appearing setting.
Wilderness—Effects of weed infestations and treatment on wilderness resources.	Acres infested within designated and recommended Wilderness (RFP Management Prescriptions 1.1-1.3, 1.5). Location, timing, and duration of treatment activity within wilderness.	Effects on wilderness values (solitude, remoteness, primitive recreation opportunities, natural appearance).

TABLE 2-2
Resource Issues of Concern, but Not Significant

Environmental Component	Indicators	Effects
Cultural Resources—Effects of weed infestations and treatment on cultural resources.	Acres of known cultural resources sites infested and/or treated.	Risk of effects to cultural resource sites.

Soil resources did not represent a significant issue nor were they a resource of concern. The rationale for this determination is presented in the following text.

Non-Significant Issue 1—Soil Resources. Soil productivity would be protected and enhanced through implementation of site restoration after treatment. Potential changes in soil productivity under the various alternatives were considered too speculative to be addressed in this analysis. The IDT determined that no significant impacts would result from implementation of treatment alternatives and therefore the issue is not considered significant.

2.3 Alternatives

This DEIS analyzes, in detail, the following three alternatives:

1) No Action (continuation of current management)

2) Proposed Action (noxious weed treatment using the most effective methods available, balanced on a site-by-site basis with reducing potential impacts to sensitive resources)

3) Weed Treatment Excluding Herbicide Use (noxious weed treatment using methods other than herbicides including mechanical [hand pulling/digging], controlled grazing, and biological agents)

These Alternatives are described in detail in Sections 2.3.4 through 2.3.6 of this Chapter.

2.3.1 Alternatives Considered But Not Analyzed in Detail

Alternatives that were considered but not analyzed in detail include:

- Alternatives that would reduce or eliminate livestock grazing as a method of preventing and controlling spread of noxious weeds
- Alternatives that would close existing travel routes (roads, trails) to prevent spread of noxious weeds
- Alternatives that would prohibit road construction, trail construction, timber harvest, and prescribed fire to prevent spread of noxious weeds

These Alternatives are not analyzed in detail because the general decision about whether or not and where to allow new road and trail construction, timber harvest, and prescribed fire have already been made in the 2003 RFP. The specific decisions for closing existing roads/trails or constructing new roads/trails; authorizing livestock grazing; harvesting timber; or using prescribed fire are made in other site-specific planning efforts such as travel management planning, allotment management planning, and/or planning for vegetation treatments. To address actions as complex and far reaching as forest-wide travel management or forest-wide livestock grazing within this analysis would be extremely cumbersome and unreasonable.

An Alternative that uses a suggested weed treatment method involving a hot foam system (Waipuna™) was considered but not analyzed in detail because the forest areas needing treatment lack suitable terrain for the necessary equipment.

2.3.2 Integrated Weed Management

As explained in Chapter 1, weed *treatment* is one element of an IWM Strategy that includes prevention, education, survey, monitoring, and cooperative partnerships. Given that the Action Alternatives analyzed in this DEIS assume an IWM Strategy, the non-treatment elements are described below **as context** for the descriptions of treatment alternatives that follow.

2.3.2.1 IWM Non-treatment Elements

Prevention

Prevention is obviously the first line of defense against noxious weed invasion, and as such, preventing the introduction and spread of noxious weeds is appropriately the first action strategy in any IWM program. Specific actions designed to emphasize prevention are contained in the RFP Appendix III (and in Appendix D in this document), and address project layout and design; monitoring and inspecting ground-disturbing activities, roadside, right-of-way (ROW), and other public vehicle concentration areas; weed-seed free feed; management of wildlife and fish habitats; grazing allotments; timber harvest; mining; energy development; special uses; soil, water, and stream restoration; and fire operations—each with specific considerations to prevent establishment and/or spread of noxious weeds. These practices are assumed as a given for all alternatives.

Education

Ongoing education efforts will be continued with the intent of increasing Forest users' awareness of the presence of or potential for noxious weed infestations and identification of existing weeds or potential new invaders. Emphasis will be placed on everybody's responsibility in preventing the introduction or spread of weeds. Numerous efforts are already underway, including key messages about noxious weeds developed as part of implementing the 2003 RFP, training of all field-going personnel in weed identification and mapping, and work with partners in several Cooperative Weed Management Areas (CWMAs). In addition, the 2004 IWM

Strategy identifies specific actions to develop educational materials to be posted at portals, trailheads, and roadsides to alert Forest users of their roles in prevention and control. These and continued educational efforts are assumed as a given for all alternatives.

Inventory

Field-going personnel have been trained to identify noxious weeds and are encouraged to document locations of weeds during regular field duties. 2005 was the first year in an effort to improve the Forest Service inventory of noxious weeds. During the 2005 growing season, specific inventories were conducted to determine and document the presence, location, and extent of noxious weed populations. These inventories focused on validating previous data and inventory along major portals and vectors (roads, trails) in the Forest. In addition, weed location information is shared among cooperators including Utah State University and County Weed Supervisors. Identification of additional potential partners in weed survey has resulted from the public scoping for this project; these partners provided field work during summer 2005. Information about species, acreage, canopy cover, and map location is recorded in a database to ease retrieval and share with cooperators. Efforts to improve these data are being emphasized and are critical to prioritization of limited resources in weed eradication and control. The Forest Service expects the Final EIS to incorporate any new data.

Monitoring

Monitoring must be conducted to evaluate effectiveness of IWM, and should be conducted in three phases:

1. Prior to treatment for use in determining rates of spread and/or effectiveness of management activities

2. During treatment to minimize the chances of human exposure (in the case of herbicide treatments)

3. Following treatment to evaluate effectiveness and schedule further action if needed.

The national Natural Resource Information System (NRIS) database will provide a standardized repository for this information in the future.

Cooperative Partnerships

Because weeds do not recognize land ownership boundaries, any effective strategy to prevent, eradicate, or control infestations must include active coordination among land managers both public and private. CWMAs are a vital component of IWM. These involve all landowners in a watershed or region, development of IWM plans, and defining roles and partnerships that allow for the treatment of infestations across jurisdictional lines of ownership to optimize cooperative efforts to eradicate and control noxious weeds. Each CWMA works with state, federal, and county officials,

and with neighboring CWMAs to coordinate weed management efforts. Currently, the W-CNF is an active participant in two CWMAs—the Utah and Idaho CWMA and the Weber River CWMA. In addition, relationships are being developed for CWMAs in Summit County and in the Bonneville Basin. CWMAs have a proven ability to acquire grants and leverage existing money to complete priority noxious weed abatement projects on the ground (VanBebber 2003).

2.3.2.2 IWM Treatment Practices

Treatment practices available for use in eradicating, controlling, and/or containing noxious weeds include mechanical, biological, controlled grazing, chemical (aerial and ground-based), and/or combinations of these treatments. Cultural treatment is discussed further as a part of site restoration techniques. Selection of the most appropriate treatment practice depends on numerous site-specific factors, including weed species biology, size and location of infestation, environmental setting (sensitive resource factors), accessibility, and management objective. The anticipated types, mix, and extent of treatment practices and the management objective associated with each weed species by ecoregion are presented later in this Chapter.

Treatment practices described in the following text were evaluated for the known infestations on the W-CNF to develop details of the Proposed Action (Alternative 2) and would be considered on a site and weed-species-specific basis for future infestations. Treatment descriptions are based on recent NEPA documents covering noxious weed management programs on other National Forests. These documents cover the former Salmon and Challis National Forests (Forest Service 2003b) (now the Salmon-Challis National Forest, Idaho); Frank Church River of No Return Wilderness, Idaho (Forest Service 1999); Flathead National Forest, Montana (Forest Service 2000a); Sandpoint Ranger District, Idaho (Forest Service 2001a); Beaverhead-Deerlodge National Forest, Montana (Forest Service 2001b); and Lolo National Forest, Montana (Forest Service 2001c).

2.3.2.2.1 Mechanical Treatment

Mechanical treatment consists of methods that physically destroy, disrupt growth, or interfere with the reproduction of noxious and invasive non-native weeds. These methods can be accomplished by hand, hand tool, or power tool, and may include pulling, grubbing, digging, hoeing, tilling, cutting, mowing, and mulching weeds. Mechanical treatment also could include burning weeds with a propane torch. Mechanical treatments would typically be used on a limited basis, primarily to control individual plants or very small, isolated infestations of weeds. Larger infestations of weeds are very difficult to control with mechanical treatment. Furthermore, steep slopes and rocky soils prohibit or limit the use of many mechanical treatment activities.

Hand pulling and grubbing of weeds is the oldest form of weed treatment, but it is very labor intensive, relatively ineffective in treating large infestations of perennial weeds, and often leaves root fragments in the ground. If sufficient root mass is

removed, the individual plant can be destroyed. However, some weed species such as leafy spurge respond to mechanical treatment by aggressively resprouting, even if small root fragments are left in the soil. This type of treatment is much less effective on rhizomatous weeds than on non-rhizomatous weed species because of their well-developed root system and carbohydrate reserves. Cutting and mowing plants can reduce reproduction in perennial species and weaken their competitive advantage by using up carbohydrates stored in the root systems. Mechanical treatments must be repeated several times a year for many years to eradicate weed species that are prolific seed producers and which have built up a residual seed bank in the soil. To be most effective, mechanical treatment must occur before seed production occurs. Plants that have already flowered must be removed from the treatment area and destroyed. For all of these reasons, mechanical treatments are difficult or impossible to implement and achieve success on large weed infestations, rhizomatous invasive weeds, and steep and/or remote terrain.

2.3.2.2.2 Biological Treatment

This treatment consists of using biological controls (agents) such as insects and plant pathogens to attack, weaken, and/or kill a targeted weed species and to reduce its competitive or reproductive capacity. Natural limiting factors such as predators (animals, insects), disease, and other vegetation competing for nutrients, moisture, space, and light generally prevent populations of native plants from spreading out of control. Non-native plant species have become a problem in parts of the western United States because of the absence of limiting factors that are present in their native habitats. Biological controls are used to reduce densities and rates of weed spread rather than to eradicate weeds. Biological controls may decrease the production of viable weed seed and may slow the rate of weed spread, but by themselves they do not completely eradicate or contain noxious weed infestations.

Biological treatment is most effective on dense infestations of a weed species covering large areas, but it may take 10 to 20 years for some biological treatments to be effective (Forest Service 1999). Other limitations in the use of biological controls include the following: weeds continue to spread while the biological controls are becoming established; some weed species do not have biological controls; populations of biological controls can fail (leave an area or die); and a mix of different species of biological controls is often necessary to effectively treat a given weed site. Most experts regard the introduction of biological controls as the best long-term solution where there are large, widespread populations of a specific noxious weed species (Forest Service 2001a).

Cycles of abundance for the noxious weed and biological control agent typically follow patterns associated with density-dependent relationships between predator and prey, and ideally result in equilibrium between the biological agent and the weed. This treatment is more effective when used in combination with, or prior to, other treatment methods such as herbicides. The U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) rigorously screens and tests new biological agents for impacts on agricultural plants and on threatened,

endangered, and sensitive plant species. It then prepares environmental assessments on the possible impacts of releasing those agents (Forest Service 1999). Before the prospective biological controls can be released, they are placed in quarantine under "eat or starve" conditions with a variety of plant species to determine if they are host-specific to the plants they are intended to control. Insects are generally the most popular and available biological agents. Only APHIS-approved biological controls would be used on the W-CNF and would be released according to APHIS requirements or Forest Service policy, whichever is more restrictive.

Examples of biological controls that could potentially be used on the W-CNF include the following:

- For spotted knapweed—seed gall fly (*Urophora affinis),* root moth (*Agapeta zoegana),* flower weevil (*Larinus minutus)*, root boring weevil (*Cyphocleonus achates*), and seedhead moth (*Metzneria paucipunctella)*
- For rush skeletonweed—gall midge *(Cystiphora schmidti*), gall mite (*Eriophues chondrillae*), and rust *(Puccinia chondrillina*)
- For St. Johnswort— beetle (*Chrysolina hyperici*) and moth (*Aplocera plagiata)*
- For leafy spurge—flea beetles (*Aphthona* spp.*)*

Appendix B, Characteristics of Herbicides, provides a listing of available biological control agents for noxious weeds of the W-CNF. Optimal biological management would include a combination of different biological agents that attack or stress different parts of a weed's system, such as noted for the five agents for spotted knapweed. New, APHIS-approved biological controls may be substituted for current agents if more appropriate, or if current agents are either no longer available or APHIS approved.

2.3.2.2.3 Controlled Grazing Treatment

This treatment category consists of controlling localized infestations of weeds by closely controlled livestock grazing. Although it can be somewhat seasonal in application, prolonged or coerced grazing by certain kinds of livestock has been used to suppress noxious weeds (Crabtree and Lake 2001). For example, sheep can be induced to eat leafy spurge, which is toxic to some livestock but not to sheep (or goats). Sheep are known to suppress leafy spurge populations, but they usually do not totally eradicate this weed and will not always graze leafy spurge to the exclusion of native grasses. Also, sheep grazing leafy spurge (and other weeds) while the seed is maturing will pick up seeds in their fleece, which may then possibly infest weed-free areas.

Goats have been used in efforts to control weeds (Dyer's woad) on lands near Willard Bay and on a Davis County wildlife area. Portable fencing is used to control the location and intensity of goat grazing. Weed control using controlled livestock grazing would require a site-specific project operation plan. The operation plan would

consider factors including target weed species, type of livestock to be used, forage preference, planned grazing intensity, herding characteristics, topography, onsite water, season of use, and a monitoring program. Forest Service regulations, policies, and the appropriate mitigation would be followed.

2.3.2.2.4 Chemical Treatment

Chemical treatment is an important method when the management objective is weed eradication or control. It involves the application of herbicides (chemical compounds) at certain stages of plant growth to kill weed species. Herbicides are extensively screened and tested before they are approved and registered for use by the U.S. Environmental Protection Agency (EPA). Such registrations typically require at least 120 tests over a 7- to 10-year period and can cost approximately $30 million to $50 million (Forest Service 2001c). Herbicide labels carry the force of laws governed by federal and state agencies. Labels contain information about the proper administration of each herbicide, including the following: a list of the ingredients; EPA registration number; precautionary statements (hazards to humans and domestic animals, personal protective equipment, user safety recommendations, first aid, and environmental hazards); directions for use, storage, and disposal; mixing and application rates; approved uses and inherent risks of use; limitations of remedies; and general information.

There are a variety of herbicides, and many have been limited in their use by the EPA or the Occupational Safety and Health Administration (OSHA). Many herbicides are “selective” and kill specific types of plants, while others are “general” and kill almost all actively growing plant species with which they come in contact. Most herbicides are not truly selective at the species level, but will selectively kill forbs or certain groups of species. Some of these herbicides are pre-emergent and absorbed through the roots while most herbicides affect the established plant through foliar and root absorption. Herbicides that could potentially be used to control weeds on the W-CNF are listed and described in *Appendix C, Treatment Options Table*. The Proposed Action is intended to have the flexibility to: 1) use any chemicals appearing on the Forest Service’s list of herbicides approved for use on National Forests, and 2) use any new or updated chemicals as they are registered and approved by the EPA and added to the Forest Service’s list of herbicides approved for use and accompanied by complete risk assessments.

Because of environmental concerns, it is essential that all herbicide applications follow label instructions, specifications, and precautions as well as applicable Forest Service policy. In instances where the herbicide label and the federal or state stipulations overlap, the more restrictive criteria would apply. Additional fact sheet information, such as characteristics and risks, on the herbicides described in Appendix B and other registered chemical herbicides can be reviewed at http://infoventures.com/e-hlth/ (Information Ventures, Inc. 2002). Characteristics and properties of herbicides are discussed further in *Chapter 4, Environmental Consequences* and Appendix B. Appendix B also lists typical and maximum label application rates for herbicides.

2.3.2.2.5 Application of Herbicides

Herbicides would be applied according to EPA product label requirements and in accordance with directions specified in Forest Service Handbooks 2109 and 6709. All herbicide applications would be performed by, or directly supervised by, a state-certified applicator. The two types of herbicide application—ground-based and aerial—are described in the following text.

Ground-based herbicide application would occur in most of the smaller, fragmented patches of weeds and along trails and roads where chemical treatment may be the most effective means of controlling or eradicating noxious weeds. Those herbicides described in the Treatment Options Table (Appendix C) and the Decision Tree (Figure 1-3 in Chapter 1) for selecting which herbicides to use would apply to the ground-based application of herbicides. Methods of application would include broadcast ("block") spraying or spot spraying with backpack pumps, spraying from a pumper unit on the back of a pickup truck or an all terrain vehicle (ATV), or using pack animals in the transport and application of herbicides in more rugged terrain. Ground-based herbicide application would only occur when wind speed is less than 10 miles per hour (mph). All herbicides would be applied according to label instructions and specifications or Forest Service policy, whichever is more restrictive. Precautionary measures associated with the ground-based application of herbicides are described in *Section 2.3.6 Management Practices and Mitigation Measures for All Alternatives*.

Aerial herbicide application can be an effective means of controlling or eradicating large weed infestations, or infestations in areas that have steep slopes, rocky soils, and are either difficult to reach or lack access to effectively treat from the ground. Aerial application provides a means to effectively treat large (or small) infestations in isolated areas rapidly and efficiently, dramatically reducing the threat of further establishment or expansion. Aerial herbicide application by helicopter and/or plane could potentially occur in selected locations of the W-CNF excluding Wilderness and Recommended Wilderness. Herbicides that would be considered for application include those chemicals proposed in ground-based herbicide applications. The herbicide(s) selected for a particular aerial treatment depend on the same factors included in the Decision Tree (Figure 1-3 in Chapter 1). Aerial application would only occur when wind speed is less than 6 mph and blowing away from sensitive resources. Mitigation measures associated with the aerial application of herbicides are described in *Section 2.3.6, Management Practices and Mitigation Measures*.

2.3.2.2.6 Combinations of Treatments

This treatment category consists of combining several types of weed treatments using the IWM approach to provide diverse coverage for a site exhibiting a range of conditions, such as differences in species density within a broad area of infestation. This integrated approach also can be used to more effectively treat different life cycles of a single weed species. The intended effect of combining weed treatments into an integrated approach is to collectively increase the stress on a noxious weed

species to the point where it dies or loses its competitive advantage and is then out-competed by native vegetation. Examples of combinations of treatments include a blend of herbicide and biological controls, herbicide and mechanical controls, mechanical and biological controls, and controlled grazing and mechanical controls (Forest Service 1999, 2001a).

2.3.3 Alternative 1–No Action (Continuation of Current Management)

Continuation of current management would consist of very limited treatment of noxious weeds in areas identified through past project activities and treated primarily through spot treatment with herbicides or hand-pulling. Traditionally the weed program for the W-CNF has been associated with other activities and areas easily accessed while performing other work. There has been no systematic approach Forest-wide, to either weed mapping or assignment of treatment objectives and priority setting. Table 2-3 shows the weed treatment acres from 2004. It should be noted that some acres were treated but have not yet been mapped. Therefore, the numbers in the following table for Alternative 1 may not match Table 1-2 in Chapter 1 for the acres of weeds mapped. Although the priority rating system described in Chapter 1 did not exist at the time that these treatments were completed, priority ratings have been assigned to weed species represented in Table 2-3 for the purposes of comparison with the Action Alternatives that follow. Continuation of current management would consist of treatment levels and weed species similar to this. All herbicide applications are in accordance with label instructions. Application is conducted or supervised by state-certified employees. The No Action Alternative does not include the Objectives and Prioritization from the Forest Weed Strategy nor does it include use of the Decision Tree (Figure 1-3 in Chapter 1). It does, however, include the non-treatment elements of an IWM Strategy described previously.

TABLE 2-3
Alternative 1–Continue Current Management - Infested Acres Treated

	Chemical				Mechanical			
	Ground Based		Aerial					
Priority	Spot	Block	Spot	Block	Cutting	Hand Pulling/ Digging	Grazing	Biological
Overthrust Mountains								
1A	0.03							
1B	0.13							
3A	91							
3B	3.79							
3C						1.04		
Total	**94.92**					**2.54**	**12**	

TABLE 2-3
Alternative 1–Continue Current Management - Infested Acres Treated

	Chemical				Mechanical			
	Ground Based		Aerial					
Priority	**Spot**	**Block**	**Spot**	**Block**	**Cutting**	**Hand Pulling/ Digging**	**Grazing**	**Biological**
Bonneville Basin								
N/A								
Uinta Mountains								
1A	0.16							
3B	14.36							
3C	1.5							
Total	**16.02**							
Grand Total	**110.94**					**2.54**	**12**	

Note: 110.94 acres treated with chemical @ $300 = $33,282 + 2.54 acres treated by hand @$2,000 = $5,080 + 12 acres treated with grazing @ $500 = $6,000 for a total of $44,362.

2.3.4 Alternative 2–Proposed Action

The proposed treatment of weed infestations is based on the objectives of eradicating small and new infestations while containing or controlling existing larger infestations. Estimated treatments were projected using current gross acres to represent future infested acres and by selecting the highest priority infestations using the Priority and Objectives setting approach defined in Chapter 1, applying the Decision Tree (Figure 1-3 in Chapter 1) to take into account sensitive resource factors, and then selecting the treatment practice most effective for that weed species infestation, and that which takes into account sensitive resources (using the Treatment Options Table [Appendix C]). As new infestations are detected and treated, the relative proportions of the various priority classes treated would shift but the total acres to be treated with a given method are expected to be similar to those represented here. Table 2-4 summarizes the results for the Proposed Action.

TABLE 2-4
Alternative 2–Proposed Action - Infested Acres Treated (current plus future)

Priority	Chemical				Mechanical		Grazing	Biological
	Ground Based		Aerial		Cutting	Hand Pulling/ Digging		
	Spot	Block	Spot	Block				
Overthrust Mountains								
1A	5				0.2	0.3		
1B	5							
1C						1		
3A	311	9	7			4	70	77
Total	**321**	**9**	**7**		**0.2**	**5.3**	**70**	**77**
Bonneville Basin								
2A	918	47	112					
Total	**918**	**47**	**112**					
Uinta Mountains								
1A	3	11				0.5		
2A	3	2						
Total	**6**	**13**				**0.5**		
Grand Total	**1245**	**69**	**119**		**0.2**	**5.8**	**70**	**77**

Note: 1,433 acres chemical @$300 = $429,900 + 6 acres hand pulling @ $2,000= $12,000 + 147 acres biological and grazing @$500 = $73,500 for a total of $515,400.

2.3.5 Alternative 3–Weed Treatment Excluding Herbicide Use

Alternative 3 responds to concerns about potential effects of herbicides by excluding chemical treatments from the options available for treatment. Estimated treatments were projected using current gross acres to represent future infested acres and by selecting the highest priority infestations using the Priority and Objectives setting approach defined in Chapter 1, applying the Decision Tree (Figure 1-3 in Chapter 1) to take into account sensitive resource factors, and by then selecting the treatment practice most effective for that weed species infestation, and that which takes into account sensitive resources (using *Appendix C*, *Treatment Options Table*), but excluding herbicide use. A cost cap equal to the total costs for treatment in the Proposed Action was used as the cutoff of total acres to be treated. This allows for ease of comparison between the two Action Alternatives. Table 2-5 summarizes the results for Alternative 3.

TABLE 2-5
Alternative 3–Treatment Excluding Herbicide Use Treatment Acres*

	Chemical				Mechanical			
	Ground Based		Aerial					
Priority	**Spot**	**Block**	**Spot**	**Block**	**Cutting**	**Hand Pulling/ Digging**	**Grazing**	**Biological**
Overthrust Mountains								
1A						5	0.18	
1B						5		
1C						1		
3A						9	233	233
Total						**20**	**233.18**	**233**
Bonneville Basin								
2A							443	
Total							**443**	
Uinta Mountains								
1A						6	9	
2A						1	4	
Total						**7**	**13**	
Grand Total						**27**	**689.18**	**233**

Note: 27 acres hand pulling @ $2,000 = $54,000 + 922 acres biological and grazing @ $500 = $461,000 for a total of $515,000.

Using an average cost of $2,000 per gross acre for mechanical (hand pulling) treatment, and $500 per gross acre for biological or controlled grazing, in this Alternative we could treat our known 1A, 1B, 1C, 2As, and some 3As for which hand pulling and grazing are options.

2.3.6 Management Practices and Mitigation Measures for All Alternatives

2.3.6.1 Revised Forest Plan

Best Management Practices (BMPs) for weed prevention and control are included in Appendix III of the 2003 W-CNF RFP, and in Appendix D of this document. This analysis assumes continuing improvement in application of these practices. Other RFP management practices and mitigation are included in Forest-wide Standards and Guidelines as follows:

2.3.6.1.1 Standards and Guidelines for Watershed, Riparian, and Aquatic Habitat Health

(S2) Apply runoff controls during project implementation to prevent pollutants including fuels, sediment, oils, from reaching surface and groundwater.

(S4) Place new sources of chemical and pathogenic pollutants where such pollutants will not reach surface or groundwater.

(S7) Allow management activities to result in no less than 85 percent of potential ground cover for each vegetation cover type. (See RFP Appendix VII for potential ground cover values by cover type).

(G3) Proposed actions analyzed under the National Environmental Policy Act (NEPA) should adhere to the State Nonpoint Source Management Plan to best achieve consistency with both Sections 313 and 319 of the Federal Water Pollution Control Act.

(G4) At the end of an activity, allow no more than 15 percent of an activity area (defined in RFP Glossary) to have detrimental soil displacement, puddling, compaction and/or to be severely burned.

(G7) Manage Class 1 Riparian Area Greenlines for 70 percent or more late-seral vegetation communities as described in Intermountain Region Integrated Riparian Evaluation Guide (Forest Service 1992). Manage Class 2 Riparian Area Greenlines for 60 percent or more late-seral vegetation communities. Manage Class 3 Riparian Area Greenlines for 40 percent or more late-seral vegetation communities.

2.3.6.1.2 Standards and Guidelines for Biodiversity and Viability/Terrestrial and Aquatic Habitats

(S8) In Lynx Analysis Units (LAUs) with current habitat at 30 percent or more in unsuitable condition (defined in RFP Glossary), allow no vegetation management activities that would result in a further increase of unsuitable conditions.

(S12) Prohibit forest vegetation treatments within active northern goshawk nest areas (approximately 30 acres) during the active nesting period.

(S14) Allow no net decrease in areal extent of tall forb communities.

(G15) In goshawk habitat, design all management activities to maintain, restore, or protect desired goshawk and goshawk prey habitats, including foraging, nesting and movement.

(G18) In LAUs, design all management activities to maintain, restore, or protect desired lynx and lynx prey habitats, including foraging, denning and movement.

(G21) For projects that may affect Forest Service sensitive species, develop conservation measures and strategies to maintain, improve and/or minimize impacts to species and their habitats. Short-term deviations may be allowed as long as the action maintains or improves the habitat in the long term.

(G22) Use native plant species, preferably from genetically local sources (harvesting seed from a project area's native species prior to project implementation), in revegetation efforts to the extent practicable. If no native seed of suitable origin is available, then certified weed free non-persistent non-natives may be used.

(G23) Avoid actions on the Forest that reduce the viability of any population of plant species classified as threatened, endangered, sensitive or recommended sensitive. Use management actions to protect habitats of plant species at risk from adverse modification or destruction. For species that naturally occur in sites with some disturbance, maintain the appropriate level of disturbance.

(G24) Management activities that negatively affect pollinators (for example, insecticide, herbicide application, and prescribed burns) should not be conducted during the flowering period of any known threatened, endangered, and sensitive plant populations in the application area. An exception to this guideline is the application of *Bacillus thuringiensis*.

(G25) Integrated weed management should be used to maintain or restore habitats for threatened, endangered, proposed, and sensitive plants and other native species of concern where they are threatened by noxious weeds or non-native plants. When treating noxious weeds, comply with policy in the Intermountain Region's *Forest Service Manual 2080*, Supplement #R4 2000-2001-1 (RFP Appendix III [Appendix D in this document]).

(G28) Discourage introduction of non-indigenous plant and animal species to national forest lands.

2.3.6.1.3 Standards for Heritage Resources Management

(S32) Review undertakings that may affect cultural resources to identify potential impacts. Compliance with Sections 106 and 110 of the National Historic Preservation Act shall be completed before the responsible agency official signs the project decision document.

2.3.6.1.4 Wilderness Standards and Guidelines

High Uintas Wilderness:

MA-01-013 (G) Maintain natural vegetative composition and diversity.

MA-01-015 (G) Use Minimal Tool Analysis to control noxious weeds to protect wilderness and downstream values.

MA-O1-070 (G) Use Minimum Tool Analysis to determine most appropriate methods for implementation of projects and proposals. Minimum tool may include mechanized and motorized means.

Mt. Naomi, Wellsville Mountain, Mt. Olympus, Twin Peaks, Lone Peak, and Deseret Peak Wildernesses:

There are no standards or guidelines that specifically relate to noxious weed treatment in these areas.

2.3.7 Additional Management Practices and Mitigation Measures for Action Alternatives

In addition to the above direction, mitigation measures specifically associated with all weed treatments, ground-based application of herbicides, and aerial application of herbicides would be implemented as integral parts of weed treatment for Action Alternatives. The IDT reviewed a large number of potential mitigation measures before identifying measures to be applied to Action Alternatives. Four categories of mitigation measures were identified: 1) Buffer zones; 2) Operations; 3) Coordination; and 4) Chemical Application Protective Measures. Buffer zones are an important part of mitigation during herbicide use to minimize the risk of chemical drift or surface movement to non-target species and sensitive resources. Mitigation measures are listed in the following text.

2.3.7.1 Buffer Zones

The intent of these Buffer Zones is to prevent Sensitive Resources from lethal exposure.

1. No chemical herbicides will be used within a 100-foot radius of any potable water spring development.
2. No spraying of any herbicide will occur within 50 feet of open water when wind velocity exceeds 5 mph.
3. A 50-foot no-spray buffer zone will apply for broadcast or ‘block’ applications along all flowing water streams and ponded water bodies. A 15-foot, no-spray buffer will apply for spot applications along all flowing water streams and ponded water bodies. A 300-foot, no-spray buffer will apply around known amphibian breeding areas. Prior to spraying in sites with potential habitat, an ocular survey will be conducted for amphibian presence. Within this amphibian buffer zone, herbicide application will be limited to techniques that do not require sprays, such as wiping, wicking, or painting.
4. No spraying of picloram will occur within 100 feet of surface water when wind velocity exceeds 5 mph.
5. No aerial spraying will occur within 300 feet of developed campgrounds or residences.

6. A 100-foot buffer will be employed around known populations of sensitive plants during broadcast (block) applications.
7. A 300-foot, no-aerial-treatment buffer zone will be applied to sensitive plant populations.
8. Prior to aerial herbicide application, buffer zones and treatment areas will be delineated (flagged and mapped) and reviewed with the pilot.
9. "No-fly" zones will be designated to avoid disturbance to active nesting raptors. (Follow U.S. Fish and Wildlife Service [FWS] Utah Raptor Guideline).
10. To prevent lethal exposure, a 300-foot, no-aerial-treatment buffer zone will be used on all fish-bearing streams, lakes, and ponds.
11. A 100-foot, no-aerial-treatment buffer zone will be used on all non-fish-bearing perennial and intermittent streams, lakes, and ponds.

2.3.7.2 Operations

1. Herbicides approved for use by the Forest Service (approved and registered by the EPA) will be used only according to label instructions; and will be applied by State certified applicators or under their direct supervision.
2. Clean all equipment before leaving the project site when operating in areas infested with weeds. Equipment coming from outside the W-CNF must be cleaned prior to entering the W-CNF. Vehicles may be inspected to ensure equipment is cleaned.
3. Herbicide applicators will be familiar with and carry a Herbicide Emergency Spill Plan to reduce the risk and potential severity of an accidental spill. The plan will identify methods to report and clean up spills should they occur. Herbicide applicators will also carry spill-containment equipment.
4. A detailed project operation plan will be required prior to initiating a controlled livestock grazing treatment.
5. Specific label directions, recommendations, and guidelines will be followed to reduce drift potential (such as nozzle size and pressure, additives, and wind speed).
6. No spraying of any herbicide will occur when wind velocity exceeds 10 mph, as per State Department of Agriculture standards.
7. No more than one application of picloram in a treatment area will occur per year.
8. Vehicle-mounted boom sprayers will travel in an upstream direction to dilute over sprays, providing traffic safety is not jeopardized.
9. All aviation activities will be in accordance with *FSM 5700* (Aviation Management), *FSM 2150* (Pesticide Use Management and Coordination),

FSH 5709.16 (Flight Operations Handbook), *FSH 2109.14, 50* (Quality Control Monitoring and Post-Treatment Evaluation), and the W-CNF Aviation Plan. A Project Aviation Safety Plan will be developed prior to aerial spray applications.

10. Aerial herbicide application will occur only when winds are 6 mph or less and blowing away from sensitive resources.

11. Use spray detection cards in buffer zones near sensitive resources (streams, campgrounds) to monitor drift.

12. Spraying operations will not occur if precipitation is expected within 24 hours following the proposed application.

2.3.7.3 Coordination

1. When scheduling treatment activities, consider the seasonal harvesting periods of wildlife, fish, and plants to accommodate the needs of the public and Tribes.

2. Herbicide applications will be coordinated with permit holders within the project areas, as appropriate.

3. Coordinate with wildlife biologist before applying herbicides on big game winter range to minimize impacts to winter forage.

4. Adjacent campgrounds within the project area will be closed during the application period.

5. Adjacent landowners and affected permit holders will be notified in advance of aerial herbicide applications.

6. Provide public notice at least 7 days in advance of planned herbicide treatments by posting notices on developed recreation site bulletin boards in the area.

2.3.7.4 Chemical Application Protective Measures

1. Chemical Application (Including aerial and ground-based application of chemicals)

   a. Complete a Pesticide Use Proposal (PUP) on a yearly basis. Complete a Pesticide Application Record (PAR) daily, or as required. Identify general treatment areas, methods, and dates, and make this information available at the Ranger District offices.

   b. Calibrate equipment often enough to ensure the application of the proper amount of herbicide.

   c. Application of any herbicides to treat weeds shall be performed by or directly supervised by a state licensed applicator.

   d. Herbicide applications shall be coordinated with permit holders within the project areas, as appropriate.

   e. Notify adjacent landowners prior to treating weeds on NFS lands.

   f. Follow label directions and guidelines to reduce drift potential (nozzle size and pressure, additives).

   g. Use dyes as necessary to ensure uniform coverage. Post signs at visible sites (campgrounds, trailheads, road intersections) to notify the public of herbicide application in the area.

   h. Apply all chemicals in accordance with EPA registration label requirements and restrictions, and applicable laws and policies. Follow FSH 6709 and 2109, and FSM 2150 guidelines.

   i. Prepare a Herbicide Emergency Spill Plan that includes methods to report and clean up spills. Applicators will be required to be familiar with the plan and carry spill-containment and clean-up equipment.

   j. No chemical would be applied directly to sensitive plant species during spot treatments, and a 100-foot buffer would be maintained around known sensitive plant populations during broadcast treatments.

   k. Individuals who exhibit idiosyncratic responses, such as hypersensitivity to natural and synthetic compounds, will not be permitted to work on herbicide spray crews.

2. Aerial Application (In addition to the chemical application requirements listed previously)

   a. Before spraying, an aerial or on-the-ground inspection will be made to ensure no one is in the area.

   b. No aerial spraying shall occur within a 300-foot buffer zone from developed campgrounds, private residences, sensitive plant populations, raptor nest sites, portable water sources, and all streams, lakes, ponds, and wetlands. Delineate (flag and map) and review buffer zones and treatment areas with the pilot.

   c. Adjacent landowners and affected permit holders shall be notified in advance of aerial herbicide applications.

   d. Herbicide application shall occur when wind speed will not result in drift and effects to sensitive resources. Spray detection cards in buffer zones near sensitive resources (streams, campgrounds) may be used to monitor drift.

   e. No aerial herbicide applications shall be allowed within watersheds that supply a municipal water source.

3. Procedures for Mixing, Loading, and Disposal of Herbicides

   a. All mixing of herbicides will occur at least 100 feet from surface waters or well heads.

   b. Applicators will mix only those quantities of herbicides that can be reasonably used in a day.

   c. Mixers will wear a hard hat, goggles or face shield, rubber gloves, rubber boots, and protective overalls during mixing.

   d. All empty containers will be triple rinsed and disposed of by spraying near the treatment site at rates that do not exceed those on the treatment site.

   e. All unused herbicides will be stored in a locked building in accordance with herbicide storage regulations contained in FSM 2109.14.

   f. All empty and rinsed herbicide containers will be punctured and either burned or disposed of in a sanitary landfill.

   g. Any additional herbicide label requirements will be strictly followed during the mixing, loading, and disposal of herbicides.

2.3.8 Comparison of Alternatives

Table 2-6 summarizes and compares the potential environmental benefits and impacts of the No Action Alternative, Proposed Action, and Alternative 3 for each resource area. The Proposed Action followed by Alternative 3, would be the most effective of the alternatives evaluated in eradicating, controlling, and containing noxious weeds within the W-CNF and in benefiting a broad range of Forest resources. The No Action Alternative (Continuation of Current Management) would be the least effective of the alternatives evaluated in treating weeds and in benefiting most W-CNF resources because of the comparatively few acres of weeds that would be treated each year.

TABLE 2-6

Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Biological Resources			
Vegetation Resources and Noxious Weeds Indicator: ▪ Relative amount of weed treatment areas that will be in occupied W-CNF plant species at-risk habitat	Up to 126 acres treated annually, with up to 111 of these acres treated with herbicides. Greatest impacts to at-risk plant species are likely to result from indirect impacts caused by the continued spread of weeds.	Would cover more acreage and could potentially be more detrimental to at-risk plant species occurring in weed-infested areas. Indirect impacts are expected to be less than those under any other alternative because the curtailment of weed spread and control of current weed populations would be highest under this alternative.	No potential for adverse direct effects on native vegetation, at-risk plant species, and wildlife habitat integrity. Large acreages on the W-CNF would be difficult to treat except with biological controls
Aquatic Resources Indicators: ▪ Estimated concentration of herbicides in receiving waters ▪ Ability to meet state water quality standards for cold water fisheries	No data or reported instances indicate that any of the weed treatment activities on the W-CNF have or have not impacted aquatic resources and, therefore, they would not be expected to do so under the No Action Alternative. However, even the very limited spot treatment of weeds using herbicides in Forest management as proposed under the No Action Alternative could inadvertently result in the chemical contamination of aquatic habitat through an accidental spill of an herbicide. Unlikely that state water quality standards related to cold water fisheries would be exceeded under the No Action Alternative because 1) only up to 111 acres of the W-CNF would be chemically spot-treated annually; 2) most of the treated areas are associated with roadways and timber sales, and treatments generally occur on uplands; 3) herbicide spot applications would be according to label instructions and conducted or supervised by state-certified employees using hand application methods; and 4) continued use of currently applied Forest-wide Standards and Guidelines would minimize the risk of chemical contamination.	Each of the treatment methods can vary by weed species in effectiveness. The potential for adverse direct and indirect effects resulting from the proposed use of aerial and ground application treatments on the W-CNF is minimized by the numerous BMPs and mitigation measures that would be applied. Expanded use of chemicals would be accompanied by an increased potential risk to exceed water quality standards for coldwater fisheries under worst-case situations. The implementation of BMPs and mitigation measures would minimize the potential for chemical contamination from both ground-based and aerial herbicide applications.	No risk of herbicides affecting aquatic resources. No risk of herbicides affecting existing water quality standards for cold water fisheries or aquatic resources

TABLE 2-6
Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Wildlife Resources Indicators: ▪ Percent of total and distribution of TES species' habitats lost to or modified by treatment ▪ Percent of total and distribution of neotropical migratory bird habitats lost to or modified by treatment ▪ Percent of total and distribution of MIS habitats lost to or modified by treatment ▪ Percent of total and distribution of big game winter ranges lost to or modified by treatment	All of the direct and indirect effects of weed infestation on wildlife habitat are especially problematic for TES species because these species generally occur at low densities and they have already suffered habitat loss, degradation, and fragmentation from a variety of other sources. Reduction of forage on big game winter range because of weed expansion would severely reduce the carrying capacity of the winter range. This would result in big game mortality, particularly during severe winters, when forage is not available in sufficient quantity to support winter herds. It would also place more stress on big game winter ranges that are not weed infested.	All of the TES/MIS species would benefit from the aggressive weed treatment and restoration of habitat (where appropriate) following treatment because of a reduction in the rate of loss of native plant community productivity from weed expansion. Analysis of herbicide toxicity also applies to TES/MIS species and indicates no adverse effects would result from herbicide application other than possibly brief displacement during application. At the Proposed Action's rate of treatment, the W-CNF would substantially slow and eventually reverse the rates of weed spread and degradation of big game winter range compared to the No Action Alternative. Potential effects on big game resulting from herbicide dermal exposure or ingestion were determined to be insignificant.	Because the actual acres of weed infestations occur over a much larger area, both target and non-target plants would certainly be grazed, degrading TES/MIS habitat values. Weed infestations are likely to continue to spread at a fairly rapid rate, degrading TES/MIS habitat values and further reducing populations of these species. The lack of substantial weed control and weed infestations are likely to continue to spread at a fairly rapid rate, further degrading big game winter range. This would result in increased big game mortality, particularly during severe winters, when forage is not available in sufficient quantity to support winter herds. It would also place more stress on big game winter ranges that are not weed infested. No potential effects on big game from herbicide dermal exposure or from ingestion would occur under this alternative.

TABLE 2-6
Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Ecosystem Function and Biodiversity Indicators: ▪ Amount of at-risk plant species habitats infested by noxious weeds ▪ Amount of big game winter range lost to or modified by noxious weeds ▪ Amount of native vegetation by cover type infested by noxious weeds ▪ Amount of habitat (and percent of total available) by wildlife/cover type groupings lost to or modified by noxious weeds ▪ Amount of habitat within 300 feet on each side of streams containing noxious weed infestations	Ecosystem function would experience little to no impact from treatment of noxious weeds, but ecosystem function would be adversely affected by weed population expansion. As weed populations expand under the No Action Alternative, the hydrologic cycle would be disrupted. Weed expansion also has a detrimental effect on the food chain, which could impact the food web throughout the W-CNF. Food web stability, structure, and complexity can decline. Biodiversity and plant species richness for native vegetation and plant communities, wildlife habitat values, and sensitive species populations are likely to be severely compromised by the unchecked invasion of weeds. Likewise, these same vegetation resources can be compromised by unconstrained weed treatment efforts as well. Noxious weeds would continue to displace native vegetation at the same or higher rates than currently exist. This would mean continued declines in plant diversity and species richness across native plant communities. Declines in natural vegetative communities would result in declines in the quality of wildlife habitats as well.	Weeds would be aggressively eradicated, controlled, or contained using a variety of methods, and, where appropriate, treatment sites would be restored to native vegetation following treatment. Loss of native plant communities to weed infestations would decrease over time as weed populations are reduced and/or eliminated. As weed populations decline, the hydrologic cycle (where currently altered) would return to operating within normal parameters for the W-CNF. Food web support would be higher under the Proposed Action than with other alternatives because weed management is the most aggressive. it is unlikely that the combination of mechanical, biological, controlled grazing, and chemical treatments on 1,586 acres of weeds—where appropriate— would adversely affect native vegetation on the W-CNF to a great degree, although there is potentially more risk from direct effects of treatment under this alternative than Alternatives 1 or 3 simply because of the additional acres that would be treated and the number of acres treated by herbicide.	Direct and indirect effects on ecosystem function would be similar to those described for the Proposed Action, but would occur at a much slower pace because of no herbicide application. Indirect impacts on native plant diversity are likely to be greater under this alternative than the Proposed Action because weed expansion is more likely to occur without the use of herbicides and thereby impact diversity.
Physical Resources			
Soil and Geology Indicator: ▪ None were identified during scoping	The No Action Alternative could cause adverse effects on soil through increased erosion from weed-infested sites and, possibly, from erosion of disturbed and/or barren weed treatment areas.	The Proposed Action would benefit soil resources because of increased levels of weed control and eradication, slower weed population spread, and less total weed-infested acreage compared to existing conditions. This would result in improved soil protection in treated areas and reduced erosion both on and off the W-CNF.	A slightly increased use of mechanical weed treatments and associated soil disturbance under Alternative 3 would cause more negative impacts than the Proposed Action.

TABLE 2-6

Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Surface Water and Groundwater Quality Indicator: ▪ Estimated concentration of herbicides in receiving waters (surface water and groundwater)	The estimated concentration of herbicides in receiving waters, the ability to meet state water quality standards, and the potential effects on human health would not be expected to change from current conditions. However, even the very limited spot treatment of weeds using herbicides in Forest management as proposed under the No Action Alternative could inadvertently result in the chemical contamination of aquatic habitat through an accidental spill of an herbicide.	Weed treatment practices that would be used under the Proposed Action include the ground-based and aerial application of herbicides, mechanical weed treatment, biological controls, controlled livestock grazing, and combinations of these treatments. The likelihood of increased erosion, surface runoff, and sediment delivery to drainages—possibly resulting in water quality degradation—would decline as weed-infested areas are treated and reclaimed. The direct and indirect effects of chemical treatments under the Proposed Action would be expected to result in long-term improved streambank, riparian habitat conditions, and water quality. However, short-term disturbances may occur from vegetation removal and may have a slight negative effect on either water quality or aquatic resources in specific areas.	There would be no risk of herbicides contaminating the surface or groundwater resources of the W-CNF with this alternative. Approximately 949 acres of weeds would be treated annually under this alternative, compared to 1,586 acres under the Proposed Action. Because fewer treatment methods are available for treating weeds under Alternative 3, fewer acres would be treated annually, and it would take longer to achieve lesser levels of weed treatment success. It would take longer to realize some benefits to aquatic and riparian resources resulting from reduced erosion and sediment delivery at weed-infested sites to drainages. Because Alternative 3 does not include the use of herbicides, there would be no potential for the occurrence of any of the worst-case situations involving herbicide application.
Air Quality Indicator: ▪ None were identified during scoping	One effect would be potential drift from herbicide spraying onto non-target areas. Spot spraying would result in little drift because applications are made close to the ground's surface. A chemical odor may persist at spray sites for several hours following ground-based application. Other direct effects on air quality would include dust from spray vehicles and mechanical weed control efforts. Indirect effects on air quality from successful weed treatment would include localized reductions in airborne pollen from weeds and allergens at certain times of the year. It is anticipated that pollen levels across the W-CNF would gradually increase with the steady spread of weeds under this alternative.	A potential short-term direct effect on air quality is herbicide drift to non-target areas during aerial spraying. Chemical odor may persist at spray sites for several hours following ground-based or aerial application. Other direct effects would include increased dust and pollen from vehicles or mechanical treatments. Short-term mechanical treatments may lead to a small increase in smoke or haze in the immediate vicinity of the treatment area. None of the herbicides currently registered for wildland weed control are known to produce airborne by-products from burning treated vegetation in amounts that affect air quality. Because the Proposed Action would provide the greatest level of weed control compared to the other alternatives, it would result in the greatest reduction in airborne weed pollen and allergens in the affected area in the long term.	Short-term effects on air quality from herbicide application would not occur under this alternative because no chemicals would be used. The slightly more extensive use of mechanical treatments may result in localized increases in dust levels and temporary, but repeated, instances of air quality degradation. Temporarily increased dust levels from mechanical treatments, at least in localized areas, may extend over a long period of time. Beneficial effects of reduced weed pollen and allergens on any particular site would occur if weeds are reduced on that site. Individually, these effects may be too small to substantially benefit local air quality.

TABLE 2-6

Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Fire/Fuels Management Indicators: ▪ Acres of noxious weed treatments resulting in a change in fuel loading ▪ Acres not available for wildland fire use and prescribed fire because of weed infestations	The area of noxious weed establishment and spread is expected to increase steadily over time under the No Action Alternative. As the infested acres steadily increase, the area available for prescribed or wildland fire use would steadily decrease.	Each year under the Proposed Action, up to 1,433 acres of weeds would be treated with herbicides; up to 6 acres by hand; up to 70 acres by controlled livestock grazing; and up to 77 acres using biological controls. Reduction in fuel loading on these 1,586 acres of weeds would help to reduce the potential for rapid fire spread on these lands. The emphasis on chemicals also would help prevent re-growth of weeds in treated areas, ensuring that the fuel load reduction is sustained.	This alternative would treat up to 949 acres of weeds annually, or about 823 acres more than the No Action Alternative and 637 acres less than the Proposed Action. Fine fuels in areas not having successful or delayed weed control would increase, followed by an increase in the danger of fire ignition and rapid fire spread.
Economic and Social Resources			
Economics Indicator: ▪ Cost of a particular combination of treatments in an alternative relative to the benefit that would be derived from the alternative	If all susceptible acres became infested with noxious weeds, as may eventually occur under this alternative, a conservative estimate of the impact to the local economy would be at least the $3.95 per infested acre times the highly susceptible acres, or 404,300 acres. This loss to the local economies—both urban and rural—may total more than $1,597,000 annually, a conservative estimate (given the use of 1996 values).	A conservative estimate of the impact to the local economy would be the savings of currently infested, highly susceptible, wildland acreage (less than 2,800 acres), which amounts to approximately $11,000 (that is, $3.95 x 2,800 acres). In addition, the highly susceptible acres (404,300) that could potentially be treated to control or prevent future infestations amounts to a savings of more than $515,400 annually.	Second most aggressive approach to treating current and future infestations of noxious weeds within the W-CNF by treating the second highest number of acres (949) annually, but by limiting the treatment flexibility to non-chemical treatment methods. A conservative estimate of the impact to the local economy would be the savings of currently infested, highly susceptible, wildland acreage (less than 2,800 acres), which amounts to approximately $11,000. In addition, the highly susceptible acres (404,300 acres) that could potentially be treated to prevent future infestations would amount to less savings than the Proposed Action.

TABLE 2-6

Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Recreation and Visual Resources Indicators: ▪ Loss of recreation opportunity or a visual impact because of recreation area closure or warnings for treatment according to chemical label directions from treatment activities ▪ Loss of recreation opportunity or a visual impact because of weed infestations that create physical barriers (such as yellow starthistle, musk thistle, scotch thistle, and puncture vine on trails)	Weed treatments can adversely impact recreation opportunities during summer when treatment would occur. Visitors may have their access to certain areas temporarily limited, and their ability to participate in and enjoy their desired recreation activity may be restricted. This may occur to a limited extent as a result of chemical, ground-based spot treatments on up to 111 acres per year Noxious weeds are expected to continue to grow and spread at a rate faster than they are removed, reducing or possibly eliminating access to those areas by creating physical barriers; noxious weeds also would affect recreationists' abilities to participate in and enjoy recreation activities on the W-CNF. This is considered an adverse effect on those recreationists and recreation opportunities.	The range of weed treatment options available and treatment of up to 1,586 acres of weeds each year is expected to be adequate for successfully managing existing and potential future weed introductions to W-CNF recreation areas. By improving access to areas used for recreation that are currently blocked by noxious weeds, recreationists' abilities to participate in and enjoy recreation activities on the W-CNF would improve. Potential impacts on scenic resources during weed management activities would be short-term in any given location and would include dust from some weed treatment activities (for example, some mechanical treatments) and the presence and activities of personnel, vehicles, and equipment.	Fewer types of weed treatments (no herbicide application), would only treat up to 949 acres of weeds per year (approximately 0.08 percent of the W-CNF), and would require a greater use of controlled livestock grazing, biological treatments, and mechanical treatment. Treatment-related effects on recreation and visual resources would generally be the same as for the Proposed Action, but at a lesser degree with fewer acres being treated and no aerial or ground-based spray equipment being used.
Wilderness Resources Indicators: ▪ Areas infested within designated and recommended Wilderness areas (RFP Management Prescriptions 1.1, 1.2, 1.3, and 1.5) ▪ Location, timing, and duration of treatment activity within Wilderness areas	No more than 126 acres (on 300,000 acres of Wilderness Areas) of weed infestations on the W-CNF would be treated annually, consisting primarily of chemical spot treatments (up to 111 acres), controlled livestock grazing (12 acres), and hand pulling or digging weeds (3 acres).	The range of weed treatment options available and treatment of up to 1,586 acres (on 300,000 acres of Wilderness Areas) of weeds each year is expected to be adequate for successfully managing existing and potential future weed introductions to W-CNF Wilderness areas.	A combination of primarily controlled livestock grazing and biological treatments, and a lesser amount of mechanical treatment, would be applied on up to 949 acres annually (on 300,000 acres of Wilderness areas) of weed infestations on the W-CNF.
Roads and Roadless Areas Indicators: ▪ No significant issues or specific issues of concern were identified during scoping	No more than 126 acres of weed infestations would be treated. This treatment level would likely be far less than is needed to successfully manage existing and potential future weed infestations along the more than 1,000 miles of roads present on W-CNF management areas.	Range of weed treatment options available and treatment of up to 1,586 acres of weeds each year is expected to be adequate for eradicating, controlling, and/or containing existing and potential future weed introductions along W-CNF roads. This also would contribute to the successful management of existing weed infestations and prevention of new weed infestations in roadless areas.	A combination of primarily controlled livestock grazing and biological treatments, and a lesser amount of mechanical treatment, would be applied on up to 949 acres annually of weed infestations on the W-CNF.

TABLE 2-6

Comparison of Effects Between Alternatives as a Function of the Issue and Indicator

Resource Area	No Action Alternative	Proposed Action	Alternative 3
Human Health and Safety Indicators: ▪ Pounds of active ingredient applied by workers ▪ Acres treated and pounds of active ingredient applied and the intensity of use by visitors on those areas	Acute worker or visitor exposures through inhalation, incidental ingestion, and dermal contact are possible, though potential for effects is low. It would be reasonable to expect that cumulative human health risk from herbicide applications and immediately adjacent areas would be very low to nonexistent.	Direct and indirect effects as indicated under the No Action Alternative heading also apply to this alternative, but would have a greater probability of occurring given the larger area to which herbicides would be applied.	No exposure pathways where workers or visitors could be exposed to herbicides.
Cultural Resources/ Indian Trust Assets/ Treaty Rights Indicators: ▪ Amount of known cultural resource sites infested and/or treated.	Slight potential to impact cultural resources because of localized ground disturbing activities from very limited hand pulling and chemical treatment of weeds, resulting in potential adverse effects if the roots of weeds are attached to archaeological deposits. It is anticipated that these activities would result in no adverse effects on cultural resources because site-specific reviews by the Cultural Resources Specialist would occur before weed treatment activities commence.	Compliance with ARPA would be met through the identification of areas of concern for historic preservation and Native American issues and consultation with the Idaho SHPO and Tribes.	Would employ the same or similar actions as the Proposed Action, using identification and consultation to avoid adverse impacts.
Environmental Justice Indicators: ▪ No significant issues or indicators associated with environmental justice were identified during public scoping	Not applicable.	Not applicable.	Not applicable.

CHAPTER 3. AFFECTED ENVIRONMENT

3.1 Introduction

This chapter summarizes the physical, biological, and social environments of the affected project area and describes existing conditions relative to the resources issues that were listed in *Chapter 2, Alternatives*, in Tables 2-1 and 2-2. This chapter also provides the baseline for the comparison of effects among the No Action Alternative (Alternative 1), the Proposed Action (Alternative 2), and the Weed Treatment Excluding Herbicide Use Alternative (Alternative 3) presented in *Chapter 4, Environmental Consequences*. As discussed in *Chapter 1, Purpose and Need*, the affected project area consists of three distinct geographic areas (also referred to as "sections"): the Overthrust Mountains (Wasatch and Bear Mountain Ranges), the Uinta Mountains, and the Bonneville Basin (Stansbury Mountains).

3.2 Project Area Setting

At the broad biophysical scale the Wasatch-Cache National Forest (W-CNF) is a part of three large geographic areas, or "ecological sections" (as defined by McNab and Avers [1994]): the Uinta Mountains (northern portion), Overthrust Mountains (Wasatch and Bear River Ranges), and Bonneville Basin (Stansbury Mountains portion). Each section has its unique geology, climate, vegetation, wildlife, and associated ecologies (see Figure 3-1).

The W-CNF provides a wide range of resources and opportunities including diverse habitats that support a wide range of wildlife, fish, and plant species. Its watersheds provide essential habitat for a number of endangered, threatened, and sensitive species of flora and fauna, as well as culinary watersheds for communities large and small. A diverse range of wilderness opportunities exists from those adjacent to major metropolitan areas along the Wasatch Front to remote areas in the northeastern part of the state. Economically, timber, mining, ranching, tourism, and agricultural in the bottomlands have contributed to the state's vitality. The Forest includes traditional homelands of the Goshute, Northwestern Shoshone, and Ute Tribes. A portion of the historic Donner-Reed/Mormon Pioneer Trail also is located on the Forest.

3.2.1 Climate

The major forest areas in Utah occur in the high mountains where the climate is humid and the precipitation is 22 to 40 inches annually. Generally, precipitation is the result of three types of storm systems: 1) winter storm fronts that move across the state from the west or northwest primarily from October through May; 2) cold lows that form over Nevada or southern Utah principally during October or late April and May and then drift across the state accompanied by gentle rain or snow; and 3) summer thunderstorms that develop in the summer months from the Gulf of Mexico (Wilson *et al.* 1975).

Strong temperature inversions occur in most valleys during the winter months. The freeze-free season ranges between 160 and 180 days on elevations near the tops of the inversions. It is 80 to 90 days in the bottoms of some of the colder valleys and less than 20 days on the tops of the higher mountains. Average wind speeds generally range between 7 and 12 miles per hour in the lower valleys but increase to 15 to 20 miles per hour on the mountain tops (Wilson *et al.* 1975).

3.2.2 Geography

The W-CNF is located in north and north-central Utah and southwest Wyoming. The net National Forest acres within the administrative unit are approximately 1,324,000 acres, of which 37,762 are in Wyoming. The National Forest lands are located in 12 counties: Box Elder, Cache, Davis, Duchesne, Morgan, Rich, Salt Lake, Summit, Tooele, Wasatch, and Weber in Utah, and Uinta in Wyoming. The W-CNF workforce manages lands located in the Wasatch, Uinta, and Stansbury mountains.

3.2.2.1 Overthrust Mountains

The analysis area located within the Overthrust Mountains Section is typically steep and rugged with elevations between 5000 and 11300. This analysis area receives large amounts of precipitation (16 to 40 inches annually), much of it as snow; these snowfields are important sources of late summer stream flow and are typically the source of spring snowmelt flooding. This analysis area consists of nine major drainages (Fifth Field Hydrologic Unit Codes [HUCs]) (Logan, Blacksmith Fork, and Little Bear to the north; Weber, Ogden, and Lost Creek centrally located; and Big Cottonwood, Little Cottonwood and Mill Creek to the south).

3.2.2.2 Uinta Mountains

The analysis area located within the Uinta Mountains Section is typically steep and rugged with elevations between 7000 and 13600. This analysis area receives large amounts of precipitation (8 to 35 inches annually), much of it as snow. These snowfields are important sources of late summer stream flow and are typically the source of spring snowmelt flooding. The eastern half of this analysis area consists of four major drainages (Fifth Field HUCs) (Blacks Fork, Smith Fork, Upper Henrys Creek, and Cottonwood Creek). The western half of this analysis area is drained by the headwaters of the Beaver, Weber, Duchesne, and Provo rivers.

3.2.2.3 Bonneville Basin

The analysis area located within the Bonneville Basin (Stansbury Mountains Section) is typically steep and rugged with elevations between 5500 and 11000. This analysis area is in a mountain range of the Great Basin west of Tooele, Utah. Average annual precipitation is typically low, between 4 and 10 inches. Consequently, there are no large rivers flowing in this area; the largest streams are about 10 to 20 feet wide.

Click here to view Figure 3-1 (0.7 MB)

3.3 Biological Resources

3.3.1 Vegetation Resources and Noxious Weeds

3.3.1.1 Analysis Method

The following documents, information, and data analysis sources were reviewed and/or used in the preparation of the *Vegetation Resources and Noxious Weeds Section*. This information provides the basis for describing the affected environment and the baseline for analyzing and comparing potential effects in Chapter 4 of the Proposed Action and alternatives on vegetation and plant resources in the analysis area.

- *Wasatch-Cache National Forest (W-CNF) Noxious Weed Strategy* (Forest Service 2004a).
- Data from field observations and maps produced in 1999 from Range Management Specialists across the W-CNF.
- Updated field observations and map information provided by W-CNF personnel, including range specialist, range technicians, and forest botanists in 2004.
- GIS map layers provided by Dr. Steven Dewey, Professor at Utah State University; provided information, both on and off the Forest, for areas in Box Elder, Rich, and Cache Counties (Dewey 1997, Dewey 1999, and Dewey 2000).
- *Salmon-Challis National Forest Noxious Weed Management Program Environmental Impact Statement (EIS)* (Forest Service 2003b).

The National Forest Management Act (1976) and Forest Service Policy require that Forest Service Lands be managed to maintain viable populations of all native plant and animal species. A viable population is defined as a population that has a large enough distribution of reproductive individuals to ensure the continued existence of the species throughout its existing range. Plant species discussed in the analysis are determined by policies, acts, and statues.

Plant species that are federally listed as threatened, endangered, or proposed for listing, are protected under the Endangered Species Act (ESA) of 1973 and Forest Service regulations (FSH 2609.25 and FSM 2670), as are candidate species and species of concern (those species with sufficient biological information and existing threats to warrant listing by the U.S. Fish and Wildlife Service [FWS]). Sensitive species are similarly protected under the Regional Forester's Sensitive Species Program. For sensitive species, management efforts to maintain their population viability and preservation are already in place. The Forest Service management policy (FSH 2609.25, 1.25, 1988 and FSM 2670) ensures that for all threatened, endangered, proposed, and sensitive (TEPS) plant species, the following measures will be taken: 1) biological evaluations will be written for all activities that may impact sensitive species and their habitat; 2) "effects" of activities will be determined as similar to those for threatened, endangered, or proposed species; and 3) sensitive species must receive special management emphasis to ensure their viability and to preclude trends toward

endangerment that would result in the need for federal listing. This Forest Service management policy will be employed at a species level in all alternatives to ensure its mandates are achieved and that sensitive species are conserved. In addition, the 2003 Forest Plan provides the following direction (in Forest-wide Guideline 23), related to rare plants on the W-CNF: Avoid actions on the Forest that reduce the viability of any population of plant species classified as Threatened, Endangered, Sensitive, or Recommended Sensitive.

Additionally, special management direction can be designed and implemented for TEPS to ensure their protection and recovery under all Forest Service management activities. Conservation assessments, strategies, agreements, and recovery plans outline the current status of such species and detail management needs to promote conservation and recovery of all TEPS plants and at-risk plant species. Many species currently found on the W-CNF have signed Conservation Strategies/Agreements and Recovery Plans (threatened species) in place. All existing strategies and plans along with future plans for these plant species will be met and upheld to provide for viability, conservation, and recovery of these species.

Additional laws and policies that govern vegetation within the W-CNF include:

- **National Forest Management Act, 1976.** This law states that Forest plans must “provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area.’’
- **Ecosystem Management.** In 1992, the Chief of the Forest Service issued a statement committing the Forest Service to the practice of ecosystem management, which is an ecological approach to managing National Forests and grasslands for multiple uses.
- **36 CFR 219.27(g)** states that management prescriptions, where appropriate and to the extent practicable, shall preserve and enhance the diversity of plant and animal communities.
- **36 CFR 219.19** requires the Forest Service to identify and prevent the destruction or adverse modification of habitat determined to be critical for threatened and endangered species. It states that fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species. Viable populations are defined as those with sufficient numbers and distribution of reproductive individuals to ensure their continued existence in the planning area.
- **36 CFR 219.19(a)** also directs the Forest Service to select management indicator species (MIS) to estimate the effect each alternative has on fish and wildlife habitat and its subsequent effect on wildlife populations, vegetation communities, and other ecological components; consult with biologists from other agencies; consider access and dispersal problems of hunting, fishing, and other uses; and, evaluate the effects of pest and fire management and the population trends of selected MIS.

3.3.1.2 Analysis Area

Specific boundaries to the analysis area for vegetation resources are described in *Section 3.2.2, Geography*. The analysis area includes parts of three different geologic

landforms and ecological sections (McNab and Avers 1994). The Uinta Mountains (Uinta Mountains Section) and the Stansbury Mountains (Bonneville Basin Section) are geologically less diverse than the Wasatch Mountains, including the Bear River and Wasatch Ranges (Overthrust Mountains Section). In addition, precipitation patterns are more variable within the Wasatch Mountains because of the common "lake effect" from storms moving across the Great Salt Lake and dropping more water, often in the form of snow, in areas primarily to the east and southeast of the lake. Both of these factors cause the Wasatch Mountains to have a much greater diversity in vegetation patterns than elsewhere on the Forest.

Vegetation is not a static covering over the land; it is a dynamic composition of plant species of various heights, canopy cover types, and age classes. Vegetation components are all in continual flux, growing, maturing, and dying at various rates. This creates a rich mosaic of species (composition), age classes (structure), and distributions (pattern) of plant communities across the landscape. Ecological functioning of vegetation provides for essential life processes such as watershed protection, water and nutrient cycling, soil building, and habitats for wildlife, from birds and big game to fish, insects, and soil microbiotic communities. Gaps in this vegetation mosaic are quickly filled—if not by native, early seral plant species, then by non-native/exotic species (weeds). When noxious weeds invade into ecologically functioning landscapes, they can sometimes instigate substantial changes to ecological functioning, even to the degree that such functioning becomes at risk. Noxious weeds have been found to impact proper functioning to such a degree that their presence is one of the four indicators of impaired rangeland health and functionality (O'Brien *et al.* 2003). Properly functioning ecosystems are typically more resilient because their diverse assortment of species fills all available niches making them less susceptible to weed invasion (Sheley *et al*. 1996; Sheley *et al.* 1999a). However, even in properly functioning habitats, relatively small soil disturbances can allow weeds the foothold they need to invade (Sheley *et al.* 1999b). Small disturbances can make a habitat susceptible and invading plants spread if they encounter susceptible habitat (Zamora and Thill 1999). Restoration of impaired plant communities into diverse properly functioning plant communities are believed to be the key to making these landscapes less susceptible and more "weed resistant" (Roundy 2005).

3.3.1.3 Existing Conditions

3.3.1.3.1 Noxious Weeds

Noxious weeds are plant species that are legally designated as "noxious" by a Federal, State, or county government. Table 3-1 lists noxious weed species found on the W-CNF.

TABLE 3-1
W-CNF Weed List

Scientific Name	Common Name	Status
Aegilops cylindrica [a]	Jointed goatgrass	County Noxious
Arctium minus [b]	Common burdock	State Noxious (WY)
Cardaria draba [a]	Whitetop/Hoary cress	State Noxious
Carduus nutans [a]	Musk thistle	State Noxious

TABLE 3-1
W-CNF Weed List

Scientific Name	Common Name	Status
Centaurea diffusa [a]	Diffuse knapweed	State Noxious
Centaurea maculosa [a]	Spotted knapweed	State Noxious
Centaurea repens [a]	Russian knapweed	State Noxious
Centaurea solstitialis	Yellow starthistle	State Noxious
Cirsium arvense [a]	Canada thistle	State Noxious
Conium maculatum [a]	Hemlock (Poison?)	County Noxious
Convolvulus arvensis [a]	Field bindweed	State Noxious
Cynodon dactylon	Bermudagrass	State Noxious
Cynoglossum officinale	Houndstongue	County Noxious
Euphorbia esula [a]	Leafy spurge	State Noxious
Euphorbia myrsinites	Blue spurge	Invasive
Hyoscyamus niger [a]	Black Henbane	County Noxious
Hypericum perforatum [a]	St. Johnswort	County Noxious
Isatis tinctora [a]	Dyer's woad	State Noxious
Lepidium latifolium [b]	Perennial pepperweed	State Noxious
Linaria dalmatica [a]	Dalmatian toadflax	County Noxious
Linaria vulgaris	Yellow toadflax	County Noxious
Lythrum salicaria	Purple loosestrife	State Noxious
Onopordum acanthium [a]	Scotch thistle	State Noxious
Taeniatherum caput-medusae	Medusahead	State Noxious
Tamarix sp.	Salt cedar	Exotic Invasive
Tribulus terrestris [b]	Puncturevine	County Noxious
Verbascum virgatum [b]	Wand mullein	Exotic Invasive

[a] Recorded infestations on the W-CNF
[b] Known locations but no formal documentation

Table 3-2 provides information regarding the sites these weed species are likely to invade. Included in these tables are species that are not classified as noxious weeds by either one or both of the states, but that are of concern because of their status in adjacent States, potential to become state or county noxious weeds, or because of their poisonous or injurious characteristics.

TABLE 3-2
Potential Habitat for Known Established, New, and Potential Weed Species on the W-CNF

Common Name	Scientific Name	Life Cycle	Habitat Criteria and Site Adaptation	Mode of Reproduction
Jointed goatgrass	*Aegilops cylindrica*	winter annual	Wheatfields, grasslands, roadsides, fence rows, and other agriculture sites.	Seeds (viable in soil up to 6 years).

TABLE 3-2
Potential Habitat for Known Established, New, and Potential Weed Species on the W-CNF

Common Name	Scientific Name	Life Cycle	Habitat Criteria and Site Adaptation	Mode of Reproduction
Whitetop (Hoary cress)	*Cardaria draba*	Perennial	Variety of non-shaded, disturbed conditions, including roadsides, waste places, fields, gardens, feed lots, watercourses, open grasslands, and along irrigation ditches. Not particular about soil type, even saline soils, except for highly acidic soils. Most aggressive, rapid expansion occurs in irrigated conditions or during moist years.	Seeds (viable 3 years) and deep creeping roots.
Musk thistle	*Carduus nutans*	Biennial or winter annual	Musk thistle does best after disturbances such as along roadsides, grazed pastures, burned areas, and old fields, but also can invade deferred pastures and native grasslands. It can occur in almost all habitats except dense forests, high mountains, deserts, and frequently cultivated farmlands.	Seeds (prolific seed producer, seeds viable up to 10 years).
Diffuse knapweed	*Centaurea diffusa*	Annual, biennial, or short-lived perennial	Disturbed or overgrazed lands are prime habitat, but can also invade undisturbed grasslands, shrublands, riparian communities, forested benchlands, and rugged terrain.	Seeds (up to 18,000 per plant).
Spotted knapweed	*Centaurea maculosa*	Biennial or short- to long-lived perennial	Best adapted to well-drained, light-textured soils in areas that receive some summer rainfall. This includes ponderosa pine and Douglas-fir forests and shrub-steppe habitats with bluebunch wheatgrass (*Agropyron spicatum*), needle-and-thread (*Stipa comata*), and Idaho fescue (*Festuca idahoensis*).	Seeds (viable up to 8 years) and lateral shoots.
Russian knapweed	*Centaurea repens*	Long-lived perennial (75 years)	Prefers heavy, often saline soils of bottomlands and sub-irrigated slopes and plains. Commonly found along roadsides, riverbanks, irrigation ditches, pastures, waste places, clearcuts, croplands, and hayfields. Prefers similar sites to those occupied by basin wildrye (*Elymus cinereus*). Does not readily establish in healthy native vegetation, requires disturbance.	Rhizomes (new shoots arise from creeping roots, up to 27 root shoots/ft^2 and roots can reach depths to 23 feet). Relatively few seeds are produced (viable for 2 to 3 years).
Yellow starthistle	*Centaurea solstitialis*	winter annual or biennial	Best adapted to open grasslands with deep well-drained soils and average annual precipitation of 10 to 60 inches.	Seeds (up to 10 years dormancy and viability).
Canada thistle	*Cirsium arvense*	Perennial (several ecotypes)	Prefers and is invasive in prairies and other grasslands and riparian areas with deep, well-aerated, mesic soils, but also occurs in almost every upland herbaceous community, especially roadsides, abandoned fields, and pastures.	Seeds, shoots from lateral roots (dormant, buried seeds can remain viable for up to 26 years).

TABLE 3-2
Potential Habitat for Known Established, New, and Potential Weed Species on the W-CNF

Common Name	Scientific Name	Life Cycle	Habitat Criteria and Site Adaptation	Mode of Reproduction
Poison hemlock	*Conium maculatum*	Biennial, winter annual, or rarely perennial	Commonly occurs along roadsides, field margins, ditches, and in low-lying waste places. Can invade native riparian woodlands and open floodplains along waterways.	Seeds.
Field bindweed	*Convolvulus arvensis*	Perennial	Agricultural lands and areas with similar disturbance regimes (little competition, repeated disturbance, and high light) are ideal for growth of this species.	Seeds (viable up to 50 years) and creeping, deep roots.
Bermudagrass	*Cynodon dactylon*	Perennial	Disturbed lands, such as ditches, cultivated fields, and idle farmlands. Somewhat cold sensitive but drought and alkali tolerant.	Seeds and rhizomes.
Houndstongue	*Cynoglossum officinale*	Biennial	Well-adapted to forested areas, roadsides, meadows, pastures, and waste places, often found on gravelly, somewhat alkaline soils.	Seeds, attach to fur and clothing.
Leafy spurge	*Euphorbia esula*	Perennial	Occurs on untilled, non-cropland habitats, including both disturbed and undisturbed sites, especially abandoned cropland, pastures, rangelands, woodlands, roadsides, and waste places. Tolerant of a wide range of soils from rich, moist soils of riparian zones to nutrient-poor, dry soils of western rangelands. It is most aggressive in semi-arid situations where competition from associated species is less intense, so invades most rapidly on dry hillsides, dry prairies, or rangelands.	Seeds (viable up to 8 years, usually germinate within 2 years) spreading roots.
Blue spurge	*Euphorbia myrsinites*	Perennial	Prefers sites with dry, well-drained soils in full sun. Tolerates poor rocky or sandy soils. Freely self-seeds. Evergreen, typically shorter lived in areas with warm winter climates.	Seeds.
Black henbane	*Hyoscyamus niger*	Annual or biennial	Disturbed open sites, roadsides, fields, waste places, and abandoned gardens. Grows best in sandy or well-drained loam soils with moderate fertility. Does not tolerate waterlogged soils.	Seeds (seeds viable for 4 years).
St. Johnswort	*Hypericum perforatum*	Perennial	Rangeland and pastures (especially when poorly managed), fields, roadsides, forest clearings in temperate regions with cool, moist winters and dry summers. Grows best in open, disturbed sites and on slightly acidic to neutral soils. Does not tolerate saturated soils.	Seeds and rhizomes.
Dyer's woad	*Isatis tinctoria*	winter annual, biennial, or short-lived perennial	Invades disturbed sites in rangelands, croplands, dry woodlands, and pastures. Can also invade native grasslands that are not highly disturbed.	Seeds.

TABLE 3-2
Potential Habitat for Known Established, New, and Potential Weed Species on the W-CNF

Common Name	Scientific Name	Life Cycle	Habitat Criteria and Site Adaptation	Mode of Reproduction
Perennial pepperweed	*Lepidium latifolium*	Perennial	Can invade wide range of sites, but occurs most frequently in riparian zones, marshes, irrigation canals, wetlands, and floodplains. Can also prosper along roadsides, hay meadows, and rangelands.	Seeds and creeping roots.
Dalmatian toadflax	*Linaria delmatica*	Perennial	Rapidly colonize open or disturbed areas, especially roadsides, fences, rangelands, croplands, clearcuts, and pastures. Seedlings are ineffective competitors for soil moisture against established perennials and winter annuals, but, once established, both species of toadflax suppress other vegetation mainly by intense competition for limited soil water. Mature plants are particularly competitive with winter annuals and shallow-rooted perennials.	Seeds (up to 500,000 seeds per plant with viability up to 10 to 15 years) and creeping, lateral roots.
Yellow toadflax	*Linaria vulgaris*	Perennial	Rapidly colonize open or disturbed areas, especially roadsides, fences, rangelands, croplands, clearcuts, and pastures. Seedlings are ineffective competitors for soil moisture against established perennials and winter annuals, but, once established, both species of toadflax suppress other vegetation mainly by intense competition for limited soil water. Mature plants are particularly competitive with winter annuals and shallow-rooted perennials.	Seeds (up to 30,000 seeds per plant with viability up to 10 to 15 years) and creeping, lateral roots.
Purple loosestrife	*Lythrum salicaria*	Perennial	Grows in wetlands, bogs, along stream and river banks, lake shores, in ditches, and disturbed wet soil areas.	Seeds and rhizomes.
Scotch thistle	*Onopordum acanthium*	Biennial	Invades most habitats, dry to moist sites: waste places, roadsides, dry meadows, rangelands, pastures, and sometimes waterways.	Seeds (can remain viable for 30 years).
Medusahead	*Taeniatherum caput-medusae*	winter annual	Dry, arid rangelands and other areas disturbed by fires, overgrazed, or cultivation.	Seeds.
Salt cedar	*Tamarix* sp.	Perennial	Streams, canals, reservoirs.	Seeds and resprouting.
Puncturevine	*Tribulus terrestris*	Annual	Grows on disturbed sites where it needs relatively high temperatures for germination and growth. Adapted to a wide range of soil conditions.	Seeds (viable in soil 4 to 5 years).
Wand mullein	*Verbascum virgatum***	Biennial	Primarily a weed of pastures, hay fields, roadsides, rights-of-way, and abandoned areas where it adapts easily to a wide variety of site conditions. Prefers, but is not limited to, dry sandy soils. May not tolerate shade.	Seeds.

Species Composition, Abundance, and Extent

Figure 3-2 shows the locations of noxious weeds that are known to occur on the W-CNF. Table 3-3 lists all weeds that are currently on or are expected to soon invade the W-CNF. Other species may occur, but those listed have been identified on the Forest. Sections that follow discuss these noxious weeds by Management Areas.

TABLE 3-3
Noxious Weeds that are Known to Occur in the Three Ecological Sections of the Wasatch-Cache National Forest, Including Potential Invaders Adjacent to National Forest Land (unless noted, all plants are both Utah and Wyoming Noxious Weeds)

Common Name	Scientific Name	Wasatch and Bear River Ranges	Bonneville Basin	Uinta Mountains
Blue spurge	*Euphorbia myrsinites*	X		
Canada thistle	*Cirsium arvense*	X		X
Common burdock[a]	*Arctium minus*	X		
Dalmatian toadflax[a]	*Linaria dalmatica*	X		
Dyer's woad	*Isatis tinctora*	X		X
Field bindweed, morning glory	*Convolvulus arvensis*	X		
Houndstongue[a]	*Cyonoglossum officinale*	X		
Jointed goatgrass	*Aegilops cylindrica*	X		
Knapweed, diffuse	*Centaurea diffusa*	X		
Knapweed, Russian	*Centaurea repens*	X	X	
Knapweed, spotted	*Centaurea maculosa*	X	X	X
Leafy spurge	*Euphorbia esula*	X		
Medusahead[a]	*Taeniatherum caput-medusae*	X		
Musk thistle	*Carduus nutans*	X		X
Saltcedar[a]	*Tamarix spp.*	X		
Scotch thistle	*Onopordum acanthium*	X		
Wand mullein	*Verbascum virgatum*	X		
Whitetop	*Cardaria draba*	X	X	X
Yellow starthistle[b]	*Centaurea solstitalis*	X		
Yellow toadflax	*Linaria vulgaris*	X		

[a]Wyoming State Noxious Weed only
[b]Utah State Noxious Weed only

Click here to view Figure 3-2 (0.2 MB)

Overthrust Mountains

Cache-Box Elder Management Area. This management area likely has the greatest variety and concentration of noxious weeds on the W-CNF. The most common noxious weed in this management area is Dyer's woad. While most abundant along roadsides and travel ways, it extends away from these areas onto adjacent areas. It occurs at nearly all elevations in the Bear River Range and has been noted at the lower to mid elevations of the Wellsville Range. Estimated population sizes range from less than 0.1 acre to over 200 acres in Wellsville Canyon and over 650 acres in lower Logan Canyon. Leafy spurge has been found in both the Bear River and the northeastern portion of the Wellsville Range. It has been inventoried in the Wellsville Wilderness Area, Mount Naomi Wilderness and adjacent areas along South Canyon, High Creek, Cherry Creek and its tributaries, and City Creek. Leafy spurge occurs along the eastern slope on the Wellsville Range on Maple Bench and Coldwater Canyon, north to Three Mile Canyon. Musk thistle has been noted at two locations in Logan Canyon: near Wood Camp and along Bear Hollow. In addition, it has been found on the eastern portion of this management area and in the Bear Management Area at five locations within the North Rich cattle allotment. Canada thistle occurs primarily along streams throughout the management area, but mostly in the Bear River Range. Hemlock has been noted in Left Hand Fork Blacksmith Fork, Providence Canyon, Right Hand Fork, Franklin Basin, and Spawn Creek. Dalmatian toadflax has been noted in Cowley Canyon south of the Logan Canyon Highway. Russian knapweed has been located in Logan Canyon near Beaver Mountain and spotted knapweed has been found in Mill Hollow. Black henbane has been noted near Temple Fork and Saddle Creek Narrows, and has been observed at other locations on the Logan district, but not mapped. It is common throughout this management area and on adjacent cultivated lands.

Bear Management Area. Rich County, in which this management area occurs, has a high concentration of noxious weeds and influences the occurrences of these species on the Forest. The most commonly found weeds in Rich County, both on and off the Forest, include houndstongue, black henbane, Canada thistle, and musk thistle (Dewey 2000). Of the species found within the Bear Management Area, Canada thistle and houndstongue (on sagebrush and other, more open sites) were the most common occurrences. Musk thistle, while not as abundant, was also present as were Dyer's woad, poison hemlock, hoary cress, and black henbane. While not inventoried and mapped, whitetop has been noted as occurring in Rich County (Welsh *et al.* 2003), and is likely to occur in this management area as well.

North Wasatch-Ogden Valley Management Area. Dyer's woad is abundant on lands adjacent to the Forest and is spreading onto the Forest primarily along travel ways. Among other locations, it occurs in the campgrounds in South Fork Canyon, on the Bonneville Terrace, and along the newly built road to Snowbasin Ski Area. It occurs along the benches in Davis County and became abundant following the Farmington Canyon Fire of 2003, on the south side of Farmington Canyon. Here, it occurs within oak and oak-maple communities that burned, as well as on the more open slopes occupied by sagebrush and on slopes occupied by a variety of non-native species. Whitetop has been noted in lower Farmington Canyon, but likely occurs elsewhere. Spotted knapweed has been noted in Weber Canyon. It is not clear whether this population is on National Forest

lands or on adjacent private lands, but it would be the highest priority for treatment. Jointed goatgrass occurs on small areas along an existing dirt road on the foothills north of Farmington Canyon. Yellow starthistle has been found near the Forest, near the mouth of Weber Canyon, north of Ogden, and likely occurs elsewhere. Like other knapweeds, this aggressive invader will likely spread onto National Forest lands if left unattended. Dalmatian toadflax has been found on lands immediately to the west of the Forest on the south side of Farmington Canyon (on the road going to Farmington Canyon) on the Bonneville Terrace. Tumble mustard was reported along the newly built road to Snowbasin Ski Area, but has not been positively identified as yet. Should this species, in fact, occur in this area, it will be added to the Forest's Noxious Weed list and treated as an aggressive invader.

Central Wasatch Management Area. Dyer's woad is abundant on the lower elevations, especially along the Bonneville Terrace, in this management area and is spreading up canyon travel ways. Whitetop has been noted in Red Butte Canyon, but likely occurs elsewhere. Dalmatian toadflax is abundant along the foothills and along travel ways in the canyons on the western portion of this management area, but has also been found at a site in Little Cottonwood Canyon on soils brought in for restoration work. It also has been found on the Bonneville Terrace immediately south of Red Butte Garden Arboretum between Red Butte and Immigration canyons, but is likely more widespread. In addition, wand mullein, which is not currently a Utah noxious weed, but which has the potential to be very invasive, has been found in Albion Basin near the parking lot at the top of the old Sunnyside Ski Lift and under the new Albion Ski Lift. Jointed goatgrass has been noted in the drainage ditches along the highway in the lower portion of Big Cottonwood Canyon. Yellow toadflax has been found about 0.3 mile east of the proclaimed Forest Boundary on private lands near Guardsman Pass. This population, which was less than 0.1 acre in size, was hand-pulled in 2004, but should be monitored for the next several years to determine whether or not it has been persistent. Canada thistle, while not mapped, occurs in this management area primarily in moist riparian areas. More noxious weeds occur in this management area, but have not been inventoried by the Forest.

Bonneville Basin

Stansbury Management Area. Whitetop has been noted along many drainages in the Stansbury Mountains including, but not limited to, North Willow, South Willow, Big Hollow, Barlow, Spring Creek, Round, Big Granite, Monument, and Chokecherry Canyons. Russian knapweed has been found in South Willow Canyon just above the Forest boundary and occupied less than 0.1 acre in 2004. Spotted knapweed has been found just off the Forest on the west side of the range. Other species are likely to occur, but have not been inventoried.

Uinta Mountains

Western Uintas Management Area. Dyer's woad is beginning to expand into this management area from adjacent areas to the west. While it has only been noted at one location along Beaver Creek east of Kamas, it is on several sites south of Evanston where it has been identified near Carrot Hollow, Moffit East Fork, near Stillwater Campground, and near the Bear River. Whitetop has been noted in many of the same areas as well.

Canada thistle is common throughout this management area, most abundantly in riparian areas adjacent to streams and open water, while musk thistle has been noted in Rileys, Smith-Morehouse, Nobletts, Swifts, and Left Hand canyons, as well as in scattered locations on the northslope of the Uinta Mountains in this management area. Russian knapweed occurs along Highway 150 immediately south and west of the Forest boundary, near the town of Samak. Also on the Kamas District, yellow toadflax occurs in Slate Creek about 0.5 mile above State Highway 150. Dalmatian toadflax has also been found on the lower portion of the Upper Setting Road and in the Cedar Hollow portions of the Kamas District. Spotted knapweed occurs along roadsides in the town of Kamas and has potential to invade sagebrush slopes on the foothills of the Forest just to the east. It also occurs on private property in the lower portion of Highway 150 east of the town of Kamas.

Eastern Uintas Management Area. Canada and musk thistle are common throughout this management area. In addition, Dyer's woad has been found near the East Fork Smiths Fork and Little Dry Creek. Whitetop has been noted near Henrys Fork and spotted knapweed has been found near the Forest boundary south of Mountain View.

Weed Ecology, Invasion and Spread, Habitat Criteria, and Site Adaptation

Most habitat criteria for weeds are fairly broad, which is one of the characteristics that makes these species so successful in adapting to new environments. Other general characteristics that often aid in the invasion and spread of weeds are their high reproductive potentials; adaptations to disturbed sites; allelopathic (toxic) compounds that provide weeds a competitive edge by suppressing growth of other vegetation; poisonous compounds, latex sap, barbs, or prickles that make weeds unpalatable; and/or their lack of natural enemies outside their native country and range.

The Forest Service (2001a, 2001c, 2001d) summarized information on the dynamics of weed invasions (Cousens and Mortimer 1995) and methods of weed spread (Roche and Roche 1991), which is presented in the following text. Weeds generally invade a region through a three-phase process, as described by Cousens and Mortimer (1995):

1. Introduction—Because of dispersal, seeds or plant fragments arrive at a site beyond their previous geographic range and establish populations of adult plants. Potential new invaders from Wyoming, such as spotted knapweed, are likely to become a serious problem if allowed to advance beyond the introduction phase.

2. Colonization—Plants in the founding population reproduce and increase in number to form a self-perpetuating colony.

3. Naturalization—The weed species establishes new self-perpetuating populations, undergoes widespread dispersal, and becomes incorporated within the native flora. For example, leafy spurge is becoming naturalized in some areas of the western part of the W-CNF ecosystem. Some noxious and invasive weed species, such as leafy spurge, are able to displace native species once they become established into native vegetation on the W-CNF.

Invasion and range expansion by a weed involves all three phases. Typically, plant invasions do not occur along a single front. Instead, new outbreaks initiated by long-distance dispersal become the centers for shorter distance dispersal that eventually fills the gaps between them.

The rate at which weed populations expand can be very difficult to determine, and may be exponential (i.e., a constant proportional rate of increase), or two-phased (with sudden range expansion following a period of little increase in abundance).

It is typically only when the naturalization phase is reached that a weed species is likely to be considered a nuisance. Weed control efforts are then focused on limiting further spread of naturalized weeds into previously uninfested areas. Eradication is usually the goal for species considered to be new invaders at a more local level.

Methods of weed spread are not limited to, but include transport along Forest roads and trails, which serve as corridors for the dispersal of many weed species. Roche and Roche (1991) discuss the historical perspective of meadow knapweed invasion in the Pacific Northwest and cite many older studies documenting the influence of road systems. Weed seeds and plant parts are moved along road systems by vehicles and people, allowing the establishment of weeds into previously uninfested areas. Many of the road systems within the western perimeter, especially those that are adjacent to human population centers and access points into the Forest, contain infestations, for example, of Dyer's woad. Road corridors allow weeds to invade areas where ground disturbance has taken place (for example, old timber harvest, gravel pits, etc.). Weeds are also transported by wildlife and domestic stock. Weed seeds consumed by animals or birds or attached to their fur or feathers are carried into the Forest. Some weed seeds are dispersed by the wind, while others are transported to new sites by streams and rivers. In this manner, weeds have been able to occupy undisturbed habitats far removed from road or trail systems (Forest Service 2001a, 2001c, 2001d).

3.3.1.3.2 Plant Communities

The W-CNF has 21 plant communities that represent cover or vegetation types that have similar environmental conditions and are dominated by similar plants. Vegetation patterns (both distribution of cover types and the age class diversity within these types) in the three ecological sections of the W-CNF are a function of numerous factors. Geology, soil characteristics, elevation (temperature), and precipitation are among the factors that affect the occurrence of cover types across the landscapes. Natural succession and disturbance factors, as well as human-induced disturbance such as prescribed fire, fire control or suppression, timber harvest, livestock grazing, development, and other actions can affect the extent of cover types, and often affect the age class diversity within each cover type on the landscapes (see Table 3-4).

TABLE 3-4
Acres of Each Vegetation Type Within the Wasatch-Cache National Forest Portions of the Uinta Mountains, Overthrust Mountains, and Bonneville Basin Ecological Sections [a]

Cover Type	Overthrust Mountains Section	Percent within Overthrust Mountains	Uinta Mountains Section	Percent within Uinta Mountains	Bonneville Basin Section (Stansbury Range Only)	Percent within Stansbury Range	Total Forest-wide	Percent of Total
Alpine	1,400	0.2	17,700	3	600	0.9	19,700	1.6
Barren[b]	21,100	3.7	79,900	13.7	500	0.7	101,500	8.3
Limber Pine	11,500	2	0	0	0	0	11,500	0.9
Spruce-Fir	24,600	4.3	127,600	21.8	1,200	1.7	153,400	12.5
Mixed Conifer	16,000	2.8	135,700	23.2	0	0	151,700	12.3
Lodgepole Pine	8,200	1.4	53,100	9.1	0	0	61,300	5
Conifer-Aspen	23,400	4.1	23,600	4	0	0	47,000	3.8
Aspen-Conifer	21,800	3.8	34,000	5.8	0	0	55,800	4.5
Aspen	74,100	12.9	27,000	4.6	1,700	2.5	102,800	8.4
Douglas-fir	70,000	12.2	8,500	1.5	9,100	13.3	87,600	7.1
Ponderosa Pine	0	0	500	0.1	0	0	500	0
Bigtooth Maple	14,600	2.5	0	0	0	0	14,600	1.2
Gambel Oak	88,700	15.4	2,100	0.4	0	0	90,800	7.4
Tall Shrub	15,700	2.7	300	0.1	6,100	8.9	22,100	1.8
Mahogany	12,800	2.2	900	0.2	100	0.1	13,800	1.1
Juniper, Pinyon-Juniper	43000	7.5	700	0.1	33,200	48.4	76,900	6.3
Sagebrush/ Grasslands	122,100	21.2	51,800	8.9	15,700	22.9	189,600	15.4
Tall Forb[c]	3,200	0.6	0	0	0	0	3,200	0.3
Bottomland Hardwood	2,800	0.5	300	0.1	400	0.6	3,500	0.3
Wet Meadow	100	0	16,800	2.9	0	0	16,900	1.4
Willow	800	0.1	3,600	0.6	0	0	4,400	0.4
Total	**575,900**	**100**	**584,100**	**100**	**68,600**	**100**	**1,228,600**	**100**

[a] Percentages are for each cover type within the Wasatch-Cache portion of those ecological sections and for total Forest-wide area.

[b] Barren areas in the Uinta Mountains occur in the upper cirque basins in and below the Alpine cover type. Some have scattered vegetation and could more appropriately be included in the Alpine cover type.

[C] *While tall forb communities have not been mapped in the Stansbury Mountains (Bonneville Basin section), they do occur at subalpine elevations, especially on the eastear side of the range. In the Uinta mountains, tall forb communities and sites that historically supported tall forb communities, occur in the Western Unitas Management Area from the Whiteny Reservoir area on the east side to Hoyt's Peak on the west.*

Wasatch Mountains (Wasatch, Bear River and Wellsville Ranges)

Vegetation Patterns

The Wasatch Mountains occur within the Overthrust Mountains Section (Figure 3-3), which is a part of the Southern Rocky Mountain Steppe–Open Woodland–Coniferous Forest–Alpine Meadow Province (McNab and Avers 1994). These mountains extend from just east of Nephi on the south to southern Idaho where the Bear River turns south toward the Great Salt Lake (Cronquist 1972). In the W-CNF, the Wasatch Mountains includes the Bear River Range and Wellsville Mountains in the northern portion (separated by the Cache Valley) and the Wasatch Range in the south-central portion of the Forest. These ranges represent a transition from the Great Basin to the Rocky Mountains.

On the west-and south-facing slopes, juniper occurs from the Bear River Range west to the Wellsville Mountains and scattered along rocky ridges in the Wasatch Range. Juniper is also becoming more and more a part of the bigtooth maple communities between Wellsville and Brigham City.

Sagebrush (primarily with mature and old overstories) occurs from the lowest to subalpine elevations all along the Wasatch Mountains. Subalpine big sagebrush, mountain big sagebrush, and low sagebrush are non-sprouting species following fire. Spiked big sagebrush and silver sagebrush both sprout following fire. Mountain big sagebrush is probably the most common variety on the Forest, occurring at elevations from 4500 to over 9000 on deep, well-drained soil. Spiked big sagebrush is also very common in the Wasatch Mountains occurring above elevation 6800 on deep, productive soils. Subalpine big sagebrush occurs in the Bear River Range near Franklin Basin and generally occurs on shallower, more rocky and less productive soils than spiked big sagebrush. Low sagebrush occurs on rockier, well-drained sites that typically have very low forage production. Silver sagebrush occurs in the North Sinks region of the Bear River Range and occurs elsewhere in this range, but most abundantly on private lands. It is not known to occur in large stands anywhere in the Wasatch Range. It typically occupies very moist, almost riparian sites. Sagebrush communities form relatively large stands, often included in aspen, conifer, and mountain brush mosaics on the landscapes.

Click here to view Figure 3-3 (3.3 MB)

Tall forbs historically occurred in the Bear River Range as well as the Wasatch Range, but have experienced perhaps the greatest impacts of any vegetation community from historic livestock grazing. Few, if any, of these communities in the Bear River Range occur with the diversity of species that they once had. Willard Basin and Ben Lomond Peak between North Ogden and Brigham City, and Albion Basin in Little Cottonwood Canyon still have relatively large expanses of this type in more-or-less natural condition. In parts of the Bear River Range, this type has been converted to a tarweed-dominated type or has significantly fewer desirable species.

Bigtooth maple forms a rim along the relatively low-elevation slopes of the Cache Valley. Maple communities also occur in the draws, often succeeding the Gambel oak communities described below. In the Cache Valley, these maple communities are similar in habitat to Gambel oak communities that do not occur on this portion of the Forest, and that may be absent here because of colder temperatures held in the valley because of winter inversions. Rocky Mountain juniper is slowly increasing in occurrence in the maple cover type in some areas, but is not expected to replace maple in most areas.

Mature to old communities of Gambel oak are abundant on the west and south-facing foothills of the Wasatch Mountains from Brigham City south to the Uinta National Forest, but do not occur north of Brigham City. Maple communities tend to replace the oak, primarily in moister draws.

Douglas-fir usually occurs in mature to old age classes at lower forested elevations from the northern to southern borders of the W-CNF. Douglas-fir may be succeeded by white fir in the southern portion of the Wasatch Range north to, but not including, the Cache Valley. Very little white fir occurs north of this area, although a few individuals have been reported in Right Hand Fork Canyon south of Logan Canyon. White fir has increased its distribution in some areas because it has succeeded Douglas-fir. Several stands along the Wasatch Front have, however, been killed by western spruce budworm, Douglas-fir tussock moth, and the fir engraver beetle, which as noted above is at epidemic levels throughout the Wasatch Range from Ogden to the south.

Lodgepole pine occurs as narrow bands on north-facing slopes on the east side of the Bear River Range. Timber harvest has occurred in some of these stands, which adds some diversity to the age classes. In some portions of these communities, aspen is a co-dominant and the same age as the lodgepole pine. Both species quickly reestablish themselves following disturbances such as timber harvest and fire. A few populations occur in Big Cottonwood Canyon and may have been planted here in the early 20th Century.

Aspen occurs in conjunction with the lodgepole pine, mixed conifer, and occasionally Douglas-fir and spruce-fir communities. In these areas aspen is an early seral component that has been largely replaced by the later-seral conifers. Climax aspen occurs in the Monte Cristo portion of the Forest east of Ogden Valley and in portions of Big and Little Cottonwood Canyons east of Salt Lake City. It is considered to be climax in these areas, because a conifer component is largely missing, which may be the result of either different site conditions or more likely because of the lack of a conifer seed source.

Spruce-fir occurs at the highest elevations below timberline throughout the Wasatch Mountains. This type is generally dominated by Engelmann spruce, with subalpine fir a minor to dominant component and some scattered Douglas-fir at the lower range of this type.

Limber pine occurs at high elevations in the Wasatch Mountains on sites that are typically well drained and unable to support Engelmann spruce or subalpine fir. Understories are usually sparse, often with Oregon grape and kings fescue common components of the herbaceous layer.

Alpine communities are limited in their distribution within the Wasatch Mountains, but are most common in the Wasatch Range in the eastern portion of Salt Lake County. These communities are typically dominated by low-growing herbaceous species that occur on rocky sites at elevations above 10500.

Vegetation Cover Types and Disturbance Regimes

Alpine. This vegetation group is characterized by patchy (not generally turf-forming) vegetation with thin to nonexistent soils with rocky outcrops, fell-fields and boulders. Native perennial plant cover includes short meadow forbs, sedges and grasses, some low shrubs, and lichens and bryophytes. These are sensitive to even slight disturbance because recovery is very slow within this harsh environment.

Limber Pine. These open plant communities are a minor, but important, component of the Wasatch Mountains. These stands are dominated by Limber pine, which is mostly mature with some younger individuals scattered among older trees. Sites supporting this type usually have shallow, rocky soils. Canopies do not close and trees are distributed in sparse stands or widely spaced clumps of trees. In the northern Wasatch Mountains, Douglas-fir is present within limber pine stands while in the south both Douglas-fir and Engelmann spruce are intermixed. Fire regime is mixed severity with 100- to 150-year intervals between stand-replacing fires.

Engelmann Spruce-Subalpine Fir. Varying combinations of subalpine fir and Engelmann spruce, with aspen as an important seral species, make up this category. The spruce is long-lived (often exceeding 300 years), but susceptible to wind-throw (resulting in spruce beetle epidemics) while subalpine fir is shorter lived (100 to 150 years) and less disease resistant. Most stands have a multi-canopy structural condition, although much of the regeneration is subalpine fir, which is more shade tolerant. Historically, small fires (1/4 to a few acres) occurred regularly in this type either killing or weakening trees in these small areas. Large fires (a few to several hundred acres) every 200 to 300 years were common because of a combination of insect epidemics and fuel buildup. For the past 100 years fire suppression has allowed a buildup of fuels and higher stand densities, which cause insect activity to be more extensive and intense than characteristic historically. Beetle kill is potentially very high and it has been 200 to 300 years in most stands since the last large fires occurred. These conditions provide potential for larger areas (several hundred to a thousand or more) to be burned at one time and the higher accumulations of large woody debris and ladder fuels create conditions conducive to more intense fires outside the historical range.

Subalpine Fir. This vegetation type occurs primarily in the Bear River Range. Stands are co-dominated by pure subalpine fir or a mixture of subalpine fir with Douglas-fir. Aspen is a major seral species, which is being replaced by subalpine fir in many areas. Subalpine fir is shorter lived (100 to 150 years) and less disease resistant than Engelmann spruce. Fire historically played an important role in these stands, with replacement fires occurring on a 100-to 300-year cycle. Root disease is common and balsam bark beetle is at epidemic levels in the Wasatch Mountains. Currently many areas are dominated by mature to old age classes with fire suppression resulting in high stand densities and basal area along with ladder fuels, which could result in larger more intense fires than occurred historically.

Mixed Conifer. The Bear River mixed conifer communities occur at mid to high elevations in the Bear River Range east of Cache Valley and Ogden Valley. They are somewhat unique in their overstory dominance of subalpine fir, with or without Douglas-fir and lodgepole pine. Occasionally limber pine occurs as scattered individuals near the Sinks area of the Bear River Range. This type is generally at transition between the high elevation spruce-fir communities and the Douglas-fir or lodgepole pine communities at mid or lower elevations.

Lodgepole Pine. A relatively small amount of this cover type occurs within the Wasatch Mountains, and it does not grow in the classic large monocultures covering thousands of acres such as in Yellowstone or the Uinta Mountains. Instead, lodgepole pine here (primarily on the east side in the “Bear Management Area”) grows in smaller, non-contiguous stands along north facing slopes of ridges often intermixed with other conifers such as subalpine fir and spruce. Historically, these probably burned with stand replacing fires on a 150- to 300-year cycle, which in recent times have been suppressed. These areas were heavily logged in the 1880s and again since 1960. Early logging slash piles were burned causing general larger stand replacement fires over much of the area. The scattered nature of these lodgepole stands creates a situation where risks of insects and disease are reduced, so this has not been a major factor in shaping the stands. However, stand structure has been altered as a result of logging, with current stands grouped primarily in the over 60- to 70-years-old class or in the under 20- to 30-years-old class.

Aspen. The aspen vegetation type may occur on sites that can be succeeded by conifers (seral aspen), or it can occur on drier sites incapable of supporting conifer communities (stable or climax aspen). On most sites, aspen is an important early seral species in the spruce-fir, mixed conifer, lodgepole, and Douglas-fir vegetation types and in the Wasatch Mountains. Studies show that much of the historic seral aspen has now been replaced by spruce-fir, lodgepole pine, and Douglas-fir (O’Brien and Pope 1997). Historically, the aspen vegetation type may have covered nearly 20 percent of these mountains, but today it occupies less than 13 percent. Aspen relies on disturbance for sprouting and regeneration, which has been reduced through fire suppression actions over the past 50 to 100 years. These two types of aspen (seral and climax) are distinct for purposes of assessing ecological conditions and trends. Seral aspen historically was disturbed by fire maintaining patterns and structural diversity across the landscape. Patchy, low-intensity fires at lower elevations, and more extensive stand replacement fires at higher elevations historically regenerated aspen and kept conifers from replacing aspen stands. An estimated 75 to 80 percent of the aspen is now in mid-age, mature, and old-age condition.

Together, fire suppression and livestock grazing (reductions in fine fuels) have combined to result in fewer fire starts and generally smaller fires in this type. Historically, the fire regime was a lethal fire burning on a 20- to 100-year cycle. Aspen regeneration after fire or cutting is often susceptible to browsing by wild and domestic ungulates, which can result in unsuccessful regeneration. This is especially true if the area treated is small (such as a stand) rather than across an entire landscape (multiple stands). Climax aspen is much less common than seral, often at the fringe of where seral aspen communities occur and adjacent to sagebrush-dominated rangelands. Present tree ages vary from 60 to 150 years. Historically, patchy, low-intensity fire at lower elevations and more extensive stand replacement fires at higher elevations were the most important disturbance factor maintaining structural diversity of this type across the landscape. High levels of grazing in this type in the past have resulted in reduced fuels to carry fire and changed species composition and dominance (western coneflower and Kentucky bluegrass are good examples of this).

White Fir. This cover type has not been mapped on the Forest, but occurs in minor amounts along the lower, western portion of the Wasatch Mountains on steep north-facing slopes. It is not known in the Cache-Box Elder or Bear Management Areas, except for an isolated stand near Logan Canyon. Minor amounts of Douglas-fir and aspen can be present mixed with the predominant white fir. White fir is shade tolerant; growing well in very dense conditions. Thus, in the absence of low-intensity fires, it increases, eventually dominating even in stands that are currently dominated by seral big-tooth maple and/or oak-maple. Because of the very dense, multi-layered canopy conditions, defoliators such as western spruce budworm and Douglas-fir tussock moth are accommodated, resulting in significant tree mortality (40 to 90 percent) in many stands. Fir engraver beetle is at epidemic levels throughout the Wasatch Mountains from Ogden to the south. The historical fire cycle was non-lethal fires every 10 to 40 years on drier sites and every 30 to 60 years on wetter sites. Some stand replacing fires, especially where Douglas-fir was seral, kept the white fir structure at younger stages. Fires are suppressed, especially given the proximity of these stands to urban populations. Lack of the frequent, low intensity fires during the last 100 years has created an accumulation of fuel, resulting in potential for fires to be more intense stand replacing fires rather than the white fir thinning fires of the past. White fir of 150+ years develops fire resistant bark similar to Douglas-fir. Currently 60 to 75 percent of white fir is mature and old with a trend toward mortality exceeding growth.

Interior Douglas-fir. This type is restricted to steep north-facing slopes, but is adapted to a wide variety of site, climate, and soil conditions. Historical stand structures were primarily even-aged, single canopy with fire regimes usually non-lethal on a 10- to 25-year frequency on drier sites and 30 to 50 years on cooler/wetter sites. Most stands have not burned in the last 100 years, increasing ladder fuels and susceptibility to stand replacement fires. In many stands that were selectively harvested in early 1900s Douglas-fir did not regenerate and the stands are now dominated by white fir. Douglas-fir beetle is at near-epidemic levels to the south and about 55 to 60 percent is susceptible. Dwarf mistletoe also is present but more common to the south. Large stand-replacing fires or continued exclusion of frequent non-lethal fires result in compromising the historical balance of patterns and structures in these landscapes.

Juniper (Pinyon-Juniper). This cover type with pinyon pine occurs only on sites where precipitation exceeds 18 inches annually. Both Utah juniper and Rocky Mountain juniper dominate this type with Utah juniper growing on the relatively drier sites. Pinyons occur within the Mollens Hollow Research Natural Area, but are generally absent elsewhere. The juniper type currently exceeds historical distribution expanding into oak, mountain brush, and sagebrush communities. It is also much denser within a stand than historically as a result of livestock grazing of fine fuels concomitant with fire suppression and juniper's allelopathic effects. The result is a lack of understory vegetation for soil protection and deteriorated watershed conditions. Historically, this type was restricted to "fire safe" sites (rocky areas with fire return interval greater than 30 years) while it was excluded from establishing on sites with fire returns of 10 to 30 years. The rooting system and year-round water use result in significant impacts to ground water and aquifer recharge. Fire regimes have changed because of lack of fine fuels but large fires can occur as wind-driven crown fires. The change from low-intensity surface fires to stand-replacing crown fires demonstrates a radical change in fire regime. In other areas, an increase of exotic annuals such as cheatgrass has enabled fires to burn more frequently than historically, and native herbaceous understories are replaced by weedy species such as cheatgrass, thistle, and knapweeds.

Mountain Mahogany. This cover type occurs with two different species: curl-leaf and birch leaf mountain mahogany. Birch leaf mountain mahogany is deciduous and sprouts following fire or browsing while curl leaf mahogany is evergreen, tree-like and reproduces only by seed. Wildlife and livestock browse both and where use is heavy, reduced soil cover results in some decline in watershed condition. Birch leaf mahogany on southerly aspects where wild ungulate winter use is heavy may be lost.

Gambel Oak. This cover type occupies more than 15 percent of the W-CNF portion of the Overthrust Mountains Ecological Section. It occurs on foothills, along the Wasatch Front, but is absent, except for one isolated stand near Logan Canyon, from the Cache Valley area. Oak is a prolific sprouter that occurs in tree form on better sites and in a medium to tall shrub form elsewhere. The massive root system holds soils well for watershed protection and until overstories become dense, stands may support abundant understory grasses and forbs. Fire intervals were historically 20 to 50 years, but years of fire suppression have resulted in somewhat greater than historical patch size and large areas of old decadent stands. Fall canker worm activity has increased because of reduced fire intervals causing top and branch mortality. However, recovery of oak communities is often rapid following disturbance. Decadent stands, when intermixed as they commonly are, with housing and other development, pose a risk to public safety from fire. Fire suppression in this type has resulted in a decrease in diversity of structure and pattern and increased fuels creating a much greater risk for more intense fires than occurred historically.

Bigtooth Maple. This cover type is found in the foothills where it is the ecological equivalent of Gambel oak and in some areas is capable of succeeding oak on more moist cooler sites. Maple often supports a sparse-to-dense understory of grasses and forbs but also has heavy leaf litter. It is capable of sprouting following fire. Fire suppression has resulted in longer than historical intervals with increasing age class, decreasing diversity

in structure and pattern, and with maple replacing or becoming co-dominant with oak in some areas.

Mountain Brush Complex. Chokecherry, serviceberry, gooseberries, snowbush, mountain maple, mountain snowberry, and elderberry make up this cover type. These include species that resprout after fire and are intermingled with sagebrush at mid and conifer/aspen at higher elevations. Insect, disease, and fire intervals were historically in 20- to 40-year cycles. Suppression has allowed some pinyon-juniper and sagebrush to replace these communities and for encroachment of species such as Douglas–fir. Historic browsing primarily by wild ungulates has reduced the extent and crown cover of some mountain brush communities.

Tall Forb. This cover type is considered the “flower garden” of the mountains. Historically, tall forb communities were common throughout the mountains above elevation 8000, where precipitation exceeds 35 inches annually. More than half of these highly productive tall forb communities were lost years ago because of excessive livestock grazing with concurrent, significant soil loss. Many sites are presently dominated by tarweed, knotweed, mulesear, and/or western coneflower. Site restoration is difficult if not impossible because of soil losses. Except in the canyons of the Wasatch front, grazing continues to occur on many of the sites currently or historically supporting tall forb communities.

Sagebrush/Grasslands. These types are found throughout the Wasatch Mountains, covering more than 20 percent of the W-CNF portion of this area. While there are seven known species subspecies, or varieties of sagebrush in the area, mountain big sagebrush makes up an estimated 60 to 70 percent and spiked big sagebrush makes up an estimated 20 to 30 percent across the landscape. Mountain big sagebrush occurs at elevations from 5,500 to 10,000 across a wide variety of landtypes. Fires historically occurred at about 20- to 40-year return cycles being lethal to individual sagebrush plants and favoring understory grasses and forbs. Fire in these landscapes typically burned in mosaic patterns leaving patches of several age and canopy classes. Currently many sagebrush communities are dominated by stands with greater than 15 percent sagebrush canopy cover due to a combination of fire suppression and livestock grazing. Forage utilization standards and monitoring are intended to increase ground cover, as well as grass and forb cover in these communities. At lower elevations, especially in foothills adjacent to urban areas, invasion of sagebrush by cheatgrass and various noxious weeds and annuals is common. Spiked big sagebrush generally occurs at elevations above 8,000 and is relatively productive, having a greater diversity of wildflowers than mountain big sagebrush. Historical fire return intervals were 20- to 40-year cycles in mosaic patterns with spiked big sagebrush capable of sprouting after fire.

Riparian. These streamside communities occupy a relatively small proportion of the landscape; however, they are highly productive, and heavily used and valued by both people and animals. These communities are very diverse and range from tree-dominated (cottonwood, box elder, etc.) to shrub dominated (willow, dogwood, alder, birch, etc.) to herbaceous (wildflowers, grasses, sedges, rushes). They are indicators of watershed conditions and play an important role in maintaining stream channels in a state of

"dynamic equilibrium" where channel changes are at a rate consistent with sustaining hydrologic functions over time.

Riparian areas can be severely impacted or disappear as a result of overuse and changes caused by humans and domesticated livestock (Forest Service 2004a). Water diversion, roads, timber harvest, grazing, and trampling, including that from recreation, can be major causes of negative impacts if improperly managed, such as lowering of water tables; stream channel erosion; exotic plant encroachment; removal of beaver populations; increased water temperatures; concentrated runoff and increased sediment; and, changes in vegetation density and composition. Changes in historic flow regimes have reduced numbers and /or health of cottonwood trees in many areas. In some areas, decreased fire frequency has allowed succession to proceed, resulting in conifers shading out deciduous species, such as willow and aspen. These changes in riparian vegetation can result in reduced flows. Aquatic habitats are intertwined with riparian and upland vegetation conditions and can be negatively impacted as a result of increased erosion and sediment deposited in stream channels. This reduces exposed gravels for native fish spawning, broadens stream channels, creates shallow waters, reduces abundance and quality of pools, and increases water temperatures. Where streams have been down cut and water tables have dropped, riparian communities have been replaced by non-riparian species such as mountain big sagebrush, silver sagebrush, and Kentucky bluegrass.

In 1992 and 1993, inventories were conducted on some of the Forest's high-priority stream channels. Approximately 29 percent of the nearly 119 inventoried miles were sampled in this ecological section. Of these inventoried miles of riparian area, 42 percent were in an ecological condition known as "potential natural communities" (PNC); 47 percent were late seral; 4 percent were mid seral; 6 percent were early seral; and the remaining 1 percent were in very early seral ecological condition. Because no attempt was made to inventory all miles of riparian area, these percentages do not necessarily represent the overall conditions in this ecological section. (Forest Service 2004a).

Rare Communities. A few rare or unique plant communities occur in this portion of the Forest. These include the single needle pinyon (*Pinus monophylla*) communities in Mollens Hollow Research Natural Area (RNA) southeast of the Cache Valley, which are not globally rare, but are very rare in this ecological section. Also near Right Hand Fork, Logan River, in the Bear River Range, are references to disjunct occurrences of Gambel oak and white fir. These species, while abundant elsewhere in the Wasatch Mountains, are not known from this portion. East of Salt Lake Valley, there are unique side-slope thinleaf alder (*Alnus incana*) communities in Little Cottonwood Canyon. While thinleaf alder is not uncommon on the Forest, it typically occurs along streams and rivers and does not occur elsewhere on the Forest as these large, sideslope seep communities. In Big Cottonwood Canyon are some ponderosa pine (*Pinus ponderosa*) communities that are likely related to plantations in the early 20th Century, but that are reproducing and maintaining themselves. These occur in and west of Mill D North Canyon.

Stansbury Mountains

Vegetation Patterns

The Stansbury Mountains are part of the Bonneville Basin Section, which occurs within the Basin and Range Physiographic Province as described by McNab and Avers (1994). The relatively low precipitation in this section (up to 18 inches annually on the mountains) affects the plant communities that occur. Salt desert communities, while generally not present on the W-CNF, are common at elevations below the Forest boundary on the west side of this mountain range. The lower foothills on the western portion of the Stansbury Mountains are dominated by juniper, which has invaded many sagebrush communities that once dominated these sites prior to fire suppression. Fire historically played a large role in controlling the expanse of juniper on these lower sites. Juniper is a more natural component on rockier sites above and within these foothills, because fire had a more difficult time burning with the naturally lower fuels.

Sagebrush communities, while not as expansive as they were historically, generally occur from low to upper elevations. On the east side of the Stansbury Mountains, crested wheatgrass was seeded on many acres during the 1960s. Because of the long-lived and competitive nature of crested wheatgrass, this species is still the dominant species on many of these areas although some natives, such as bluebunch wheatgrass, are beginning to reestablish.

While aspen communities are not as big a component as is found elsewhere on the Forest, they are still an important part of mid-elevations in the Stansbury Mountains. In many areas aspen is being replaced by Douglas-fir and occasionally by some white fir in riparian areas.

Douglas-fir communities are common mid-elevation communities within the conifer belt of the Stansbury Mountains. At the upper reaches of Douglas-fir dominance there is a transition into spruce-fir communities. White fir is invading riparian communities along South Willow and North Willow channels and is becoming a minor component in Douglas-fir stands.

The Engelmann spruce and subalpine fir (spruce-fir) communities, while not covering large acres within the Stansbury Mountains, are present at elevations above the Douglas-fir as well as on cooler, moister sites within the Douglas-fir belt. At the highest elevations below timberline in the range, these communities often form a mosaic with the limber pine-bristlecone pine communities.

Both limber and bristlecone pines occur at the upper forest zone, just below timberline in the Stansbury Mountains.

Alpine and subalpine forbs (tall forbs) occur at higher elevations in the Stansbury Mountains. Tall forb communities, while not mapped in the Stansbury Mountains, occur interspersed with sagebrush communities, especially at the upper eastern elevations. Deseret Peak, at just over elevation 11000, offers what little alpine habitat there is in the Stansbury Mountains. These sites are generally rocky rather than sod forming with scattered vegetation.

Vegetation Cover Types and Disturbance Regimes

Alpine. Vegetation here at elevations above tree line (greater than elevation 10500) is patchy with thin soils. Even slight disturbance is significant because of slow recovery in this harsh environment. Past human recreation traffic and some grazing are the only disturbance to vegetation in the alpine area and the effects have been negligible based on limited historic information.

Limber Pine and Bristlecone Pine. These cover very small acreage in this mountain range. This cover type is primarily composed of limber pine, but with some bristlecone present on limestone substrates. Given the location in steep high elevation inaccessible areas, this type appears to be protected from any human caused impacts. The area gets frequent lightening strikes, but fuel loading is sparse and fires usually do not carry.

Aspen. These communities occupy mid-elevations in canyon bottoms, near springs, and on moist cool side slopes. Aspen is interspersed with Douglas-fir at higher elevations and tree ages vary from 60 to 150 years. Patchy, low-intensity fires at higher elevations and more extensive fires at low elevations historically regenerated aspen and kept age classes in balance. Fire suppression has resulted in some of this type being replaced by coniferous forest, and cattle grazing and recreation can impact stands especially where cattle or people congregate.

White fir. This cover type occupies relatively minor acreage in drainages at low to mid elevations. It regenerates in the shade of cottonwoods and aspen and is very sensitive to frequent low intensity fires. In the absence of fire, white fir has increased in numbers and density.

Douglas-fir. This cover type occupies a moderate amount of acreage in pockets on north-facing slopes. Historical stand structures were primarily even-aged, single-canopy stands. A variety of insects and diseases are associated with this type, including Douglas-fir beetle, Douglas-fir tussock moth, and dwarf mistletoe. Fire regimes were usually non-lethal at frequencies of 10 to 30 years on dry sites, and 30 to 50 years on cooler/wetter sites with lethal fires very rare. Most stands have not burned in the past 100 years, have few seedling or sapling stands, and are not actively regenerating. Fires suppression appears to have allowed Douglas-fir to overtake some aspen. Fuels have continued to build and potential for large lethal fires has increased. Older dense stands of Douglas-fir are also susceptible to Douglas-fir beetle.

Juniper (Pinyon-Juniper). This cover type is the most common vegetation type in the W-CNF portion of the Bonneville Basin. Juniper dominates most sites, while pinyon pine are scattered within some communities. Both Utah and Rocky Mountain juniper occur with Utah juniper on relatively drier sites increasing in density due to grazing and fire suppression, and replacing sagebrush and in some instances mountain brush. Rocky Mountain juniper, on more moist sites, has not expanded as much as Utah juniper. Pinyon-juniper currently exceeds its historical distribution and density by as much as 60 percent. These pinyon-juniper communities occur on sites that were historically maintained in a sagebrush state through natural fires that occurred every 20 to 40 years. Currently, wind-driven crown fires can burn thousands of acres at a time, which is a radical change from the low-intensity surface fires every 10 to 30 years that were part of

the historical fire regime. Historic grazing significantly reduced fine fuels and also accelerated loss of topsoils with a resulting decrease in production of herbaceous vegetation in the undergrowth. Some stands have been chained and seeded to crested wheatgrass. An increase in pinyon-juniper is thought to have had a dramatic impact on local aquifers because of the transpiration use year-round.

Mountain Mahogany. This cover type is not common to this mountain range. Most is curl-leaf mountain mahogany with birchleaf as a very limited component of the mountain brush type. Curl-leaf mountain mahogany is evergreen, has a tree-like form, and has a number of disease pathogens. It is a weak resprouter following fire and reproduces mostly from seed. This type has been heavily browsed and is primarily in an old structural condition. It is being lost on dry southerly slopes where livestock and large ungulates overgraze, reducing groundcover and degrading watershed conditions.

Mountain Brush Complex. This complex of species is relatively common and includes chokecherry, serviceberry, gooseberries, birchleaf mountain mahogany, mountain snowberry, and elderberry, some of which sprout after fire. This complex occurs on slightly moister areas than sagebrush with annual precipitation of 15 to 25 inches. It occurs in mosaics with sagebrush and conifer/aspen or aspen providing a highly diverse landscape cover. Fire suppression has resulted in mature to old age classes of dominant shrubs, which is uncharacteristic of a type that historically burned every 20 to 40 years.

Tall Forb. While the tall forb vegetation cover type has not been mapped in the Stansbury Mountains, forb-dominated plant communities occur here. They are similar to forb communities that occupy drier, often rocky sites in the Wasatch Mountains with species such as bee balm (*Mondardella odorotissima*), spike fescue (*Leucopoa kingii*), scarlet gilia (*Gilia aggregata*), rock goldenrod (*Petradoria pumila*), and various species of beardtongue (*Penstemon* spp.) present. As vegetation mapping procedures improve, this type will possibly make up about 1 percent or more of the W-CNF portion of this mountain range.

Sagebrush/Grasslands. Sagebrush and grasslands are common at elevations of 5500 to 10000, with mountain big sagebrush composing an estimated 80 to 90 percent of the landscape and other sagebrush species being minor. Fire regime historically had a return interval of 20 to 40 years with fires lethal to individual sagebrush plants and favoring understory grasses and forbs. Historic fire patterns created a mosaic of several age and canopy classes within any given landscape. Many acres of mountain big sagebrush have been treated and replanted to crested wheatgrass on the lower eastern portion of the Stansbury Mountains and it continues to be a major component among a few native species. Where treatments have not occurred, sagebrush stands are dominated by mature shrubs with greater than 15 percent canopy cover and ground cover less than 85 percent of potential (which does not provide adequate soil protection). Many acres of mountain big sagebrush have been replaced by pinyon-juniper because of removal of fire and reduction of fine fuels in the understory. Soil stability and productivity may be seriously affected from a loss in understory vegetation and surface erosion may increase. Fires that have occurred recently on the Stansbury Mountains have resulted in a decrease in juniper and an associated increase in non-native grasses (both seeded and invasive), as well as some early seral sagebrush/grassland communities. Without aggressive reseeding of

perennial grasses and forbs and control of cheatgrass following fire, it has and will continue to dominate many drier landscapes.

Riparian. These communities are a small amount of the land base, but are highly productive and heavily used by people and animals. The area comprises a few live water streams, and many seeps and springs scattered over the landscape. Many water sources become subterranean with most of the larger stream systems becoming dry near the Forest boundary because of water diversions for downstream users. Recreation use is often very high where water is adjacent to accessible roads, with subsequent soil compaction and loss of streamside vegetation. White fir has replaced some of the cottonwood stands shading out deciduous willows. *Cytospora* and scale insects have adversely affected viability of cottonwood and willow in some areas. Interruption of historic disturbance patterns and several decades of reduced flows have led to a decrease in numbers of cottonwood trees. Other changes, resulting from fire suppression, include white fir, Douglas-fir, pinyon-juniper, and sagebrush increases, which have increased year-round water use reducing the amount of water available for stream flows (Forest Service 2004a). Aquatic habitats are intertwined with riparian and upland vegetation conditions and can be negatively impacted as a result of increased erosion and sediment deposited in stream channels. This reduces exposed gravels for native fish spawning, broadens stream channels, creates shallow waters, reduces abundance and quality of pools, and increases water temperatures. Streamside vegetation, food sources, and cover are also reduced as stream dynamics change and the effect is a net loss of aquatic and riparian species diversity.

In 1992 and 1993, inventories were conducted on some high-priority stream channels on the Forest. Approximately 3 percent of the nearly 119 inventoried miles were sampled in this ecological section (the Stansbury Mountains have a relatively low percent of the Forest's total riparian areas). Of these inventoried miles of riparian area, 15 percent were at PNC; 58 percent were late seral; 14 percent were mid-seral; 10 percent were early seral; and the remaining 3 percent were in very early seral ecological condition. Because no attempt was made to inventory all miles of riparian area (as previously noted), the percentages do not necessarily represent the overall conditions in this ecological section.

Rare Communities. As noted above, there are some bristlecone pine (*Pinus longaeva*) communities in the Stansbury Mountains that do not occur elsewhere on the Forest and that are generally uncommon throughout their range. These bristlecone have been described as infrequent, but "locally dominant on limestone slopes at moderately high elevations" (Taye 1983).

Uinta Mountains

Vegetation Patterns

The Uinta Mountains are an ecological area located within the Southern Rocky Mountain Steppe–Open Woodland–Coniferous Forest–Alpine Meadow Province (McNab and Avers 1994). The Uinta Mountains are primarily in northeastern Utah with a small portion occurring in southwestern Wyoming and western Colorado. The patterns of vegetation across the Uinta Mountains are fairly uniform from east to west, although landscape patterns west of Stillwater are more similar to the Wasatch Mountains. In

addition, there are limestone uplifts within the northern portion of the Uinta Mountains that run east-west with north-facing slopes typically dominated by Douglas-fir and south-facing slopes often dominated by sagebrush.

In general, going from north to south (lower elevation to higher elevation) on the North Slope of the Uinta Mountains, the plant communities include open sagebrush flats, aspen, lodgepole, Uinta Mountain mixed conifer (a mixture of lodgepole pine, Engelmann spruce, and subalpine fir), spruce-fir forests, high elevation Engelmann spruce, including krummholz, semi-circular rocky cirque basins, and alpine tundra. Interspersed at higher elevations throughout this portion of the North Slope are a profusion of lakes, streams, and wetlands.

While present throughout the Uinta Mountains, sagebrush communities are most evident in the western Uinta Mountains near Whitney Reservoir, on the western face of the range east of Kamas and Oakley, and on the far eastern portion of the Forest adjacent to birchleaf mountain mahogany, aspen, and lodgepole communities. Nearly all sagebrush stands are mature with canopy cover over 15 percent. Some stands on the south faces of limestone ridges have been treated within the past 10 to 15 years and have a more open canopy. Silver sagebrush is a common component adjacent to riparian ecosystems and is sometimes a part of riparian ecosystems.

Tall forb communities historically occurred in the western portion of the Uinta Mountains (Hoyts Peak and Whitney areas), but have experienced impacts from historic livestock grazing. In parts of the Hoyts Peak area, this type has been converted to a tarweed-dominated type and has experienced significant soil loss as well. This loss of topsoil has made the natural recovery of these sites very difficult.

Birchleaf mountain mahogany occurs in the vicinity of Widdop Mountain on the eastern portion of the Forest on the North Slope. Birchleaf mountain mahogany communities are managed so that use of browse is at a level that not only provides for the continued maintenance of existing vegetation, but also provides for the continued reproduction and replacement of decadent and dead individuals within the stands.

Aspen stands on the northern most fringes of the Uinta Mountains are climax in nature, not being replaced over time by conifers in the overstory. These typically have common juniper (a shrub form of juniper) in the understory. They occur on the drier fringe of the Forest ecosystems. Somewhat higher in elevation, pure lodgepole pine communities occur. In many cases aspen is a component and a seral co-dominant.

Lodgepole pine occurs on the lower portion of the conifer forest zone in the Uinta Mountains. At these lower elevations, lodgepole pine is generally not seral to spruce and fir. It may be associated with aspen, and where it is they often co-dominate before and after fire, but with continued fire suppression, these stands will eventually become dominated by lodgepole alone.

The role of fire in the lodgepole pine, mixed conifer, and aspen ecosystems has been replaced to some extent by timber harvest over the last 100 years. Extensive tie hacking in the late 1800s/early 1900s produced uneven-age stands and affected watershed and wetland functions. Logs cut for railroad ties were placed in several streams on the north

slope of the Uinta Mountains. Large dams were formed with these logs, and then blasted so the logs would flow northward off the Forest. This practice affected the riparian areas to an extent that is still unknown.

Above the band of pure aspen, lodgepole pine and aspen regenerated concurrently following fires with mixed regimes (some stand replacing and some ground fires). Most of the pure lodgepole pine type appears to have regenerated following large, stand replacing fires. Some of the lodgepole pine stands on drier sites appear to have experienced cycles of surface or mixed severity fires that allowed them to develop an uneven-aged structure.

Douglas-fir communities are restricted to limestone outcrops at mid to upper elevations in a band across the north slope of the Uinta Mountains. Most of these stands are mature to old in age class.

A majority of the forested stands on the north slope of the Uinta Mountains are what have been described as the Uinta Mountain mixed conifer communities, dominated by a mixture of lodgepole pine, Engelmann spruce, and subalpine fir. There is no clear succession to spruce-fir dominance as is evidenced by the presence of mature trees (150 years or older) of each of these overstory dominants. Aspen, as previously noted, occurs from the northern fringes of the forested portion of the Uinta Mountains. In addition, it occurs up to the spruce-fir zone but is primarily a major component in the lodgepole and Uinta mixed conifer zones. These forests are dependent on disturbance to maintain a properly functioning condition.

While not mapped in the Uinta Mountains, tall forb communities and sites that at one time supported tall forb communities occur from the Whitney Reservoir area on the Evanston District to the Hoyts Peak area on the Kamas District. Most of these communities have been altered through historic livestock grazing, and many areas, especially on the westernmost portion, no longer support more than scattered perennial forbs and annuals such as tarweed and knotweed.

At even higher elevations, spruce-fir communities occur. These differ from the mixed conifer communities at lower elevations in their lack of lodgepole pine. Disturbance regimes historically included smaller, more localized fires. Pure Engelmann spruce communities occur at the upper tree line and often grade into krummholz growth forms at the uppermost elevations, where it occurs.

Upper elevation forested stands (both spruce-fir and Engelmann spruce) appear to have a relatively infrequent fire history that is probably due in part to the wetter conditions during the fire season. These upper elevation stands are frequently in smaller patch sizes with changes in species composition dependent on how large and intense the fires were and how long succession from seral lodgepole pine to subalpine fir and Engelmann spruce has been progressing.

Rock talus (barren) sites are an important part of the upper landscape, but tend to form the cirque basin walls below the alpine communities, which are the uppermost vegetation zone in the Uinta Mountains. These differ from those on other ecological sections of the

Forest because of the abundance of vegetation cover, which results from more soil and relatively fewer rocky outcrop sites.

Alpine communities form the uppermost elevations of the Uinta Mountains. While variable in composition, these are most commonly sod-forming communities with dense, herbaceous ground cover.

Vegetation Cover Types and Disturbance Regimes

Alpine. Distribution of alpine plant communities is tied to rock type, landform, and depth and duration of snow cover. Lewis (1970) described the curly sedge/cushion plant, alpine avens-sedge and sedge-alpine avens, sedge-grass, wet meadow and bog, dry meadow, and alpine shrub communities. The alpine communities have not been mapped to this level of accuracy. Areas of semi-barrens vary from year to year depending on the persistence of snow cover and in "good" years are covered with sparse vegetation. Talus creep and cliff faces support other plant communities and the Red Pine Shale formation supports the sensitive plant species, alpine poppy. Limestone substrates support different plant composition than the common quartzite. Except for the sheep driveway, at localized salting and bedding grounds, and where high recreation use is concentrated (Naturalist Basin), alpine plant communities appear to be much as they might have been prior to European settlement. However in these use areas, ground cover is significantly lower than potential, and erosion has occurred resulting in watershed concerns.

High Elevation Engelmann Spruce. These communities occur from above elevation 10400 and extend down to about elevation 10000. Spruce trees are 300 to 400 years and older with little or no replacement by subalpine fir. Typical fire regime is small infrequent fires with long intervals (300 years or more) between disturbance and maturation of forests. Uneven age and old stands dominate. Very little of these forests have been harvested and they show comparatively little mortality from insects with frequency of insect epidemics much lower than for lower elevations. At the highest elevation, these communities are represented by stunted krummholz conditions because of the severe environmental conditions that occur.

Spruce-Fir. As noted in Table 3-4, this type covers over 20 percent of the W-CNF portion of the Uinta Mountains. Spruce-fir occurs in the western portions of the Uintas between elevations of 8000 and 10000. These communities often occur as relatively small group stands rather than the large continuous forest more typical of mixed conifer. Engelmann spruce is long-lived (250 to >300 years) on cool, moist sites and has shallow roots (susceptible to wind-throw); and most stands are in multi-canopy structural condition. Subalpine fir is similar in ecology but shorter-lived (100 to 150 years). Blue spruce is a very minor component with aspen, lodgepole pine, and a few Douglas-fir associated in mixed or seral stands. Harvest of spruce-fir stands was common both prior to and after World War II. The majority of the type is mid-aged and mature to old with many stands being uneven-aged and/or multi-storied. Areas harvested are covered with saplings and seedlings with composition weighted toward subalpine fir. There is a dynamic cycle between spruce and subalpine fir dominance depending on stand conditions and insect activities with subalpine fir co-dominating during the first century and then declining while the stand became dominated by Engelmann spruce. Historic fire

regimes were mixed with small fires burning individual trees to a few acres on a relatively frequent basis within most stands. These lethal small fires served to create uneven-aged stands. Less frequent stand-replacing fires occurred on a 200- to 400-year cycle creating an earlier seral stage with more even-aged stands. There is increasing risk from fire and insects because of the increasingly mature component of stands as a result of fire suppression. Recent inventories of the spruce-fir communities, especially in the western portion of the Uinta Mountains, show extensive mortality from spruce beetles.

Mixed Conifer-Uinta Mountains. This type occurs between elevations 9000 and 10500. A conspicuous difference between this type in the Uinta Mountains and many other areas is the strong presence of mature and old lodgepole pine intermixed with Engelmann spruce with rather low presence of subalpine fir. Lodgepole pine often clearly dominates stands, reflecting its more-rapid establishment following disturbance. In places, subalpine fir shows a strong presence in shrubby form by layering, however it appears that the vast area of quartzite materials of the Uinta Mountain Group presents substrates on which subalpine fir fails to express dominance. As noted in Table 3-4, this type covers nearly 25 percent of the W-CNF portion of the Uinta Mountains. Areas of this type outside Wilderness have been harvested and a mountain pine beetle epidemic swept the eastern, but not western Uinta Mountains. Historic fire regimes were lethal fires on a 100- to 300-year cycle. Following fire, lodgepole pine tends to dominate stands for a period while spruce, a shade-tolerant species, eventually again becomes a significant component. Without fire or other disturbance, the lodgepole pine component will be greatly reduced. Recent inventories of the Uinta mixed conifer communities show extensive mortality from mountain pine, fir, and spruce beetles.

Lodgepole Pine. In the Uinta Mountains, lodgepole pine occupies large areas in unbroken stands. Historical fire regimes included large stand replacing fires at intervals of 100 to 200 years followed by rapid regeneration of trees with a resulting relatively few age classes across the landscape. Mountain pine beetle is also a contributor to regeneration creating conditions suitable for large fires. Dwarf mistletoe is an active agent throughout theses ecosystems with highly variable levels of infestation. Clear cutting has been widespread as well as tie-hacking in the Blacks Fork and Bear River drainages. Tie hacking was a process of tree harvest and placement of trees in waterways where streams backed up large amounts of water, then blasted to allow the trees to flow downstream off the Forest for cutting into railroad ties. This practice affected thousands of acres of upland (clear-cut) and riparian ecosystems with effects evident even today. Early harvests were done in blocks of 300 to 500 acres or more with later harvest limited to 40-acre blocks considering elk hiding cover. Gently sloping areas have mostly been harvested with long persistent lodgepole remaining on steeper or rockier areas. Mountain pine beetle heavily impacted lodgepole pine in the Uinta Mountains in the early 1980s, and again appears to be increasing in its effect in this area, possibly as a result of several years of drought and of older stands with greater tree density. For several years, many thousands of acres of lodgepole were treated to minimize impacts from the beetle, but these treatments were, for the most part, unsuccessful in the long term. The largest number of acres affected by the beetle in the 1980s occurred on the Ashley National Forest in the eastern portion of the Uinta Mountains.

Aspen. Three distinct categories of this type have been identified. Conifers eventually replaced seral aspen in the absence of disturbance. Seral aspen-lodgepole is composed of co-dominate aspen and lodgepole with both regenerating after fire. Climax aspen is usually at lower elevations and/or drier sites where conifer encroachment remains low with or without fire or other disturbance. On the north slope of the Uinta Mountains there has been a large loss of seral aspen to mixed conifer and spruce-fir as a result of fire suppression. Conifers make up more than 35 percent in most existing aspen stands except in the eastern Uintas where mountain pine beetle in the 1980s and harvest in the past 50 years has regenerated seral aspen. Seventy to 80 percent of aspen stands are mature or old age classes with a resulting loss of structural diversity. Expanding elk herds also pose a risk to regenerating seral aspen. The historical fire regime was for lethal fires at intervals needed to keep aspen abundant and vigorous. Seral aspen-lodgepole is the largest aspen cover type with most stands in the mature to old age classes as a result of successful fire suppression. Stands are becoming dominated by lodgepole pine without lethal fire return intervals within the historic range; however, where pine bark beetle has killed lodgepole pine stands, aspen stands have been rejuvenated. Climax aspen is typically adjacent to sagebrush/grasslands on lower elevation sites that cannot support conifers. Some clones have great ability to regenerate under mature stems while others do not. Most of these stands are in the mature and old age classes affecting structural diversity, but clone-by-clone evaluation is necessary to determine proper functioning condition. Expanding elk herds pose a risk, which has become significant in some areas.

Interior Douglas-fir. This community is confined to a limestone belt, primarily within the eastern Uinta Mountains in mid to old age classes. Historic fire regimes were non-lethal and mixed severity on a 10- to 25-year cycle on drier sites and 30 to 50 years on wetter sites. Lack of non-lethal ground fires has allowed for an increase in the shade tolerant true firs and a build up of dead and down ladder fuels. Insect activities do not currently exceed endemic levels, but conditions are such that most stands rate out at “high” risk because of stand densities and age. Clear cutting in this type has resulted in slow tree regeneration and created grass/forb openings. Douglas-fir is moving into sagebrush, mahogany, and mountain brush communities in the absence of fire. The lack of fires during the last century increases the likelihood that fires will be stand-replacing and may result in greater watershed damage than historic fires.

Juniper (Pinyon-Juniper). This is a minor cover type occupying less than 1,000 acres in the western portion of this area. No pinyons are known to occur in this portion of the Uinta Mountains Ecological Section. Historical fire return intervals were 50 to 200 years. Without fire, juniper crown closure results in a significantly reduced understory, exposing soils to erosion because of lack of ground cover. Old stands with risk to watershed conditions are within the historic range of variability. Risk of cheatgrass invasion exists, especially where fires are not followed with the seeding of vigorous perennial species that have the ability to compete with it.

Mountain Mahogany. Both birchleaf mahogany and curl-leaf mahogany occur in the Uinta Mountains. Curl-leaf mountain mahogany is a poor sprouter, readily killed by fire. It has winter persistent leaves and is highly hedged by wildlife, including mule deer, elk, and moose. Stands in this area are relatively small (100 to 200 acres) and show that concentrated elk and moose utilization are resulting in declining conditions (vigor,

density, and reproduction). Fire regimes were historically mixed severity/lethal on a 50- to 70-year cycle. Birchleaf mountain mahogany sprouts after fire and is found from about 6,000 to 9,000 feet elevation with lower areas seral to pinyon-juniper and higher areas seral to Douglas-fir. Heavy big game use on several birchleaf mahogany sites on the north slope has resulted in a loss of this type. Curl-leaf mahogany stands in the Kamas Ranger District are not regenerating, possibly because of lack of seed set and/or germination. Stands are old with tall, with highlined structure and cheatgrass invasions.

Gambel Oak. This community is present along the western end of the Uinta Mountains. Gambel oak is a prolific sprouter with bigtooth maple a common component on more moist sites. Oak expanded somewhat into areas of sagebrush/grass. Historic fire regimes were mixed severity with crown fires every 20 to 50 years. Fire suppression has resulted in reduced understory species and cheatgrass is common in lower elevation stands adjacent to agricultural lands. A majority of this cover type, however, has been treated through prescribed fire and is probably the most close to its historic range of variability of any cover type in the Uinta Mountains. A variety of insects are common to the oak type; however, none of the native insect species has posed a serious threat to the oak to date. Residential encroachment is occurring in this type in many foothill areas.

Tall Forb. Tall forb communities occur only on the western portion of the Uinta Mountains on limestone-derived soils. It is estimated that about 50 percent of the sites once occupied by tall forbs are no longer present because of loss of productive topsoil resulting from historic impacts of heavy livestock grazing. On sites where potential remains, plant composition has changed significantly; currently, many of these sites have high gopher populations, which prevents development of perennial forb cover. Invasion of tarweed, mulesear, and other weedy species is common. Risks to the cover type include uncontrolled livestock grazing, continued loss of topsoil, and invasion of annual weedy species (tarweed and knotweeds) and noxious weeds.

Sagebrush/Grasslands. Of eight known taxa of sagebrush in the area, mountain big sagebrush is the most common. The fire regime historically was on about a 20- to 40-year return interval, with sagebrush having the ability to return to pre-fire cover within 20 years. The majority of sagebrush is currently in older age-classes with higher canopy cover and reduced grass-forb cover. Spiked sagebrush, while less common, occurs on more moist sites. Silver sagebrush occurs adjacent to many streams on the north slope, but is not common on the western portion of the Uinta Mountains. Silver sagebrush and spiked sagebrush both have the ability to sprout following fire and, therefore, these communities return to pre-burn canopy cover more quickly.

Riparian. Inventories were conducted on some high-priority stream channels on the Forest in 1992 and 1993. Approximately 68 percent of the nearly 119 inventoried miles were sampled in this ecological section. Of these inventoried miles of riparian area, 42 percent were at PNC status, 47 percent were late seral, 4 percent were mid seral, 6 percent early seral, and the remaining 1 percent in very early seral ecological condition. As previously noted, because no attempt was made to inventory all miles of riparian these percentages do not necessarily represent the overall conditions in this ecological section. In the Uinta Mountain Section, the PFC assessment (Forest Service 1998a) divided these

areas into Stream Canyon Riparian Complexes and Subalpine Meadow Complexes, which are described in more detail in the following text.

Stream Canyon Riparian Complexes. These complexes occur at all elevations with a great diversity of communities and structure that exceeds all other cover types. Both deciduous and evergreen trees (aspen, narrowleaf cottonwood, box elder, bigtooth maple, limber pine, lodgepole pine, Douglas-fir, blue spruce, Engelmann spruce, and subalpine fir) occur along with tall shrubs and low trees (thinleaf alder, western birch, Bebb's willow, Scouler willow, caudate willow) and shorter shrubs (Booth's willow, Drummond's willow, Geyer's willow, red-osier dogwood, and Wood's rose), as well as an herbaceous layer of grasses, sedges, and forbs. Because these generally narrow communities are often adjacent to moderate to steep gradient streams well armored by rock and adjacent to conifer communities, they are typically protected from large amounts of domestic or wild grazers. Timber harvest has been minor and structural diversity is high. Fuel loading is extreme in some places, but in general these communities can be expected to recover rapidly from fire, which historically was on a 100- to 200-year cycle.

Subalpine Meadow Complexes. These plant communities vary with geomorphology and both wet and dry conditions. Wet meadow complexes are dominated by willow, water sedge, mud sedge, few-flowered spikerush, deerhair bulrush, marsh marigold, elephants head, and other wetland species intergrading into tufted hairgrass communities. These wetter communities transition into dry meadow complexes dominated by timber oatgrass or sheep fescue. Wolfs willow is common where the water table is at or near the surface for much of the growing season. Red Pine Shale occurrence is accompanied by barrens and semi barrens with inherent infertility and varying degrees of resistance to erosion. Cattle allotments are common at lower elevations, but some of these meadow complexes have been without livestock grazing for many years. Impacts from years of livestock grazing to some of these broad meadow complexes are apparent with ecological status ranging from very early seral to PNC. Recreation stock use is common in these areas while hiking and camping are largely confined to trails running through meadows and in the vicinity of lakes. Beaver are common where willows and aspen are available for dam construction. Their activities store water and raise the water table, expanding riparian areas and trapping stream sediments. Ponds provide habitat for fish, birds, and aquatic furbearers. Dry meadow complexes are more sensitive than wet meadow complexes to sheep grazing because they receive more use. Where livestock have been removed or numbers reduced from those of the early part of the 20th Century, composition and ground cover can more readily return to proper functioning conditions.

Rare Communities. There are some unique spruce communities with water birch as a component on the lower meadows typically north of the Forest, but these communities also occur in a few locations on the eastern portion of the Evanston Ranger District/western portion of the Mountain View Ranger District. Some white fir, which is identified as a Wyoming State rare species (S1), has been noted on the northern portions of the Uinta Mountains. Their presence on the Forest has not been identified to date, but if present it will be important to protect them.

Other Plant Communities

Ponderosa pine communities are present only in a small amount (about 500 acres) on the Kamas Ranger District. This is the westernmost extent of ponderosa pine in northern Utah, except for a few scattered individuals and small groups in the Wasatch Mountains on the Uinta National Forest (only ponderosa pine plantations occur on the W-CNF portion of the Wasatch Mountains). Historic, non-lethal ground fires with a return interval of 5 to 25 years could have cleared the ground of some of the duff layer and provided favorable seedbeds for ponderosa pine regeneration. Successive fires would have favored continued growth of established ponderosa pine saplings. Planting ponderosa pine, as well as clearing invading juniper aimed at perpetuating the ponderosa pine, has been completed.

Threatened, Endangered, and Sensitive Species

Botanical resources include the abundance and distribution of different vascular and non-vascular native plant species. This section presents a more detailed analysis of the most rare elements of the flora—the threatened, endangered, and sensitive (TES) plant species. Additionally, some discussion of watch list species, species at risk, rare and unique communities, and plant species of cultural and social importance is included.

The state of Utah has a remarkable diversity of native flora and is known for its large number of endemic and rare plant species. Indeed, only four other states—California, Florida, Texas, and Oregon—equal or exceed Utah in the total numbers of rare plant species (Shultz 1993, UDWR 1998a). The flora diversity of Utah is comprised of 2,723 species and 415 infra-specific taxa (subspecies or varieties) (Welsh *et al.* 2003) of vascular plant species that are considered to be native. An additional 793 species are exotic, or have been introduced to Utah from elsewhere (Welsh *et al*. 2003). Many of these rare species—247 taxa (157 species and 90 infraspecific taxa)—are narrow endemics with their entire global distribution within the state of Utah (UDWR 1998b). Several of these species have their entire global distribution within the boundaries of the W-CNF (Cronquist 1972, UDWR 1998b).

The richness of native plant species and unique flora of Utah and the W-CNF can best be explained by the wide diversity of habitats and wide range of geomorphology (UDWR 1998b). Habitats within the state of Utah and within the W-CNF range from semi-arid shrublands, to high mountain ranges that support coniferous forests, subalpine forests and grasslands, and true alpine communities (Cronquist 1972). Many rare and endemic species are tied to unique soil types. The geomorphology of the Middle Rocky Mountain Province and much of the W-CNF is comprised of the very dissimilar Uinta Mountains and Wasatch Range and the Bear River Range. The Uinta Range trends east-west and is practically devoid of igneous rock while the Wasatch Range trends north-south and is comprised of an unusual assembly of igneous, sedimentary, and metamorphic rock (Stokes 1988). The Bear River Range of the W-CNF contains habitat for six rare endemic plant species, including one threatened species. Some of these species are endemic to Logan Canyon and its tributaries while others are limited in distribution to portions of the range in northern Utah and southeastern Idaho (Glisson 1995). These species are all closely associated with the dolomite and limestone geologic formations.

A list of endangered, threatened, proposed candidate species, and Utah State Imperiled species (species likely to be proposed for listing in the near future) from the FWS and Utah Natural Heritage Program indicates that six species occur within one or more of the 11 counties in the analysis area. The FWS list indicates that the species occur in or have habitat in the county. The list does not indicate the species or suitable habitat that occur on W-CNF lands. Table 3-5 shows plant species listed by the FWS and the counties in which they occur.

TABLE 3-5
Threatened, Candidate, and Species Likely to be Proposed as Threatened or Endangered on the Wasatch-Cache National Forest

Scientific Name	Common Name	Status	Distribution
Primula maguirei L. O. Williams	Maguire's primrose	Threatened	Logan Canyon Endemic
Spiranthes diluvialis Sheviak	Ute ladies'-tresses	Threatened	Potential Habitat – through the Wasatch-Cache National Forest[a]
Viola frank-smithii N. Holmgren	Frank Smith's violet	Sensitive[b]	Logan Canyon Endemic
Dodecatheon dentatum Hook var. *utahense* N.H. Holmgren	Wasatch shooting star, Utah shooting star	Recommended Sensitive[b]	Salt Lake County Endemic
Draba burkei	Burke's draba	Sensitive[b]	Northeastern Utah Endemic
Botrychium lineare W.H. Wagner	Slender moonwort	Candidate	Colorado, Oregon, Montana, Washington, (Historical sites in California, Idaho, Montana, Utah, Nevada and Quebec and New Brunswick, Canada)

[a]Most potential habitat for *Spiranthes diluvialis* has been surveyed on the W-CNF and no populations have been found.
[b]Likely to be proposed as Threatened or Endangered because of rarity and/or because of potential threats.

The Utah Native Plant Society and Utah Conservation Data Center identified two Intermountain Region Sensitive species, *Viola frank-smithii* and *Draba burkie and one recommended sensitive species, Dodecatheon dentatum* var. *utahense,* (Utah Rare Plant Meeting Results 2000) that have sufficient threats and conservation needs to be proposed as a threatened species. These species have not been formally petitioned or listed with the FWS. However, these species could be listed in the foreseeable future. As listed species, special management efforts and conservation measures would be required under the ESA. Due to their current conservation needs and threats, these species will be examined separately from the other Intermountain Region Sensitive species. Detailed information regarding status, habitat information, threats, current condition, and management efforts are provided below. Threats are defined as those activities, Forest Service or otherwise, or natural conditions that currently or potentially have negative effects on the viability of the TES plants and plant species at risk or their habitat. Threats listed are not all-inclusive, but focus on those that have the most potential to adversely affect plant and habitat recovery, and the persistence of known populations.

Maguire's Primrose (*Primula maguirei*)

Maguire's primrose was first collected in Logan Canyon, Utah in 1911 and was formally described as a new species in 1936 (Williams 1936). The FWS officially listed Maguire's primrose as threatened in August 1985 (FWS 1985). Currently, a total of 14 element occurrences of Maguire's primrose have been identified within a corridor of Logan Canyon approximately 19 km long and less than 1 km wide. The total global population of Maguire's primrose is estimated at 3,000 individuals (FWS 1990). Reproduction is thought to be strictly sexual, and Maguire's primrose is likely an obligate outbreeding species based upon the heterostylous floral structure (Richards 1993). Bees and flies have been observed visiting Maguire's primrose flowers, but specific pollinators have not been determined (Padgett 1986). Successful conservation of this species will require protecting occupied habitat and pollinator requirements in and around populations.

The narrow distribution and small population size of Maguire's primrose is likely best explained by its unique habitat requirements and need for calcareous substrates. There is no evidence to suggest that the range of Maguire's primrose is any more restricted at present than as indicated by historical botanical records (FWS 1990, Glisson 1995, Wolf and Sinclair 1997). It is more likely a relict species that formerly had wider ranges when climatic conditions in North America were wetter and cooler. Current research and phylogenetic analyses of *Primula spp.* add support to this hypothesis (Richards 1993, Wolf and Sinclair 1997). The role of human intervention in the restricted range of this species is unknown. Potential and actual habitat within the canyon and along the canyon floor may have been significantly impacted by human activity due to development (FWS 1990).

Habitat. Maguire's primrose is categorized as a mesophytic calciphile and is restricted to cool, moss-covered shallow soils on dolomite cliffs and boulders of the Laketown and Fish Haven Dolomite formations (FWS 1990, Glisson 1995). Populations of Maguire's primrose are restricted to an elevational range of 4600 to 5900 along the lower canyon walls of Logan Canyon (Padgett 1986). Plants are often found in cracks or crevices or amidst well-developed mats of moss and are most often found in areas of cool, moist microclimates. Apparent differences in the moisture regimes of up canyon and down canyon populations have been documented (Padgett 1990). Extensive surveys of potentially suitable habitat (additional outcrops of Fish Haven and Laketown Dolomites) have been conducted in adjacent drainages and in other portions of the Bear River Range of northern Utah and southern Idaho. No additional populations of Maguire's primrose have been located (Franklin 1990).

Threats. The most significant threats facing Maguire's primrose and its habitat are recreational rock climbing activities, the recently completed realignment and expansion of U.S. Highway 89 in Logan Canyon, and horticultural collection (FWS 1990, Glisson 1995, UDWR 1998a). Climbing activity in Logan Canyon has increased dramatically in recent years. The climbing community has participated in conservation efforts with the Forest Service to identify potential conflict areas and to educate climbers about the presence of this species. With the understanding of the local climbing community, 21 climbs have been formally closed to ensure protection of this species (Glisson 1995). A local climbing guide discusses the presence of Maguire's primrose and urges the

cooperation of climbers to further protect this species and its habitat (Monsell 1998). The Record of Decision for the expansion of US Highway 89 identified preventative measures that were implemented to minimize potential impacts to the Maguire's primrose populations, which included limited vegetation removal, dust-suppression, and construction timing to prevent impacts during flowering (Glisson 1995). The Forest Service was responsible for ensuring that preventative measures were employed and that population viability is maintained.

Current Management. The FWS prepared a Recovery Plan for Maguire's primrose in 1990 (FWS 1990). The general provisions of the Recovery Plan include inventorying suitable habitat, conducting minimum viable population studies, managing activities that could affect populations or habitats, and developing techniques for artificially propagating plants for possible population expansion or establishment. Additionally, a Conservation Strategy for the Bear River Range Endemics, which includes Maguire's primrose, was prepared and signed in 1995 (Glisson 1995). The general provisions of this conservation strategy include implementation of population biology monitoring studies to assess stability, trends, impacts from climbing and grazing activities, and autecology of all endemics. Direct provisions for Maguire's primrose include the development and implementation of specific research aimed at determining habitat dynamics, germination requirements, and phylogenetic relationships within and among populations. A progress report and amendment to the Conservation Strategy and Action Plan is currently in draft form. This amendment will provide new information and proposed changes to the existing strategy and will enhance conservation and recovery efforts for Maguire's primrose and the other Bear River Range Endemics. Additional efforts would include: finalizing a formal policy to address rock climbing; increasing genetic, germination, and pollination research; and completing Conservation Agreements in consultation with FWS.

Ute Ladies'-tresses Orchid (*Spiranthes diluvialis*)

Ute ladies'-tresses orchid was named in 1984 and federally listed as threatened on January 17, 1992, under the ESA. Ute ladies'-tresses orchid populations are found in relatively low-elevation riparian, spring, and lakeside wetland meadows in these general areas of the interior western United States: near the base of the eastern slope of the Rocky Mountains in southeastern Wyoming and north-central and central Colorado; in the upper Colorado River Basin; historically along the Wasatch Front and westward in the eastern Great Basin; and in north-central and eastern Utah and extreme eastern Nevada. In 1994, the range was expanded north by discoveries in central Wyoming and western Montana and in 1996, Ute ladies'-tresses orchid was discovered in southeast Idaho, along the Snake River. Most potential habitat on the W-CNF has been surveyed and no populations have been located. Historical populations occurred, however, on the Forest in Red Butte Canyon (last observed 1966), west of the Forest in the Salt Lake Valley near the Jordan River (last observed 1953), and in Weber County (last observed 1887) near the town of Ogden (Federal Register 1992). The largest known population is found just south of the W-CNF in Diamond Fork Canyon on the Uinta National Forest. Reproduction is strictly sexual, with ground- and log-nesting bumblebees as the primary pollinators (Sipes and Tepedino 1995, Pierson and Tepedino 2000). Successful conservation of this orchid will require protecting suitable habitat and pollinator habitat in and around orchid populations.

Habitat. Ute ladies'-tresses orchid is endemic to moist soils in mesic or wet meadows near springs, lakes, and perennial streams. The elevation range of known habitat in Utah is 4900 to 7000, but has been found as low as elevation 1500 in surrounding states. Most of the occurrences are along riparian edges, gravel bars, old oxbows, and moist-to-wet meadows along perennial streams and rivers, although some localities are near freshwater lakes or springs. Ute ladies'-tresses orchid appears to be well adapted to disturbances caused by water movement through flood plains over time. Populations are often found on point bars and other recently created riparian habitat. This orchid species appears to require permanent sub-irrigation, with the water table holding steady throughout the growing season and into late summer and early autumn. Ute ladies'-tresses orchid occurs primarily in areas where the vegetation is relatively open.

Potential habitat for Ute ladies'-tresses orchid can be found throughout the W-CNF, but occupied habitat has not yet been discovered. Extensive surveys for Ute ladies'-tresses orchid were completed on the Wasatch-Cache and Uinta National Forests in 1992 (Stone 1993). Field surveys were focused on perennial streams draining out through the Wasatch Mountains, usually at elevations below 6500. No botanical finds were made for Ute ladies'-tresses orchid on the W-CNF in this fairly comprehensive survey. Subsequent surveys each year following this study to present have also resulted in no botanical finds of this threatened species (Padgett 2000b in Forest Service 2003a).

Factors in the life history and demography of this species often make it difficult to locate. Populations appear to fluctuate dramatically from year to year, making it difficult to assess population status and distribution. The genus *Spiranthes* also undergoes a dormant period that may last 7 to 10 years, apparently with no evidence of above ground structures. Currently, the factors involved in dormancy and the triggering mechanisms required are unknown. In order to locate this species, potential habitat must be surveyed every year before ground-disturbing activities take place.

Threats. Ute ladies'-tresses orchid is found infrequently and in scattered locations. Threats include livestock grazing, trampling due to hiking and undeveloped recreation, exotic weed invasion, alterations of the hydrologic regime due to controlled flooding, dewatering of streams, loss of pollinators, and development (Stone 1994, FWS 1995). Because it prefers open, early seral riparian areas, its management may be in direct conflict with rare fish habitat management that emphasizes undisturbed climax conditions.

Current Management. The FWS has prepared a Draft Recovery Plan (FWS 1995) and developed actions designed to restore populations and remove threats. The general provisions of the Recovery Plan include: obtaining information on life history, demographics, habitat requirements, and watershed processes; managing watersheds to perpetuate or enhance viable populations; and protecting and managing populations in wet meadow, seep, and spring habitats.

The following is from the Federal Register (FWS 1992):

> *Except for two small populations in wetlands near Utah Lake, all known historic populations of this species (S. diluvialis) along the Wasatch Front in the populated north-central area of Utah are*

> *presumed extinct, as are all other known historic populations in the eastern Great Basin and two of the four known populations in Colorado. It is believed that alteration of riparian habitat caused the extinction of these populations. With the exception of the two Utah Lake populations, recent attempts to locate the Wasatch Front and eastern Great Basin populations were unsuccessful (Coyner 1989, 1990).*

While the potential for additional impacts to this species is limited, W-CNF personnel will continue to survey potential habitat before ground-disturbing activities take place.

Slender Moonwort (*Botrychium lineare*)

The Federal Register (FWS 2002) describes slender moonwort in the following manner:

> *Slender moonwort is a small perennial fern that is currently known from a total of nine populations in Colorado, Oregon, Montana, and Washington. In addition to these currently known populations, historic populations were previously known from Idaho (Boundary County), Montana (Lake County), California (Fresno County), Colorado (Boulder County), and Canada (Quebec and New Brunswick). However, they have not been seen for at least 20 years and may be extirpated (Wagner and Wagner 1994). Since the 12-month petition finding was published we received some additional information regarding the status and distribution of slender moonwort. Two new population sites of slender moonwort were tentatively identified in 2001, one site each in Idaho and Nevada, with an additional historic site discovered from a herbarium specimen collected in Utah in 1905.*

The Utah herbarium specimen was collected at Silver Lake in Big Cottonwood Canyon in 1901 at approximately elevation 8700. Attempts to relocate this population on the meadows surrounding Silver Lake in both 2001 and 2002 were unsuccessful. But because of its diminutive size and its ability to remain below ground during periods of low precipitation (Farrar 2002), it is possible for this plant to still exist on this site. Because of possible impacts to potential habitat, surveys were also conducted on private lands around Lake Solitude in 2002. No plants were found.

Habitat. Describing the habitat requirements for this species is difficult because of its current and historically disjunct distribution. It occurs at sea level in Quebec to nearly 9840 elevation in Colorado. Slender moonwort may be a habitat generalist and is often found along disturbed roadsides. Farrar (2002) stated that it commonly occurs where a combination of sedges, grasses, and small forbs such as wild strawberry, common cinquefoil, and aster grow in combination. It may also be that this species is more common than currently known because it is difficult to observe in the wild for reasons noted above.

Threats. Threats identified in the Federal Register (FWS 2002) include road maintenance, herbicide spraying, recreation, timber harvest, trampling, and development. It was also noted that livestock or wildlife grazing might affect slender moonwort, but

that these effects are currently unknown. None of these threats occur at the historic collection site at Silver Lake. Livestock grazing has not occurred on this species' historical range for over a century. The construction of a raised boardwalk in the mid-1990s to protect the fragile wetland habitats from trampling (recreation use) has also eliminated threats from road maintenance and development. No herbicides are currently used in the vicinity of Silver Lake. Timber harvest occurred in the early 1900s to support mining activities in the area, but now is restricted to maintenance of ski runs at both Brighton and Solitude Ski areas adjacent to Silver Lake. Farrar (2002) noted that slender moonwort has been found on constructed ski slopes elsewhere so this treatment may have a positive effect on this species.

Current Management. Slender moonwort is not currently on the U.S. Forest Service, Intermountain Region sensitive species list and is not currently given any formal consideration. The FWS has concluded that "…the overall magnitude of threats to slender moonwort throughout its range is moderate and the overall immediacy of these threats is non-imminent" (FWS 2002). They assigned this species a listing priority number of 11 and any additional information they receive on the distribution, threats, and conservation actions associated with *Botrychium* will influence their determination on whether listing under the ESA is still warranted.

Utah Shooting Star, Wasatch Shooting Star (*Dodecatheon dentatum* var. *utahense*)

Utah shooting star, Wasatch shooting star is a Salt Lake County, Utah, endemic. It was described as a new taxon in 1994 (Holmgren) and is apparently restricted to Big Cottonwood Canyon in the central Wasatch Range. Little work to determine life-history characteristics, demography, or pollination requirements for this taxon has been completed (Padgett 2000b in Forest Service 2003a).

Habitat. Utah shooting star, Wasatch shooting star is endemic to shady, moist cracks and crevices of rock outcrops, often in the spray of waterfalls (Holmgren 1994). The elevation range of known habitat is 6400 to 9500. Four known populations have been identified in crevices in Big Cottonwood Canyon at Moss Falls, within an area of approximately 3 miles square (Welsh *et al.* 2003). Many surrounding seeps have been surveyed for the presence of Utah shooting star (Wasatch shooting star), although no new populations have been located. All of the surrounding seeps that were examined were higher in elevation and were above shading trees (Stevens and Padgett 1999).

Threats. Recreational impacts pose the greatest threat to Utah shooting star, Wasatch shooting star populations. All known locations are found along trails or in the vicinity of high recreational use areas. Hikers, picnickers, and climbers frequent the areas in which these populations currently exist. Soil instability along some trailside populations is so great that even minimal use and light walking along the trail causes the uprooting of plants (UDWR 1998a). Based upon the high use of the area, and the extreme impacts from picnic area use, hiking, and climbing, this species is thought to be critically imperiled sufficient to warrant proposed listing as threatened under the ESA (Utah Rare Plant Meeting Results 2000).

Current Management. Utah shooting star, Wasatch shooting star has been recommended for addition to the Region 4 Sensitive Species list for the W-CNF, and is

on the Utah Natural Heritage Program Tracking list (UDWR 1998a). It currently has no designation or proposed legal protection with the FWS. Currently, no preventative measures (i.e., fences, barriers) have been taken to exclude picnickers, hikers, or climbers from the fragile populations (Padgett 2000b in Forest Service 2003a).

Frank Smith's Violet (*Viola frank-smithii*)

Frank Smith's violet was first discovered in May 1989 by botanist Frank Smith and was formally described as a new species in 1992 by Holmgren (1994). Frank Smith's violet is known to occur only in the lower to middle portion of Logan Canyon and several of its main side canyons in the Bear River Range of northern Utah (Glisson 1995). There are currently 11 known element occurrences that comprise a total global population of approximately 10,000 individuals (Stone 1994). Little is known about the life-history characteristics of Frank Smith's violet, although it is thought to be a short-lived, sexually reproducing perennial species. Pollinators are likely required for seed set (Glisson 1995).

Habitat. Frank Smith's violet is one of the few rock-dwelling violets known in North America (Holmgren 1994). It is endemic to cliffs and near-vertical outcrops of carbonate rock, specifically limestone, and Fish Haven and Laketown Dolomites. The elevation range of known habitat is 5400 to 6800 with most populations occurring on cool, northerly exposures that are shaded most of the day (Stone 1994). Surrounding vegetation, including Douglas-fir and maples also provides additional shading for the microsites in which Frank Smith's violet is found. Rock outcrops and aspects other than steep, north-facing slopes appear to be too warm and dry to support populations of Frank Smith's violet. Frank Smith's violet is found in distinct microhabitats similar to those of Maguire's primrose, and these species are often found in close proximity (UDWR 1998a).

Threats. Not unlike Maguire's primrose, the most significant threats to Frank Smith's violet and its habitat are recreational rock climbing activities, the recently completed realignment and expansion of U.S. Highway 89, and horticultural collection (Welsh *et al*. 2003, Glisson 1995, UDWR 1998b). As previously stated, climbing activity in Logan Canyon has increased dramatically in recent years and has resulted in the removal of plants in areas where Maguire's primrose and Frank Smith's violet are found. Efforts by the Forest Service and the local climbing community have focused on education and the conservation of these species (Monsell 1998). As with Maguire's primrose, the Record of Decision for the Expansion of US Highway 89 identified preventative measures that were implemented to minimize potential impacts to the Frank Smith's violet populations, which included limited vegetation removal, dust-suppression, and construction timing to prevent impacts during flowering (Glisson 1995). The Forest Service was responsible for ensuring that preventative measures for Frank Smith's violet were employed at the same level of care as defined for Maguire's primrose, and that population viability is maintained.

Current Management. A Conservation Strategy for the Bear River Range Endemics, which includes Frank Smith's violet, was prepared and signed in 1995 (Glisson 1995). This conservation strategy includes provisions that would promote implementation of population biology monitoring studies to assess stability, trends, impacts from climbing

and grazing activities, and autecology of all endemics. Additionally, this strategy provides direct provisions for Frank Smith's violet, which include the development and implementation of specific research aimed at determining habitat dynamics, germination requirements, and pollination, seed set, and dispersal requirements. A progress report and amendment to the Conservation Strategy and Action Plan is currently in draft form. This amendment will provide new information and proposed changes to the existing strategy. Completing Conservation Agreements in consultation with the FWS and establishing an interagency Technical Team to oversee implementation of the Conservation Strategy and Action Plan will further enhance conservation and recovery efforts for all the Bear River Range Endemics.

Burke's Draba (*Draba burkei*)

Maguire's draba was described for the Bear River Range and the northern Wasatch Mountains of Northern Utah. It was further divided into two varieties (*Draba maguirei* var. *maguirei* and *Draba maguirei* var. *burkei*). Subsequent taxonomic and phylogenetic research has shown that variety *burkei* is a distinct species (Windam and Beilstein 1998) and has been elevated to the species level. A total of 13 populations are known, ranging from the Wellsville Mountains, Strawberry Peak, and James Peak (Padgett 2000b in Forest Service 2003a). Burke's draba appears to require cross-pollination to set seed, though a pollen vector has not been determined for this taxon (Windham and Beilstein 1998).

Habitat. Burke's draba populations occur on ledges and in crevices of exposed carbonate and quartzite outcrops and on the adjacent rock loam soils in Douglas-fir and mixed conifer communities. The elevation range for this taxon is 5400 to 9765. Lower elevation populations appear to be confined to steep slopes with shady north and easterly aspects while higher elevation populations appear to occur on all aspects. Plants appear to prefer open filtered light in protected microhabitats and in association with semi-barren herbaceous plant communities.

Threats. The Snowbasin population, the largest known population of Burke's draba, has had the greatest impacts and threats to population viability. Many plants have been removed from near Mt. Allen in order to build a ski run for the 2002 Olympics Men's Downhill Event. Additionally, a large number of plants in this population were destroyed as a result of rock overburden being placed over a large portion of the population during a road construction project for the City of Ogden's communication site (Padgett 2000b in Forest Service 2003a). The other known potential threats to Burke's draba are from recreational activities and from mountain goats recently transplanted near Willard Peak. Recreational impacts include hiking, trail use, and rock scrambling. Impacts from the mountain goats include trampling and other physical damage. Plants appear to be too diminutive to be eaten (Padgett 1998).

Current Management. Burke's draba currently a sensitive species on the Region 4 sensitive species list for the W-CNF and is on the Utah Natural Heritage Program Tracking list (UDWR 1998a). It currently has no designation or proposed legal protection with the FWS. Due to the existing threats to this taxon and its conservation needs, it was suggested by the Utah Native Plant Society (2000) that Burke's draba status be elevated

to threatened with the FWS. Forest Service ecologists, biologists, and managers are currently preparing a Conservation Assessment and Strategy for Burke's draba. This Conservation Assessment and Strategy outlines management objectives that upon implementation will maintain the viability of populations, provide research opportunities to determine life history, demography, ecology, and factors contributing to rarity, and establish monitoring protocols for Burke's draba.

Forest Service Sensitive Species and Species At Risk

Sensitive species are those species identified by the Regional Forester for which population viability is a concern, either because known populations are in a downward trend in numbers or density or because there is little information available on their populations or habitat trends. Table 3-6 lists plant species designated as sensitive by the Intermountain Region Regional Forester and plants that are recommended to be placed on the Sensitive Species list and Watch List. The Recommended Sensitive (and Watch List species are designated in the W-CNF's Revised Forest Plan (RFP) (Forest Service 2003a). Those with FWS and State status were listed previously Table 3-5, and are repeated here in order to establish a comprehensive list of all plant species with special status.

TABLE 3-6
Habit, Life Form, Habitat Group, and Plant Status (USFS and UCDC) of the SAR Plants that Occur on the Wasatch-Cache National Forest

Species Name	Common Name	Habit	Life Form	Habitat Group	Plant Status
Primula maguirei	Maguire's primrose	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree, Woodlands	Threatened
Spiranthes diluvialis	Ute ladies'-tresses	Perennial	Herb	Riparian Meadows/Seeps	Threatened
Botrychium lineare	Slender moonwort	Perennial	Herb	Riparian Meadows/Seeps	Proposed
Astragalus jejunus var. *jejunus*	Starvling milkvetch	Perennial	Herb	Shrubland	Sensitive
Cypripedium fasciculatum	Clustered lady's slipper, Brownie lady's slipper	Perennial	Herb	Mountain Forests	Sensitive
Draba burkei	Burke's draba	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree, Subalpine, Alpine	Sensitive
Draba globosa (D. densifolia var. *apiculata)*	Rockcress draba	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree, Alpine	Sensitive
Draba maguirei	Maguire's draba	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree, Subalpine, Alpine, Mountain Forest	Sensitive
Erigeron cronquistii	Cronquist daisy	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree	Sensitive
Eriogonum brevicaule var. *loganum*	Logan buckwheat	Perennial	Herb	Mountain Forest, Rock Cliffs/Crevices, Talus/ Scree, Shrubland, Woodland, Alpine, Subalpine	Sensitive

TABLE 3-6
Habit, Life Form, Habitat Group, and Plant Status (USFS and UCDC) of the SAR Plants that Occur on the Wasatch-Cache National Forest

Species Name	Common Name	Habit	Life Form	Habitat Group	Plant Status
Jamesia americana var. *macrocalyx*	Wasatch jamesia, Wasatch cliff-bush	Perennial	Shrub	Rock Cliffs/Crevices, Talus/Scree	Sensitive
Lesquerella garrettii	Garrett's bladderpod	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree, Subalpine	Sensitive
Papaver radicatum ssp *kluanense*	Alpine poppy	Perennial	Herb	Alpine, Rock Cliffs/ Crevices, Talus/Scree	Sensitive
Penstemon compactus	Cache beardtongue	Perennial	Herb	Subalpine, Rock Cliffs/ Crevices, Talus/Scree	Sensitive
Potentilla cottamii	Cottam's cinquefoil, Cottam's Potentilla	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree	Sensitive
Thelesperma pubescens	Uinta greenthread	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree	Sensitive
Viola beckwithii	Beckwith's violet	Perennial	Herb	High Elevation Grassland, Woodland, Shrubland	Sensitive
Viola frank-smithii	Frank Smith's violet	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree	Sensitive
Angelica wheeleri	Wheeler's angelica	Perennial	Herb	Riparian, Meadows/ Seeps	Rec. Sensitive
Arabis glabra var. *furcatipilis*	Hopkin's tower-mustard	Biennial/ perennial	Herb	Riparian, Meadows/ Seeps, Woodland	Rec. Sensitive
Artemisia norvegica var. *piceetorum*	Spruce wormwood	Perennial	Herb	Mountain Forest, Alpine	Rec. Sensitive
Corydalis caseana ssp. *Brachycarpa*	Wasatch fitweed	Perennial	Herb	Woodland, Mountain Forest, Alpine, Riparian Meadows/Seeps	Rec. Sensitive
Cymopterus lapidosus	Echo spring-parsley	Perennial	Herb	Shrubland	Rec. Sensitive
Cypripedium calceolus ssp *parviflorum*	Lady's slipper	Perennial	Herb	Riparian Meadows/Seeps	Rec. Sensitive
Dodecatheon dentatum var. *utahense*	Utah shooting star, Wasatch shooting star	Perennial	Herb	Riparian Meadows/Seeps	Rec. Sensitive
Draba brachystylis	Wasatch draba	Biennial/ Perennial	Herb	Mountain Forests, Rock Cliffs/Crevices, Talus/ Scree	Rec. Sensitive
Erigeron arenarioides	Wasatch daisy	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree	Rec. Sensitive
Erigeron garrettii	Garrett's daisy	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree, Subalpine, Alpine	Rec. Sensitive
Ivesia utahensis	Utah Ivesia	Perennial	Herb	Alpine, Rock Cliffs/ Crevices, Talus/Scree	Rec. Sensitive

TABLE 3-6
Habit, Life Form, Habitat Group, and Plant Status (USFS and UCDC) of the SAR Plants that Occur on the Wasatch-Cache National Forest

Species Name	Common Name	Habit	Life Form	Habitat Group	Plant Status
Lepidium montanum var. *alpinum*	Alpine pepper plant, Wasatch pepper-wort	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree	Rec. Sensitive
Penstemon platyphyllus	Broad-leaf beardtongue, Broad-leaf penstemon	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree, Woodland	Rec. Sensitive
Potentilla pensylvanica var. *paucijuga*	Alpine cinquefoil, few-leaflet cinquefoil	Perennial	Herb	Alpine, High Elevation Grassland	Rec. Sensitive
Abies concolor (Gord. & Glind.) Lindl.	White fir	Perennial	Tree	Mountain Forest	Watch
Arabis lasiocarpa	Wasatch rock-cress, Toiyabe rock-cress	Perennial	Herb	Mountain Forest, Woodland, Shrubland	Watch
Aster sibericus var. *meritus*	Siberian aster		Herb	Rock Cliffs/Crevices,/ Talus/Scree, Alpine	Watch
Astragalus flexuosus var. *flexuosus*	Bent milkvetch	Perennial	Herb	Mountain Forest, Shrubland, Woodland	Watch
Astragalus robbinsii	Robbins' milkvetch	Perennial	Herb	Shrubland, Woodland	Watch
Botrychium crenulatum	Dainty moonwort, Crenualte moonwort	Perennial	Herb	Shrubland, Woodland	Watch
Cirsium eatonii var. *murdockii*	Murdock's thistle	Perennial	Herb	Rock Cliffs/Crevices,/ Talus/Scree	Watch
Cymopterus acaulis var. *parvus*	Small spring parsley	Perennial	Herb	Shrubland	Watch
Epipactis gigantea	Giant helleborine	Perennial	Herb	Riparian Meadows/Seeps	Watch
Lathyrus lanszwertii var. *Lanszwertii*	Nevada sweetpea	Perennial	Forb	Woodland	Watch
Lesquerella utahensis	Utah bladderpod	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree, Shrubland, Riparian Meadows/ Seeps, Alpine	Watch
Musineon lineare	Rydberg's musineon	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree	Watch
Pedicularis parryi ssp. *Mogollonica*	Mogollon lousewort	Perennial	Herb	Mountain Forest, Shrubland, Woodland, Alpine	Watch
Penstemon uintahensis	Uinta beardtongue	Perennial	Herb	Rock Cliffs/Crevices, Talus/Scree, Alpine, Subalpine	Watch
Porterella carnosula	Western porterella	Annual	Herb	Riparian Meadows/Seeps	Watch
Potamogeton foliosus var. *fibrillosus*	Fibrous-stipuled pond-weed	Perennial	Aquatic Herb	Riparian Meadows/Seeps	Watch

3.3.2 Aquatic Resources

3.3.2.1 Analysis Method

Aquatic resources on the W-CNF are examined at the Forest-wide level for the affected environment. However, hydrologic boundaries provide a more appropriate means for analyzing aquatic resources because aquatic species are reliant on hydrologic connectivity for dispersal and distribution. The areas of distribution are examined by general drainage areas that include the Bonneville drainage basin and the Colorado River drainage basin. The description of the affected environment for aquatic resources includes the available information for fishes and their habitats within the two basins. Primary documents used to describe the affected environment include the following:

- *W-CNF Noxious Weed Strategy* (Forest Service 2004a).
- *Revised Forest Plan for the Wasatch-Cache National Forest (W-CNF RFP)* (Forest Service 2003a).
- *Endangered, Threatened, and Sensitive Species of the Ashley, Uinta, and Wasatch-Cache National Forests (Northern Utah Ecoregion)* (1999 update).
- *Conservation Agreement and Strategy for Colorado River Cutthroat Trout in the State of Utah* (Forest Service 1997a).
- *Conservation Agreement and Strategy for Bonneville Cutthroat Trout in the State of Utah.* (Forest Service 1997b).
- *Range-Wide Conservation Agreement and Strategy for Bonneville Cutthroat Trout* (Forest Service 2000b).
- *Conservation Agreement and Strategy for Colorado River Cutthroat Trout in the States of Colorado, Utah, and Wyoming* (2001e).

3.3.2.2 Analysis Area

The analysis area for the proposed project includes the lands managed by the W-CNF within the Bonneville drainage basin and the Colorado River drainage basin.

3.3.2.3 Existing Conditions

3.3.2.3.1 Habitat Conditions and Threats

The W-CNF includes approximately 1,200 miles of perennial streams and 2,200 miles of intermittent streams. The Forest also contains 4,700 acres of lakes and ponds, 4,400 acres of reservoirs, and 2,300 acres of marshes. Habitat conditions across the Forest are considered good, with many streams and lakes containing trout. The landscape conditions for aquatic species are based on Forest Service Inland West Watershed Initiative (IWWI) classifications at the Sixth Field HUC for geomorphic integrity, water quality integrity, and watershed vulnerability (Forest Service 2004a). The synopsis for aquatic conditions across the W-CNF is presented in the following text.

Geomorphic Integrity. The geomorphic integrity was identified as moderate for approximately 73 percent of the W-CNF watersheds analyzed. Geomorphic integrity was considered high for approximately 23 percent, and low for approximately 4 percent of the W-CNF watersheds (east sides of the Logan and Ogden Districts that drain into the Bear River) analyzed (see Table 3-7). In the Colorado River drainage, all of the Sixth Field HUCs were “moderate” (Table 3-7).

TABLE 3-7
Geomorphic Integrity, Water Quality Integrity, and Watershed Vulnerability as Developed for the Wasatch-Cache National Forest (Forest Service 2003a)

Rating	Geomorphic Integrity (percent)	Water Quality (percent)	Watershed Vulnerability (percent)
Forest Wide			
Low	4	14	9
Moderate	73	80	71
High	23	6	20
Bonneville Drainage			
Low	5	16	10
Moderate	67	77	67
High	28	7	22
Colorado Drainage			
Low	0	6	0
Moderate	100	94	89
High	0	0	11

Water Quality Integrity. When water quality integrity was identified across the Forest, minor parts of stream segment miles were shown to be damaged (approximately 80 percent). Approximately 14 percent (Davis County north along the Wasatch Front) of the W-CNF watersheds analyzed were considered to have few, if any, damaged segments, while about 6 percent (mostly Upper Provo River watersheds) of the watersheds analyzed were considered to have damage to a major part of the segments. Water quality integrity did not vary greatly between the Colorado and Bonneville basins.

Watershed Vulnerability. Across the Forest, 71 percent of the subwatersheds (Sixth Field HUC) were rated as having moderate watershed vulnerability (Table 3-7). Twenty percent of the Forest had major parts of the watershed in sensitive lands including Bear River, Box Elder Creek Drainage, the Wasatch Front in Davis County, and the Mill Creek Drainage in Summit County.

Threats

In a number of cases, man has altered the habitat to meet the needs of the times. These alterations include the construction of roads across streams, the construction of dams and diversions, and the modification of stream channels to minimize flooding or to provide a means to transport railroad ties to the market. Timber harvest, grazing, and recreational activities have also impacted aquatic and semi-aquatic species' habitats (Forest Service 2003a).

3.3.2.3.2 Threatened, Endangered, and Sensitive Species

Fish species-at-risk (SAR) include those species that are listed as Regional Sensitive by Region 4 of the Forest Service as well as those that are federally listed under the ESA (Forest Service 1999). W-CNF SAR found in the proposed project area were identified in the W-CNF RFP (Forest Service 2003a) and are included in Table 3-8. Several native SAR found on or adjacent to the Forest are analyzed for potential effects from the proposed project; Bonneville or Colorado River cutthroat trout are used as the fish indicators because of their viability requirements. The assumption is that by meeting the biological needs of cutthroat trout, the biological needs of the other coldwater fishes will also be met. These species, for which the cutthroat trout would be considered a "focal species," are mountain whitefish, mountain sucker, bluehead sucker, sculpin, and dace.

TABLE 3-8
Fish Species At Risk On or Downstream of the Wasatch-Cache National Forest, Utah (Forest Service 2005a)

Fish	Scientific Name	Comments
Cutthroat Trout, Bonneville	*Oncorhynchus clarki utah*	FS Sensitive[1,2]
Cutthroat Trout, Colorado River	*Oncorhynchus clarki pleuriticus*	FS Sensitive[1]
Colorado Pikeminnow	*Ptychocheilus lucius*	FWS Endangered
Humpback Chub	*Gila cypha*	FWS Endangered
Bonytail Chub	*Gila elangas*	FWS Endangered
Roundtail Chub	*Gila robusta*	FS Sensitive[2]
Razorback Sucker	*Xyrauchen texanus*	FWS Endangered
June Sucker	*Chasmistes liorus mictus*	FWS Endangered

[1]Forest Service Region 2 Listed
[2]Forest Service Region 2 Listed

Source: Forest Service (2005a)

Colorado River Fishes

The Colorado River fishes that may be a concern include the bonytail chub, Colorado pikeminnow, humpback chub, razorback sucker, and roundtail chub (Table 3-8). All of these fish, with the exception of the roundtail chub, are listed as endangered under the ESA. These species reside off-Forest, and W-CNF consultation with the FWS is required only for water withdraw projects on the Forest (M. Long, pers. comm. *in* Forest Service 2003a). No site-specific projects are identified in the W-CNF RFP (2003a) or activities associated with the proposed project that would restrict water flows from the Forest;

therefore, no additional effects from Forest activities are expected and no further examination of these species will be conducted.

June Sucker (Chasmistes liorus mictus)

This species' historic habitat is off-Forest; Forest Service consultation with the FWS is similar to the Colorado River fishes. Water withdrawal projects are the only projects that may impact the June suckers found in their historic habitat. No site-specific projects are identified in the W-CNF RFP (2003a) or activities associated with the Proposed Action that would restrict water flows from the Forest; therefore, no additional effects from Forest activities are expected and no further examination of these species will be conducted.

3.3.2.3.3 Management Indicator Species (MIS)

Colorado River cutthroat trout and Bonneville cutthroat trout are identified as W-CNF MIS for aquatic communities. MIS are representative species whose condition and population changes are used to assess the impacts of management activities on similar species in a particular area (W-CNF 2003a). As mentioned previously, the cutthroat trout species are used as the fish indicators because they represent other native coldwater fishes. The assumption is that by meeting the biological needs of cutthroat trout, the biological needs of the other coldwater fishes will also be met (Forest Service 2003a).

Colorado River Cutthroat Trout (Oncorhynchus clarki pleuriticus)

The Colorado River cutthroat trout was been petitioned for federal listing under the ESA, but was found not warranted at this time (69 FR 51362). This species has been identified as both a SAR (Forest Service 2003a) and a MIS (Forest Service 2003a) for the W-CNF. The range of the Colorado River cutthroat trout is bounded by the Missouri, Snake, and Bonneville drainages and, downstream, by the temperature gradient of the Colorado River. Historically, Colorado River cutthroat trout occupied all accessible cool waters of the upper Colorado River drainage, including the Green, Yampa, Gunnison, Dolores, San Juan, Duchesne, and Dirty Devil rivers (Young *et al.* 1996). A rough estimate suggests that Colorado River cutthroat trout are presently found in about 1 to 2 percent of their historic habitat (B. May, pers. comm. *in* Forest Service 2003a). Almost all (95 to 100 percent) of the remaining populations currently reside on National Forest lands (B. May, pers. comm. *in* Forest Service 2003a). This subspecies was once found on eight National Forests in the states of Wyoming, New Mexico, Colorado, and Utah. The W-CNF contains 3 percent of the existing watersheds in which cutthroat trout are present (Table 3-9). Colorado River cutthroat trout are currently found in 26 percent of their historic watersheds on National Forest lands. Of the watersheds where Colorado River cutthroat trout are currently present, their populations are strong in only 15 percent of the watersheds (Forest Service 2003a). A number of threats to Colorado River cutthroat trout were identified on W-CNF lands; these include roads, trails, motorized trails, grazing, developed recreation sites, and special uses authorized in riparian zones (that is, within 300 feet of streams) on National Forest System lands. Timber harvest allocations and the presence of non-native fish also have been included in the analysis (Forest Service 2003a). Additional threats include introduced, non-native fishes (Forest Service 2003a).

TABLE 3-9
Metapopulations/populations (MP/P) Found in Identified Subwatersheds with their Identified Trend from the Forest Plan for Cutthroat Trout on the Wasatch-Cache National Forest[1]

Populations/Metapopulations	Subwatershed	Forest Plan MP/P Converted Trend*	MP/P Trend (based on survey data)
1—Burnt Fork	Upper Burnt Fork Lower part of Burnt Fork	Flat	NE[2]
2—Beaver Meadows Reservoir and Tributaries	Lower part of Burnt Fork	Flat	NE[2]
3—Beaver Fork (West, Middle and East Fork)	East & Middle Fork Beaver West Fork Beaver	Flat	NE[2]
4—Henrys Fork	Upper Henrys Fork	Flat	NE[2]
5—Gilbert Creek	Gilbert Creek	Up	NE[2]
6—East Fork Smith Fork	East Fork Smiths Fork	Flat	NE[2]
7—West Fork Smith Fork	West Fork Smiths Fork	Flat	NE[2]
8—Willow Creek	Willow Creek	Down	NE[2]
9—Sage Creek	Sage Creek	Flat	NE[2]
10—Blacks Fork	E. F. Blacks Fork W. F. Blacks Fork	Flat	NE[2]
11—Lower Blacks Fork	Lower Blacks Fork River	Down	NE[2]
12—Little West Fork Blacks Fork	Little West Fork Blacks Fork	Flat	NE[2]
13—Muddy Creek	W.F. Muddy Cr.	Flat	NE[2]
14—Upper Bear River	East Fork Bear River Stillwater Drainage Hayden Fork	Flat	Flat
15—West Fork Bear River	West Fork Bear River, Meadow, Humpy, Deer C	Flat	Flat
16—Whitney Reservoir	West Fork Bear River, Whitney Reservoir and upstream	Flat	Up
17—Mill City Creek	Mill City Creek	Flat	Flat
18—Mill Creek Upper Bear	Mill Creek Drainage	Flat	Flat
19—Upper Woodruff Creek	Upper Woodruff Creek	Flat	NE[2]
20—Logan River	Lower Logan Canyon Right Hand Fork Cottonwood Canyon Temple Fork Tony Grove area Franklin Basin Beaver Creek	Flat	Down
21—Blacksmith Fork 1	Sheep Creek Upper Blacksmith Fork	Flat	NE[2]
22—Blacksmith Fork 2	Curtis Creek Rock Creek	Flat	Down

TABLE 3-9
Metapopulations/populations (MP/P) Found in Identified Subwatersheds with their Identified Trend from the Forest Plan for Cutthroat Trout on the Wasatch-Cache National Forest[1]

Populations/Metapopulations	Subwatershed	Forest Plan MP/P Converted Trend*	MP/P Trend (based on survey data)
23—Left Hand Fork Blacksmith	Left Hand Fork Blacksmith Fork Middle Part of Blacksmith Fork	Down	Down
24—Beaver Creek, Weber Drainage	Beaver Creek	Flat	NE[2]
25—Weber River	Weber Headwaters South Fork Weber River (Nobletts Creek)	Flat	NE[2]
26—Smith Morehouse	Smith Morehouse	Flat	NE[2]
27—Ogden Canyon	Ogden Canyon	Flat	NE[2]
28—North Fork Ogden	Upper Part of North Fork Ogden River	Flat	NE[2]
29—Causey Reservoir	Left Fork South Fork Ogden River Wheat Grass Creek	Flat	NE[2]
30—South Fork Ogden	Middle South Fork Ogden River	Down	NE[2]
31—Wheeler Creek	Wheeler Creek	Flat	NE[2]
32—Middle Fork Ogden	Pineview Reservoir area	Down	NE[2]
33—Upper Provo River	Upper Provo River North Fork Provo River	Flat	NE[2]
34—Little Cottonwood	Little Cottonwood Canyon, mile of cutthroat trout	Down	NE[2]
35—Mill Creek Jordan	Mill Creek	Down	NE[2]
36—Parleys Creek	Parleys Canyon	Up	NE[2]
37—Red Butte	Red Butte Canyon	Up	NE[2]

[1]The MP/P trend is based on survey data collected since the implementation of the Forest Plan in 2003.
NE[2]-Trend not yet established.

Bonneville Cutthroat Trout (Oncorhynchus clarki utah)

The Bonneville cutthroat trout has been petitioned for Federal listing under the ESA, but was found not warranted at this time (66 FR 21151). This species has been identified as a both a SAR and a MIS for the W-CNF (2003a). For the range of the Bonneville cutthroat trout, the Snake River drainage forms the boundary on the north, the Colorado River on the east and south, and the Nevada desert lands and drainages on the west. Historically, Bonneville cutthroat trout occupied approximately 90 percent of the Bonneville Basin (Duff 1996 *in* Forest Service 2003a). Bonneville cutthroat trout currently occupy about 2,380 miles of habitat, which is approximately 35 percent of the nearly 6,758 miles of historically occupied habitat. Bonneville cutthroat trout currently occupy more than 1,515 miles in Utah (63.7 percent of current, range-wide occupied habitat and 31 percent of historical habitat within Utah); 540 miles in Idaho (22.7 percent of current, range-wide

habitat and 47 percent of historical habitat in Idaho); 296 miles in Wyoming (12.4 percent of current, range-wide habitat and 49 percent of historical habitat in Wyoming); and, about 29 miles in Nevada (1.2 percent of current, range-wide habitat and 35 percent of historical habitat in Nevada) (May *et al.* 2005).

A number of threats to Bonneville cutthroat trout were identified on W-CNF lands, with the most critical being roads, trails, motorized trails, grazing, developed recreation sites, and special uses authorized in riparian zones (within 300 feet of streams) on National Forest System lands. Timber harvest allocations and the presence of non-native fish have also been included in the analysis (Forest Service 2003a). Additional threats include introduced, non-native fishes (Forest Service 2003a).

A number of guiding documents, directives, and processes that are currently in-place will aid in the long-term conservation of aquatic ecosystems and are pertinent to the Bonneville and Colorado River cutthroat trout on the W-CNF. The existing documents that provide direction for the long-term persistence of cutthroat trout include the following:

- *Fish Stocking and Transfer Procedures* of the Utah Division of Wildlife Resources (Forest Service 1997a *in* Forest Service 2003a). This document describes the general policy and procedures for stocking and transplanting fish in the State of Utah. In its policy direction it states, "Fish stocking... will only be conducted in a manner that does not adversely affect the long-term viability of native aquatic species or their habitat, aids native species conservation, and enhances fish populations in existing aquatic habitats and aids the efficient and effective management of recreational fisheries to provide angling diversity and participation" (Forest Service 1997a *in* Forest Service 2003a).
- The *Conservation Agreement and Strategy for Colorado River Cutthroat Trout in the State of Utah* (Forest Service 1997a). This conservation strategy identifies the major threats and actions to be taken to preserve this species. It is generally a fish management document with minimal emphasis on habitat protection and enhancement.
- *The Conservation Agreement and Strategy for Bonneville Cutthroat Trout in the State of Utah* (Forest Service 1997b). This conservation strategy identifies the major threats and actions to be taken to preserve this species. It is generally a fish management document with minimal emphasis on habitat protection and enhancement.
- *The Conservation Agreement and Strategy for Colorado River Cutthroat Trout (Oncorhynchus clarki pleuriticus) in the States of Colorado, Utah and Wyoming* (Forest Service 2001e) provides an interagency approach for the conservation of Colorado River cutthroat trout.
- *Range-wide status of Bonneville Cutthroat Trout (Oncorhynchus clarki utah): 2004 (*May *et al.* 2005) provides an update on interagency efforts for the conservation and distribution of the species within its range.
- *The Range-wide Conservation Agreement and Strategy for Bonneville Cutthroat Trout (Oncorhynchus clarki utah) (*Lentsch *et al.* 2000) provides an interagency approach for the conservation of Bonneville cutthroat trout across its range.

The *Final Environmental Impact Statement on Rangeland Health* (Forest Service 1996b), as amended by the W-CNF RFP (Forest Service 2003a), provides recognition of the value of waters with native cutthroat trout. These waters containing native cutthroat are identified as having Class 1 riparian values.

The goals, standards, and guides in this document also provide conservation measures along with the *Forest Service Manual, Section 2600*. As part of this direction, and prior to approval of any ground-disturbing activity, a biological evaluation/assessment must be prepared. This document must then be signed by the botanist, and terrestrial and aquatic ecologists identifying the consequences of those activities.

One major action that has taken place is the general recognition of the value of W-CNF streams to the long-term preservation of cutthroat trout in the states of Utah and Wyoming; in the W-CNF RFP (Forest Service 2003a), this occurred by designating all areas inhabited by cutthroat trout as prescription 3.1A Riparian. This sets forth the objectives for the area and the importance of the W-CNF in preserving these species. A 3.1A designation was also placed on the lower Provo River to recognize the importance of the spotted frog populations found there.

3.3.2.3.4 Recreational Fisheries and Non-Game Species

At least 24 fish species occur in the waters of the W-CNF. Seven of these were historically found within the planning area (Table 3-10), seven occur downstream, and more than 14 fish species have been introduced to enhance sport-fishing opportunities (Forest Service 2003a). Many of the fish species currently found in the Forest are considered economically important from a recreation and/or sport fishing perspective (Table 3-10). Of the numerous fish species that occur in the W-CNF, those that are native to the Forest are the focus of the remainder of the discussion.

TABLE 3-10
Fish Believed to Have Been Found Pre-Settlement (1845), Downstream, and those Introduced to the Lands Administered by the Wasatch-Cache National Forest (Forest Service 2003a)

Fish	Scientific Name	Historically	Downstream	Introduced
Cutthroat Trout, Bonneville	*Oncorhynchus clarki utah*	X		
Cutthroat Trout, Colorado	*Oncorhynchus clarki pleuriticus*	X		
Longnose Dace	*Rhinichthys cataractae*	X		
Mottled Sculpin	*Cottus bairdi*	X		
Paiute Sculpin	*Cottus beldingi*	X		
Mountain Whitefish	*Prosopium williamsoni*	X		
Mountain Sucker	*Catostomus platyrhynchus*	X		
Bluehead Sucker	*Catostomus discobolus*		X	
Colorado Pikeminnow	*Ptychocheilus lucius*		X	
Colorado River Roundtail Chub	*Gila robusta robusta*		X	

TABLE 3-10
Fish Believed to Have Been Found Pre-Settlement (1845), Downstream, and those Introduced to the Lands Administered by the Wasatch-Cache National Forest (Forest Service 2003a)

Fish	Scientific Name	Historically	Downstream	Introduced
Humpback Chub	*Gila cypha*		X	
Bonytail Chub	*Gila elangas*		X	
Razorback Sucker	*Xyrauchen texanus*		X	
June Sucker	*Chasmistes liorus mictus*		X	
Arctic Grayling	*Thymallus arcticus*			X
Black Crappie	*Pomoxis nigromaculatus*			X
Bluegill	*Lepomis macrochirus*			X
Brook Trout	*Salvelinus fontinalis*			X
Brown Trout	*Salmo trutta*			X
Common Carp	*Cyprinus carpio*			X
Golden Trout	*Oncorhynchus aguabonita*			X
Kokanee (lacustrine sockeye salmon)	*Oncorhynchus nerka*			X
Largemouth Bass	*Micropterus salmoides*			X
Rainbow Trout	*Oncorhynchus mykiss*			X
Smallmouth Bass	*Micropterus dolomieu*			X
Tiger Muskie	*Esox masquinongy X lucius*			X
Yellow Bullhead	*Ameiurus melas*			X
Yellow Perch	*Perca flavescens*			X
Yellowstone Cutthroat Trout	*Oncorhynchus clarki bouvieri*			X

The distribution of fish species was identified through review of survey information and discussions with the Utah Division of Wildlife Resources (Forest Service 2003a). Much of these data were developed during the Inland West Watershed Initiative (IWWI). Unless otherwise specified, description of range and habitat is based on species range-wide information (Forest Service 2003a).

Mountain Whitefish (Prosopium williamsoni)

In general, this species is wide ranging and is viewed as at minimal risk by actions occurring on the W-CNF (Table 3-11). The primary habitat for the mountain whitefish is found off the National Forest with only fringe habitat being found on the Forest. Sigler and Sigler (1996 *in* Forest Service 2003a) in *Fishes of Utah* state that, "Mountain whitefish appear to be prospering throughout their range." Cutthroat trout are found in all streams containing mountain whitefish. By maintaining habitat to support cutthroat trout, it is assumed that mountain whitefish would be viable. This is assumed because the two species are found occupying similar habitat where they coexist and their basic habitat

requirements are similar. Whitefish are fall spawners and so some of the threats, such as the potential for trampling, would be reduced during spawning.

TABLE 3-11
Streams and Lakes Surveyed on the Wasatch-Cache National Forest that Contain Native Fish Other Than Cutthroat Trout*

Stream	Drainage	County	Mt. Whitefish	Sculpin	Mt. Sucker	Longnose Dace
East Fork Bear River	Bear River	Summit	No	Yes	Yes	Yes
Hayden Fork	Bear River	Summit	Yes	Yes	No	No
Mill City Creek	Bear River	Summit	No	Yes	No	No
Mill Creek	Bear River	Summit	No	Yes	No	No
North Fork Mill Creek	Bear River	Summit	No	Yes	No	No
Ostler Fork	Bear River	Summit	No	Yes	No	No
Stillwater Fork	Bear River	Summit	Yes	Yes	Yes	No
Teal Lake Tributary	Bear River	Summit	No	Yes	No	No
West Fork Bear River	Bear River	Summit	No	Yes	No	No
Hidden Lake	Beaver Creek	Summit	No	No	Yes	No
Middle Fork Of Beaver Creek	Beaver Creek	Summit	No	Yes	No	No
East Fork Of Blacks Fork	Blacks Fork	Summit	Yes	Yes	No	No
Little East Fork Blacks Fork	Blacks Fork	Summit	Yes	No	No	No
Little West Fork Blacks Fork	Blacks Fork	Summit	No	No	Yes	No
West Fork Of Blacks Fork	Blacks Fork	Summit	Yes	Yes	Yes	No
Curtis Creek	Blacksmith Fork	Cache	No	Yes	No	No
Rock Creek	Blacksmith Fork	Cache	No	No	Yes	No
Henrys Fork	Henrys Fork	Summit	No	Yes	Yes	No
Big Cottonwood Creek	Jordan River	Salt Lake	No	No	Yes	No
West Fork Muddy Creek	Muddy Creek	Summit	No	Yes	No	No
Left Fork, South Fork Ogden	Ogden River	Weber	No	Yes	No	No
Right Fork, South Fork Ogden	Ogden River	Weber	No	Yes	No	No
Boulder Creek	Provo River	Summit	No	Yes	No	No
North Fork Provo River	Provo River	Summit	No	Yes	Yes	No
Upper Provo River	Provo River	Summit	No	Yes	No	No
China Lake	Smiths Fork	Summit	No	No	Yes	No
Steel Creek	Smiths Fork	Summit	No	Yes	No	No
West Fork Of Smiths Fork	Smiths Fork	Summit	No	Yes	Yes	No
Beaver Creek	Weber River	Summit	Yes	Yes	Yes	Yes
Coop Creek	Weber River	Summit	No	Yes	No	No
Gardners Fork	Weber River	Summit	No	Yes	No	No
Redpine	Weber River	Summit	No	Yes	No	No
Shingle Creek	Weber River	Summit	Yes	Yes	Yes	No
Slate Creek	Weber River	Summit	Yes	Yes	No	No
South Fork Weber	Weber River	Summit	No	Yes	No	No

TABLE 3-11
Streams and Lakes Surveyed on the Wasatch-Cache National Forest that Contain Native Fish Other Than Cutthroat Trout*

Stream	Drainage	County	Mt. Whitefish	Sculpin	Mt. Sucker	Longnose Dace
Yellow Pine Creek	Weber River	Summit	No	Yes	No	No
West Fork Beaver	Burnt Fork	Summit	No	Yes	No	Yes
West Fork of Smiths Fork	Smiths Fork	Summit	Yes	Yes	Yes	No

* Many other lakes and some streams have not yet been surveyed and/or summarized (Forest Service 2003a).

Mottled and Paiute Sculpin (Cottus sp.)

Sculpin are well distributed across the Forest (Table 3-11) and are not viewed as at-risk based on their distribution and densities. Both species need cool, clean, well-oxygenated water for survival, similar to the cutthroat trout. By maintaining habitat to support cutthroat trout, it assumed that the viability of mottled and Paiute sculpin would be maintained (Forest Service 2003a).

Mountain Sucker (Catostomus platyrhynchus)

This species occurs across much of the western United States. The species is native to Utah, and can be found in both the Bonneville Basin and Colorado River system. The primary habitat for the mountain sucker is found off the W-CNF with only fringe habitat being found on the Forest. The locations where mountain sucker have been found on the Forest vary greatly, but are similar to those for mountain whitefish (Table 3-11). The primary exception on the W-CNF is that these fish are found in some lakes on the Forest (Forest Service 2003a). The mountain sucker population of greatest concern is the stream population located up Big Cottonwood Canyon. During surveys in 1998 only two suckers were captured near Brighton Ski Resort in Big Cottonwood Creek. No other suckers have been captured in Big Cottonwood Creek over the past 10 years, although much of the drainage has been surveyed for fish species. These fish may, however, have just come downstream from Twin Lake, which contained mountain sucker when surveyed in 1981. For this analysis, the mountain sucker in Big Cottonwood Creek will be grouped with mountain sucker in general because of the lack of any scientific data suggesting they are a unique subspecies. This species is wide ranging and is not viewed as at risk by actions occurring on the W-CNF. By maintaining habitat to support cutthroat trout, it is assumed that mountain sucker would also remain viable. Sigler and Sigler (1996 *in* Forest Service 2003a) state, “Preventing habitat degradation is the primary protection requirement.”

Bluehead Sucker (Catostomus discobolus)

Bluehead sucker are distributed in the Green River, upper Colorado River, and upper Bear River drainages and south to Arizona. They are also found in the Snake River above Shoshone Falls (Sigler and Sigler 1996 *in* Forest Service 2003a). They are found in moderately swift moving water with a substrate of rocks, gravel, or boulders mixed with mud and sand (Borthwick 1983 *in* Forest Service 2003a). This species is wide-ranging (Table 3-11) and is not viewed as at-risk by actions occurring on the W-CNF (Forest Service 2003a). The general habitat of this species and that of the Colorado River cutthroat trout differ. The bluehead sucker generally lives in larger, warmer streams,

which would be downstream of most of the trout habitat. By maintaining habitat to support trout, conditions to support the bluehead sucker also should be maintained and the populations on the Forest would remain viable. Sigler and Sigler (1996 *in* Forest Service 2003a) identify predation and hybridization as the primary threats to the species. Bluehead sucker are known to exist downstream of the Forest in a number of drainages (Baxter and Simon 1970).

Longnose Dace (Rhinichthys cataractae)

The primary habitat for this dace is found off the W-CNF with only fringe habitat being found on the Forest. The two locations where dace have been found on the Forest are at the Forest boundary in Beaver Creek and the East Fork of the Bear River (Table 3-11). This species is wide-ranging and is not viewed as at risk by actions occurring on the W-CNF. Sigler and Sigler (1996 *in* Forest Service 2003a) identify predation as the primary limiting factor and also state that water quality is an important management factor. Bonneville cutthroat trout are found in all of the locations where longnose dace are found. By maintaining habitat to support Bonneville cutthroat trout, it is assumed that the longnose dace would remain viable.

Leatherside Chub (Gila copei)

The primary habitat for the leatherside chub is found off of the W-CNF forest (Baxter and Simon 1970). The leatherside chub is listed as a Species of Concern by the Wyoming Game and Fish Department (WGFD [2005]). The only location it has been found on Forest is in the Bear River adjacent to the Bear River Ranger Station south of Evanston, Wyoming. The species is rare and inhabits cool, clear streams and appears to favor pool habitats (Baxter and Simon 1970). Although the species is restricted in range, it is not viewed as at risk by actions occurring on the W-CNF.

3.3.3 Wildlife Resources

3.3.3.1 Analysis Method

The following documents, information, and data analysis sources were reviewed and/or used in the preparation of the *Wildlife Resources Section*. This information provides the basis for describing the affected environment and the baseline for analyzing and comparing potential effects in Chapter 4 of the Proposed Action and alternatives on wildlife resources in the analysis area.

- *W-CNF Noxious Weed Strategy* (Forest Service 2004a).
- *W-CNF RFP* (Forest Service 2003a).
- Forest Service data and expertise. This consists of published documents, GIS data, field data, observations gathered for this and other projects, and interviews of other personnel experienced in the area.

3.3.3.2 Analysis Area

The analysis area for wildlife resources is as described in *Section 3.2.2, Geography*. The following text discusses wildlife resources across all three ecological regions (Overthrust Mountains, Bonneville Basin, and Uinta Mountains), as the resource is applicable to all regions, depending on habitat conditions. Those wildlife resources having a specific, ecological area, concern are called out in the following text.

3.3.3.3 Existing Conditions

The wildlife issue is the effect of the proposed project on terrestrial wildlife species. This is evaluated in Chapter 4, using indictors that address Federal protected species and Forest Service Sensitive Species, MIS, and migratory bird species. Evaluation indicators related to big game winter range and wildlife habitats are discussed within the context of biodiversity or within the vegetation section. Although existing conditions (Chapter 3) and effects analysis (Chapter 4) focuses on the indictors identified for the issue, some general comments on terrestrial wildlife are provided in both chapters.

3.3.3.3.1 Wildlife Species

Wildlife could be categorized in general as big game, small game, non-game, and neo-tropical migratory birds. A general discussion of these categories follow, but the reader is directed to species specific discussions in other sections.

Big Game

Big game species found on the Forest include mule deer (*Odocoileus hemionus hemionus*), elk (*Cervus elaphus nelsoni*), and moose (*Alces americanus shirasi*). See Table 3-12 for estimated numbers of animals and population objectives by Harvest Unit for deer, and elk.

Mule deer habitat within the W-CNF includes both summer and winter range. The amount and quality of winter range in Northern Utah is the limiting factor for deer. Elk habitat also contains both summer and winter range, with winter range being the limiting factor.

Moose numbers are currently near herd objectives and within UDWR's management objectives. Moose are yearlong residents moving little between summer and winter ranges. Because of their large body mass and long legs only minor adjustments between summer and winter ranges are necessary. Habitat primarily used by moose includes riparian areas with plentiful willow browse and areas such as ridgelines with abundant mahogany shrubs.

Winter range is the most limiting habitat for big game and is the only aspect of big game to be discussed further (see *Section 4.2.3 Wildlife Resources*, in Chapter 4).

TABLE 3-12
Estimated Numbers of Animals and Population Objectives in the Cache Herd Unit for Deer, Elk, and Moose.

		Deer		Elk	
Harvest Unit Number	**Harvest Unit Name**	**Objective**	**Present Numbers Post 2002**	**Objective**	**Present Numbers Post 2003**
1	Box Elder	24,000	14,500	675	330
2	Cache	25,000	18,400	2,300	1,950
3	Ogden	12,000	9,400	1,200	650
4	Morgan, S. Rich	12,500	10,100	3,500	4,300
5	East Canyon	8,500	8,600	1,000	1,500
6	Chalk Creek	11,500	11,800	1,900	2,100
7	Kamas	9,000	6,800	650	600
8	North Slope Summit-W. Daggett	5,300	4,500	1,600	1,220
17	Wasatch Mts.	40,800	32,200	2,850	2,850
18	Oquirrh-Stansbury	10,600	10,800	800	700

Note: Harvest Units go beyond Forest boundaries.
Source: Data provided by Mike Welch, UDWR Wildlife Biologist (2003)

Small Game

Small game species include ruffed grouse (*Bonasa umbellus incana*), and blue grouse (*Dendragapus obscurus*). Snowshoe hares (*Lepus americanus*) are also considered small game animals and are discussed in Section 3.3.3.3.4 Wildlife Management Indicator Species. Sage Grouse are covered under *Section 3.3.3.3.3 Forest Service Sensitive Species*.

Ruffed grouse numbers have been fairly stable for several years. They prefer thickets of mixed hardwood, including aspen, and conifers. In Northern Utah, birds display some seasonal differences in diet. Important summer forage items consist of insects, fruits, forb seeds, and plant tissues. Fall foraging centers on rose hips, aspen leaves, and chokecherries, while winter diets are almost exclusively deciduous plant buds, in particular aspen buds. Ruffed grouse thrive best in young seral stage forests where understory forbs and shrubs flourish.

Blue grouse populations have been higher for the last few years. The blue grouse prefers subalpine habitats—which occur throughout much of the upper elevations of the proposed project area—foraging heavily on conifer needles and buds of shrubs. Habitat selection generally consists of dense herbaceous cover and sagebrush for nesting and dense, insect-rich herbaceous plants near riparian zones for brood rearing.

As mentioned above, snowshoe hare and sage grouse are the small game species discussed further in this DEIS.

Small Mammals

Small mammals that occur or are likely to occur on the W-CNF include various squirrels, chipmunks, shrews, mice, voles, and gophers. No inventory of species numbers or diversity has been conducted; therefore, abundance or trends are unknown.

Ground squirrels are highly adaptable and use a variety of environments, mostly open, non-forested areas, with the exception of the golden-mantled squirrel, which uses open forests. Ground squirrels primarily use plant material for food. Chipmunks and tree squirrels primarily use seeds as food and are more common in forested environments.

Shrews are primarily insectivores and usually are tied closely to moist habitats with higher amounts of vegetation cover such as riparian areas and meadows. Most mice use a variety of food resources such as insects, seeds, and plant material and use a variety of habitat types. Voles primarily use plant material for food and usually are tied closely to moist habitats with higher amounts of vegetation cover such as riparian areas and meadows. Gophers use a variety of environments, both forested and non-forested. Gophers use plant material such as roots and tubers for food.

Several small mammals, such as bats, pygmy rabbit, and wolverine, are discussed within *Section 3.3.3.3.3, Sensitive Species*. No other small mammal species will be directly addressed in this DEIS.

3.3.3.3.2 Threatened, Endangered, and Candidate Species

A list of endangered, threatened, and candidate species from the FWS indicates that five species occur within one or more of the 11 counties in the analysis area. The FWS list indicates that the species occurs in or has habitat in the county. The list does not indicate that the species or suitable habitat occurs on W-CNF lands. Wildlife species listed by the FWS and the counties in which they occur are shown in Table 3-13.

TABLE 3-13
Federal Threatened, Endangered, and Candidate Species that may Occur on the Wasatch-Cache National Forest Within the Analysis Area

Species	County										
	BE	**CA**	**DA**	**DU**	**MO**	**RI**	**SL**	**SU**	**TO**	**WE**	**UI**
Bald eagle (Threatened)[a] *Haliaeetus leucocephalus*	X	X	X[b]	X	X	X	X[b]	X	X	X	X
Western yellow-billed cuckoo (Candidate)[c] *Coccyzus americanus occidentalis*	X	X	X	X	X		X	X	X	X	
Canada lynx (Threatened) *Lynx canadensis*		X		X	X	X	X	X		X	X
Black-footed ferret (Endangered)[d] *Mustela nigripes*				X		X		X			X
Gray Wolf (Experimental, Non-essential) *Canis lupus*											X

Source: FWS 2005: List of January 2005 for Utah and March 2004 for Wyoming.
BE = Box Elder; CA = Cache; DA = Davis; DU = Duchesne; MO = Morgan; RI = Rich; SL = Salt Lake; SU = Summit; TO = Tooele; WE = Weber; UI = Uinta, Wyoming
Footnotes are those that pertain from the FWS species list:
[a] Wintering populations (only four known nesting pairs in Utah).
[b] Nests in this county of Utah.
[c] Candidate species have no legal protection under the Endangered Species Act. However, these species are under active consideration by the Service for addition to the Federal List of Endangered and Threatened Species and may be proposed or listed during the development of the proposed project.
[d] Historical range.

Bald Eagle (*Haliaeetus leucocephalus)*

The FWS listed bald eagle populations south of the 40th parallel as endangered in 1967 under the authority of the ESA of 1973 (32 FR 4001, March 11, 1967). Eleven years later in 1978, their status was re-examined and eagles resident in the lower 48 states were separated into areas with a threatened status and an endangered status. Populations in Michigan, Minnesota, Wisconsin, Oregon, and Washington were all assigned a threatened status (43 FR 6233, February 14, 1978). In 1995, bald eagles were once again reassessed and down-listed from endangered to threatened in all of the lower 48 states (60 FR 36000, July 12, 1995).

The Forest Service (2003a) summarized bald eagle range and habitat. Bald eagles range across North America. Breeding range extends from south of the arctic tundra in Alaska and Canada south to the southern United States and Baja California. During winter, eagles generally move south to open water or wherever food is available. Bald eagles can be found in almost every state for all or part of the year.

In Utah, five nesting pairs are known to occur, though none of these pairs occurs in the W-CNF. The state winters several hundred bald eagles. Wintering bald eagles tend to concentrate wherever food is available. This usually means open water where fish and waterfowl can be caught. They also winter on more upland areas feeding on small mammals and carrion. Bald eagles commonly roost in large groups in wintering areas.

On the W-CNF, bald eagles use lower elevation areas on south and west facing slopes for roosting in areas where there is open water and other abundant food sources. The heaviest concentrations are along the Wasatch Front and the Vernon area, with individuals and smaller groups around Cache Valley, Ogden Valley, and Kamas. They can, however, occasionally be observed at almost any lower elevation area on or adjacent to the Forest, especially during the fall and spring migrations.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)

The FWS received a petition dated February 2, 1998, to list the yellow-billed cuckoo as an endangered species. The petitioners stated that "habitat loss, overgrazing, tamarisk invasion of riparian areas, river management, logging, and pesticides have caused declines in yellow-billed cuckoo." The 90-day finding dated February 17, 2000 (65 FR 33), found that the petition presented substantial scientific and commercial information to indicate that the listing of the yellow-billed cuckoo may be warranted. In that finding, FWS indicated that the factors noted by the petitioners may have caused loss, degradation, and fragmentation of riparian habitat in the western U.S., and that loss of wintering habitat may be adversely affecting the cuckoo. In July 2001, the FWS announced a 12-month finding for a petition to list the yellow-billed cuckoo as threatened or endangered in the western U.S. They determined that listing the yellow-billed cuckoo was warranted but precluded by higher priority species. The Western Distinct Population Segment (DPS) of the yellow-billed cuckoo was given status as a candidate species by the FWS.

Members of this species may go unnoticed because they are slow-moving and prefer dense vegetation. In the West, they favor areas with a dense understory of willow (*Salix*

spp.) combined with mature cottonwoods (*Populus* spp.). The yellow-billed cuckoo is also known to use non-riparian, dense vegetation such as wooded parks, cemeteries, farmsteads, tree islands, Great Basin shrub-steppe, and high elevation willow thickets. They feed on insects (mostly caterpillars), but also beetles, fall webworms, cicadas, and fruit (especially berries). Breeding often coincides with the appearance of massive numbers of cicadas, caterpillars, or other large insects (Ehrlich *et al.* 1988).

The western yellow-billed cuckoo is very rare in Utah but sightings do occur on a fairly consistent basis (Forest Service 2003a). The best habitats on the W-CNF are in the lower ends of the major canyons in Salt Lake County, along the Ogden River, around Pine View Reservoir, and along the lower Blacksmith's Fork and Logan Rivers.

Canada Lynx (*Lynx canadensis*)

The Canada lynx was listed as a threatened species on March 24, 2000. This final rule listed the DPS of the Canada lynx in the contiguous United States as threatened. Critical habitat has not been designated for this species.

The following discussion about the Canada lynx is from Forest Service (2003a). The Canada lynx occurs across the boreal forests of Canada and Alaska. They are also found in isolated spruce, fir, and lodgepole pine forests of Washington, Idaho, Montana, Wyoming, Colorado, and Utah. Lynx breed from mid March to early April. Females are sexually mature their first year, but do not usually breed until their second year. During low prey years, they may not breed at all. Males generally breed in their second year. Young are born in late May to early April. Litter size is three to four kittens.

Lynx are generally found in the northern boreal forest in association with snowshoe hare habitat or habitat of other suitable prey species. Early successional stands with high densities of shrubs and seedlings are optimal for hares, and subsequently important for lynx. Mature forest stands are used for denning, cover for kittens, as well as travel corridors. Home ranges of lynx are generally 6 to 8 square miles, but they range from 5 to 94 square miles. Males have larger ranges than females. Overlapping ranges do occur, mainly among animals of different sex and age classes. Adult lynx of the same sex tend to keep exclusive home ranges. Scent marking is used extensively by lynx to avoid one another. Density of lynx in an area is highly dependent on prey (snowshoe hare) abundance. Most densities are in the range of one lynx per 6 to 10 square miles.

Historic threats to lynx are hunting pressure, predator control, and loss of wilderness forests. They are vulnerable to heavy trapping during low population cycles. Habitat management for snowshoe hares is beneficial. Dense stands of conifers with openings that are no further than 1,300 feet from cover are also beneficial. Stands of mature forest near prey habitat should be available for denning and security cover.

Reports of lynx in Utah include sightings between 1961 and 1982 on the W-CNF, but no sightings between 1983 and 1993 (McKay 1991). Hair snare surveys on the Forest from 2000 thru 2002 did not detect any lynx. The same survey technique has been used by Brigham Young University in a Forest carnivore study in the Uinta Mountains that also showed negative results. In the summer of 2004 two individual lynx, one male and one female, were tracked on the W-CNF. The individuals were part of a program to

reintroduce lynx to Colorado. The male lynx moved north through the W-CNF and into Idaho. There have been no further reports of this individual moving back onto the Forest. The female lynx has been moving on and off the Forest since being discovered in the fall of 2004. The current location of the female lynx is unknown.

Lynx occurrence in Utah was also discussed in the Federal Register (2003). In that re-evaluation of the listing of the lynx in the lower 48 states, the FWS stated:

> *There are only 10 verified records of lynx in Utah since 1916 (McKay 1991; McKelvey et al. 2000). Nearly all the reliable lynx reports are from the Uinta Mountain Range along the Wyoming border (McKay 1991). Four of the records correlate to the cyclic highs of the 1960's and 1970's. Recent DNA results documented presence of a lynx in Utah (McKelvey in litt. 2003). There is no evidence of lynx reproduction in Utah. We conclude that lynx that occur in Utah are dispersers rather than residents, because most of the few existing records correspond to cyclic population highs, there is no evidence of reproduction, and boreal forest habitat in Utah is remote and far from source lynx populations.*

The Lynx Conservation Assessment and Strategy (LCAS) (Ruediger *et al.* 2000) defines lynx analysis units (LAUs) as the fundamental or smallest scale at which to evaluate and monitor the effects of management actions on lynx habitat. LAUs do not depict actual lynx home ranges, but their scale should approximate the size of area used by an individual lynx. LAUs will likely encompass both lynx habitat (may or may not be currently in suitable condition for denning or foraging habitat) and other areas (such as lakes, low elevation ponderosa pine forest, and alpine tundra). Conservation measures (objectives, standards, and guidelines) generally apply only to lynx habitat on federal lands within the LAU.

The LCAS further defines lynx habitat in the western U.S. as follows:

Western U.S.: lodgepole pine, subalpine fir, Engelmann spruce, and aspen cover types on subalpine fir habitat types. Cool, moist Douglas-fir, grand fir, or western larch forests, where they are interspersed with subalpine forests, also provide habitat for lynx.

Primary habitat: habitat that must be present to support foraging, denning, and rearing of young.

Secondary habitat: other vegetation types, when intermingled with or immediately adjacent to primary habitat, that contribute to lynx annual needs (for example, in the western U.S., primary habitat is lodgepole pine on subalpine fir habitat types, while adjacent cool/moist Douglas-fir habitat types provide secondary habitat).

Non-habitat: Dry forest types (for example, ponderosa pine, climax lodgepole pine) do not provide lynx Habitat.

W-CNF geographical information system (GIS) data indicate that the highest density of both primary and secondary lynx habitat occurs within the Uinta Mountains. The Overthrust Area also includes both primary and secondary habitat, especially in the north. Primary and secondary habitat in the Bonneville Basin is limited. The LCAS recommends that LAUs be built around primary and secondary habitat instead of the habitat/non-habitat classification. The distribution of primary and secondary habitat was based on vegetation cover type mapping (Forest Service 2002). This analysis determined that the Uinta Mountains include 12 LAUs. No LAUs exist in the Overthrust Area or the Bonneville Basin. All other counties identified as lynx counties are considered linkage areas.

Black-footed Ferret (*Mustela nigripes*)

Black-footed ferrets are a prairie species almost entirely obligate on prairie dog towns for food and shelter. Because of poison over many years that greatly reduced the number of prairie dogs and prairie dog towns, the number of ferrets has also been greatly reduced. Captive breeding and reintroductions are currently taking place in some areas.

Portions of Summit and Rich Counties, which border Wyoming, are considered historic range for the black-footed ferret. Forest boundaries in both areas would be the very outer edge of this range if it is included at all.

Gray Wolf (*Canis lupus*)

This species was listed as endangered on March 11, 1967. A revised recovery plan was approved by FWS in 1987 (FWS 1987). It identified a recovered wolf population as being at least 10 breeding pairs of wolves, for 3 consecutive years, in each of three recovery areas (northwestern Montana, central Idaho, and Yellowstone National Park). The plan recommended natural recovery in Montana and Idaho. If two wolf packs did not become established in central Idaho within 5 years, the plan recommended that conservation measures other than natural recovery be considered. The plan recommended use of the Act's Section 10(j) Authority to reintroduce experimental wolves. By establishing a nonessential experimental population, more liberal management practices could be implemented to address potential negative impacts or concerns regarding the reintroduction. The Final EIS was filed with the U.S. Environmental Protection Agency (EPA) on May 4, 1994. The notice of availability was published on May 9, 1994. The EIS considered five alternatives: 1) Reintroduction of Wolves Designated as Experimental; 2) Natural Recovery (no action); 3) No Wolves; 4) Wolf Management Committee Recommendations; and 5) Reintroduction of Wolves Designated as Non-experimental.

The FWS proposed to reintroduce wolves into Yellowstone National Park and central Idaho as experimental, non-essential populations. Fourteen wolves were released into Yellowstone National Park in 1995. Seventeen more were released in 1996. Another ten were released in 1997. Within 2 years, the wolves released in 1995 and 1996 divided into four packs and produced 23 pups. The wolves released in 1997 divided into nine packs and produced 64 pups in 13 litters (NPS 2004). At the end of 2003, at least 174 wolves divided among 13 to 14 packs. Two groups of wolves of undefined status, and two lone

wolves, were reported as having some portion of their territory within Yellowstone National Park.

Up until 2002, the last verified gray wolf taken in Utah was in 1930. During the past several years, sightings of wolf-like animals have occurred in Utah. Many of these have been identified as wolf-dog hybrids (McLaughlin 2003). In 2002 a wolf from a Yellowstone National Park pack was captured near the town of Morgan in northern Utah, southeast of Ogden. The animal was returned to Grand Teton National Park where it later rejoined its pack.

In Utah, the gray wolf is not part of the FWS experimental recovery effort being conducted in Wyoming, Idaho, and Montana. Neither a breeding pair nor a pack has been identified in Utah to date—only a dispersing animal. If wolves from the federal recovery areas enter Utah, they will receive protection under the ESA. Managing the Forest at or toward properly functioning condition will provide cover for wolves and habitat for prey species. Wolves are not currently included in the list of threatened or endangered species for any county in Utah by the Utah Field Office of the FWS.

The wolf is listed by the Wyoming FWS Office for Uinta County, Wyoming. There are 37,762 acres of the W-CNF lands in Wyoming. The statements above concerning Utah also apply to W-CNF lands Wyoming. Connectivity of vegetation types in this 37,762 acres are into Utah, and it is at least 90 miles to similar vegetation types farther north into Wyoming. No reports of wolves in this portion of Wyoming on the W-CNF have been received.

3.3.3.3.3 Forest Service Sensitive Species

Sensitive species are those species identified by the Regional Forester for which population viability is a concern, as evidenced by a significant current or predicted downward trend in numbers or density, or a significant current or predicted downward trend in habitat capability that would reduce the species' existing distribution. On the W-CNF, the Regional Forester has designated the following terrestrial species as sensitive:

- Spotted bat (*Euderma maculatum*)
- Townsend's big-eared bat (*Plecotus townsendii*)
- Wolverine (*Gulo gulo*)
- Pygmy rabbit (*Brachylagus idahoensis)*
- Boreal owl (*Aegolius funereus*)
- Flammulated owl (*Otus flammeolus*)
- Great gray owl (*Strix nevulosa*)
- Northern goshawk (*Accipiter gentilis*)
- Peregrine falcon (*Falco peregrinus*)
- Northern three-toed woodpecker (*Picoides tridactytus*)
- Columbian sharp-tailed grouse (*Tympauchus phasianellus columbianus*)
- Greater sage-grouse (*Centrocercus urophasianus*)
- Spotted frog (*Rana luteiventris*)

The following is a summary of the status of these species on the W-CNF. More detail is contained in the Biological Evaluation written for this plan.

Spotted Bat

Historically, the spotted bat has not been documented on the W-CNF. In northern Utah, the only historical record found by the Utah Natural Heritage Program is a female collected from a school in Salt Lake City in 1934. Its normal habitat is arid country relegating it mostly to lower elevations on the Forest.

Townsend's Big-eared Bat

This bat is known from several locations on the Logan, Ogden, and Salt Lake Ranger districts. It is associated with caves and mines that are used for nursery colonies and hibernacula.

Wolverine

Historically the wolverine was found throughout the W-CNF. There has not been a confirmed sighting for at least ten years. In the early 1990s one was reported on the Logan Ranger District. Cameras placed over bait were unsuccessful in documenting presence. Wolverine prefer mature and old growth forest, but do forage in meadows and talus slopes.

Pygmy Rabbit

There is no known presence of the pygmy rabbit on the W-CNF. They are known to be present at elevations lower than the National Forest boundary within Rich County, Utah.

Boreal Owl

Utah is the southern edge of the boreal owl's range. This species has responded in the past to broadcast surveys in two locations on the Forest. No nesting individuals have been located.

Flammulated Owl

Flammulated owls are more common in the state then boreal owls but they are still rare. They have been documented in several locations on the Bear River and Wasatch Ranges, but not on the Uinta Mountains.

Great Gray Owl

The great gray owl is considered a winter vagrant in Utah, with one observation recorded by the Utah Natural Heritage Program on the Uinta National Forest.

Northern Goshawk

In 1991, the goshawk was designated as a sensitive species in the Intermountain Region of the Forest Service. As a result of this designation, special management is emphasized to ensure the goshawks viability (*Forest Service Manual 2670*). In March of 1997, the UDWR classified the goshawk as a State sensitive species. The purpose of this designation was to identify species in the State that are most vulnerable to population declines or habitat loss and to stimulate management actions for the conservation of this species.

To address the issue of declining goshawk habitat in Utah, a technical team was assembled. They developed seven questions and attempted to answer them in, “The Northern Goshawk in Utah: Habitat Assessment and Recommendations” (Graham *et al.* 1999). The seven questions and a summary of the findings follow, as quoted from the report:

1. Is there adequate nesting habitat available?

Presently there appears to be adequate nesting habitat in the State and on the W-CNF to maintain a breeding population of goshawk.

2. Is there adequate foraging habitat available?

Based on habitat features important to selected prey used by goshawks, it appears that foraging habitat is presently available throughout the State and on the W-CNF.

3. Are northern goshawks able to move freely between habitat patches?

Goshawks appear to be able to move freely among habitat patches throughout Utah and the Forest (it is noted that satellite tracked birds captured on the W-CNF have wintered south of Delta, Utah and along the Utah/Arizona border).

4. Is the population viable at the State level?

This assessment could not answer the question of population viability directly because there are inadequate demographic data available. Most of the currently forested lands were rated as medium or high value for both nesting and foraging habitat. Where surveys have been conducted, goshawks are present and nesting successfully. Furthermore, all available habitat patches are connected, and no known population is isolated. In general, existing habitat appears to be capable of supporting a viable population of goshawks at the State and Forest spatial scales.

5. Where is the high value habitat?

High value habitat is distributed throughout the State, with 60 percent controlled by the Forest Service.

6. How are current management policies affecting goshawks?

Current management policies are affecting northern goshawks in a variety of ways. On National Forest Service administered lands in Utah, 20 percent of the high value habitat is being managed with a timber emphasis, 35 percent with mixed uses, and 27 percent with a range emphasis. Each of these management categories allows for activities that either can degrade or improve goshawk habitat. The information in this assessment does not reveal any substantial deficiencies in habitat quality in any management category.

7. What are the important habitat trends and their implications for goshawks?

The most obvious trend in Utah forests and woodlands is the lack of early and mid-seral species in all of the potential vegetation types. If Forest management stresses properly functioning condition, importance of large trees, maintaining native processes, using adaptive management, and recognizing the role of fires, the habitat outlook could be favorable for the goshawk and its prey. This is true on the W-CNF also.

Urbanization and more intensive uses of the Forest by humans could degrade goshawk habitat, especially on private lands. Private lands in Utah will continue to be developed,

making the lands administered by federal entities increasingly important for goshawks. This trend could also affect the connectivity of the habitat across the State.

The situation on the goshawk on the W-CNF fits the discussion above. They are found on all Districts on the Forest.

To formalize the recommendations made in the assessment above, the six National Forests in Utah amended all Forest Plans in March 2000. The amendment was to cover the period from March 2000 until individual Forests revised their Forest Plans over the next several years.

Peregrine Falcon

Peregrine falcons are tied to high cliffs or buildings for nesting in areas where there are abundant avian species for prey. Historically for the W-CNF this was along the Wasatch Front. The best habitats on National Forest System lands are located in Salt Lake, Box Elder, and portions of Weber Counties. There are known nesting pairs in Box Elder County.

Northern Three-toed Woodpecker

This species is found in conifer and aspen vegetation types throughout the W-CNF and Utah. It may presently be at some of its highest population levels on the Forest where amounts of mature and older forests exist. Populations may also increase where large-scale disturbances occur, such as the 2002 East Fork Fire.

Columbian Sharp-tailed Grouse

The range of the sharp-tailed in Utah is in Box Elder, Weber, and Cache Counties. It is a sagebrush/grassland species that would be found at the lower elevations of the Forest.

Greater Sage Grouse

Sage grouse are an incidental user on portions of the W-CNF and are found most commonly in Rich County where they use fringe areas of National Forest lands that provide suitable habitat. There is also some incidental use along the Wyoming border on the North Slope of the Uinta Mountains and on the Stansbury Mountains. No leks (mating grounds) are found on the Forest.

Spotted frog

The spotted frog is discussed in *Section 3.3.2 Aquatic Resources*.

3.3.3.3.4 Wildlife Management Indicator Species (MIS)

Management Indicator Species (MIS) are species selected because changes in their numbers are believed to indicate the effects of management activities on a range of species. One of the factors considered when selecting MIS is their close tie to the communities they represent. Monitoring directions for MIS are contained in 36 CFR 219.14(f) of the 2005 Planning Rule (Federal Register, Vol. 70, No. 3, pps. 1022-1061).

The W-CNF has chosen the goshawk (*Accipiter gentilis*), snowshoe hare (*Lepus americanus*), beaver (*Castor canadensis*), Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus)* and Bonneville cutthroat trout (*Oncorhynchus clarki utah*) as their MIS (Forest Service 2003b:J4-J5).

The following information is found in *Management Indicator Species of the Wasatch-Cache National Forest, Version 2005-2* (–Forest Service 2005b). Refer to that report for additional information about Forest MIS.

Northern Goshawk—Aspen, Conifer and Mixed Conifer

The range of the northern goshawk is circumpolar. In the West it is found from Alaska through the Rocky Mountains to New Mexico. The goshawk is a forest habitat generalist that uses a wide variety of forest ages, structural conditions, and successional stages. While all forested landscapes are used to some extent, certain forest cover types appear to be occupied by goshawks more than others (Graham *et al.* 1999). Cover types most often occupied by goshawks, based on sightings and nest locations, are Engelmann spruce, subalpine fir, lodgepole pine, and quaking aspen—in either single or mixed species forests. The population under consideration for MIS is Forest-wide.

Three components of a goshawk's home range have been identified, including the nest area (approximately 30 acres), post fledging-family area (approximately 420 acres), and foraging area (approximately 5,400 acres). Goshawks nest in a wide variety of forest types including aspen, coniferous, and mixed conifer forests. It typically nests in mature and old forests.

The goshawk preys on large-to-medium-sized birds and mammals, which it captures on the ground, in trees, or in the air. Observations of foraging goshawks show that, in fact, they hunt in many forest conditions. This opportunism suggests that the choice of foraging habitat by goshawks may be as closely tied to prey availability as to habitat structure and composition.

Specific habitat attributes used by these species include snags, downed logs and woody debris, large trees, herbaceous and shrubby understories, and a mixture of various forest vegetation structural stages.

It was concluded in the *Conservation Strategy and Agreement for the Management of Northern Goshawk Habitat in Utah* (Forest Service 1998b) that goshawk populations in Utah were viable. This conclusion was based on the findings of Graham *et al.* (1999 [the 1998 report referenced above used the 1998 draft of Graham *et al.*]) that good quality habitat is well distributed and connected throughout the state, the absence of evidence of a population decline on National Forest System lands since 1991, and conclusions of the FWS in their decision to not list the northern goshawk under the ESA (Federal Register, 1998).

Monitoring Results and Trend

Territory occupancy has been monitored consistently on the Forest since 1999. Table 3-14 shows the results of that monitoring.

TABLE 3-14
Goshawk Territories Forest-wide

Year	1999	2000	2001	2002	2003	2004
Known Territories						
Salt Lake	1	1	1	2	2	5
Kamas/Evanston/Mt. View	21	22	22	22	29	31
Ogden/Logan	7	8	11	11	14	15
TOTAL	29	31	34	35	45	51
Territories Monitored For Occupancy						
Salt Lake	1	1	1	2	2	7
Kamas/Evanston/Mt. View	12	22	11	20	28	17
Ogden/Logan	7	8	11	11	11	12
TOTAL	20	31	23	33	41	36
Occupied Territories						
Salt Lake	1	1	1	2	1	4
Kamas/Evanston/Mt. View	4	2	6	6	9	12
Ogden/Logan	2	4	4	6	6	6
TOTAL	7	7	11	14	16	22
Percent of Monitored Territories Active	35	23	48	42	39	61

Figure 3-4 shows territory occupancy from 1999 to 2004 (adjusted to 1999 occupied territories, based on the difference in numbers of territories monitored). The baseline used was the 1999 territory occupancy of seven known occupied territories. Adjusting to the 1999 occupied territories there has been a high in 2001 of 9.76 occupied territories and a low of 4.33 in 2003. These differences in years are not statistically significant, showing a static trend in the goshawk population Forest-wide. Table 3-15 shows the same numbers in table form.

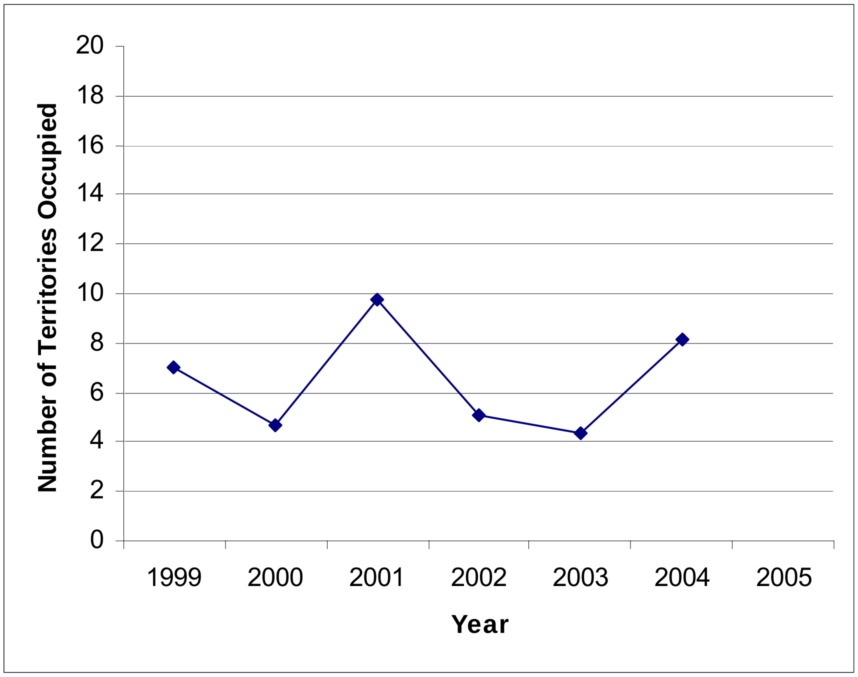


FIGURE 3-4
Territory Occupancy, 1999-2004
(Adjusted to 1999 Occupancy)

TABLE 3-15
Territory Occupancy Numbers from Figure 3-4 in Table Form

Year	1999	2000	2001	2002	2003	2004
Total Occupied Territories*	7	4.66	9.76	5.09	4.33	8.18

*Sum of each Districts' territory occupancy

Snowshoe Hare—Pole/Sapling Aspen, Conifer and Mixed Conifer

The snowshoe hare is a valuable prey species to the lynx, goshawk, and other predators. In the Rocky Mountains and westward, hares mainly use coniferous forests in the higher mountainous areas. They are predominately associated with forests that have a well-developed, shrubby understory that supplies them with both food and protection from predation. Such habitat structure is common in early seral stages but may also occur in coniferous forests with mature but relatively open overstories (Ruggiero 1999). In summer, snowshoe hares eat forbs, grasses, shrub leaves, and some woody browse, while the winter diet is restricted to smaller-diameter twigs and some bark of shrubs and trees.

On the W-CNF there are two populations of snowshoe hare. They are the Wasatch/Bear River Range population and the Uinta Mountains population. These two populations were identified because of the large habitat gap between these mountain ranges that essentially blocks genetic mixing.

Monitoring Results and Trend

Uinta Mountains Population: Bunnell (2004) has estimated 0.05 to 0.9 hares/hectare based on methods developed by Krebs et al (2001). Bunnell's work on the Uinta Mountains from 2001 through 2003 shows an average of 0.33 hares per hectare over the three-year period within mature vegetation types. Bunnell's studies are our best indication that snowshoe hare were stable across the North Slope from fall 2000 thru summer 2003. In 2003, 61 transects (610 plots) were established across a variety of habitat types and age classes across the North Slope. A portion of Bunnell's transects were incorporated as part of the USFS Forest MIS monitoring effort. Tables 3-16 and 3-17 display results of monitoring in 2004.

TABLE 3-16
Snowshoe Hare Mean (Mean of the Transect Means) Pellet Counts and Hare Density by "Mature" Vegetation Cover Type within the Uinta Mountains Population for 2004

Vegetation Type	Total Pellet Counts	Pellet Counts Mean of the Transect Means	Hares/ha (Murray's Regression)
Douglas-fir	328 (20 plots/2 transects)	16.40	4.34-8.24
Spruce/Fir	806 (97 plots/10 transects)	8.21	2.12-4.02
Mixed Conifer	529 (78 plots/8 transects)	6.95	1.78-3.39
Aspen/Conifer	539 (99 plots/10 transects)	5.46	1.39-2.64
Lodgepole Pine-Mature	493 (106 plots/11 transects)	4.61	1.17-2.22

TABLE 3-17
Snowshoe Hare Mean (Mean of the Transect Means) Pellet Counts and Hare Density by Young-Midaged Vegetation Cover Type within the Uinta Mountains Population of the Wasatch-Cache National Forest for 2004

Vegetation Type	Total Pellet Counts	Pellet Counts Mean of the Transect Means*	Hares/ha (Murray's Regression)
Aspen/Conifer – young/mid	1074 (90 plots/9 transects)	11.93	3.12-5.92
Lodgepole Pine – young/mid	597 (99 plots/10 transects)	5.97	1.52-2.90

*The Kamas, Mountain View, and Evanston Ranger Districts used survey methodology similar to the extensive survey method developed by Murray *et al.* 2001.

Results and analysis of Bunnell's study and comparison to data collected in 2004 can be found in the MIS report (Forest Service 2005b). From the analysis completed in this report, the snowshoe hare population was stable or displayed very little change from fall of 2000 to summer of 2003 for the Uinta Mountains population. From the summer/fall of 2003 to summer of 2004, the data suggest an increase in snowshoe hare numbers for the Uinta Mountains population.

Wasatch/Bear River Range Population: For the Wasatch/Bear River Range population, which includes the Salt Lake, Ogden, and Logan Ranger districts, snowshoe hare transects were established and swept in 2003 and read for the first time in 2004. Table 3-18 shows the vegetation type by district, as well as the data collected in 2004.

TABLE 3-18
Vegetation Type (Mature), District, and Results of 2004 Pellet Counts for Snowshoe Hare for the Wasatch/Bear River Population

Vegetation Type and Location	Total Pellet Counts	Mean Pellet Counts(x) (1m²)	Hares/ha (Murray's Regression)
OGDEN Douglas-fir	409	8.18	2.11-4.01
OGDEN Mixed Conifer	354	7.08	1.82-3.45
OGDEN Aspen/Conifer or Conifer/Aspen	313	6.26	1.60-3.04
SALT LAKE Mixed Conifer	252 (n=44)	5.73	1.46-.2.78
OGDEN Lodgepole Pine – Mature	216	4.32	1.10-2.08
LOGAN Douglas-fir	147	2.94	0.74-1.41
LOGAN Spruce/Fir	135	2.7	0.68-1.29
SALT LAKE Aspen/Conifer or Conifer/Asp	106	2.12	0.53-1.02
LOGAN Aspen/Conifer or Conifer/Aspen	96	1.92	0.48-0.92
LOGAN Mixed Conifer	53	1.06	0.27-0.52
LOGAN Lodgepole Pine – Mature	52	1.04	0.27-0.51
OGDEN Spruce/Fir	41	0.82	0.21-3.04
LOGAN Aspen	7 (n=48)	0.15	0.06-0.11
OGDEN Aspen	1 (n=49)	0.02	0.03-0.05

Figure 3-5 shows the trend of a snowshoe hare transect established by a now retired Utah Division of Wildlife Resources employee in the North Amazon Basin in 1999—which has been read every year through 2004.

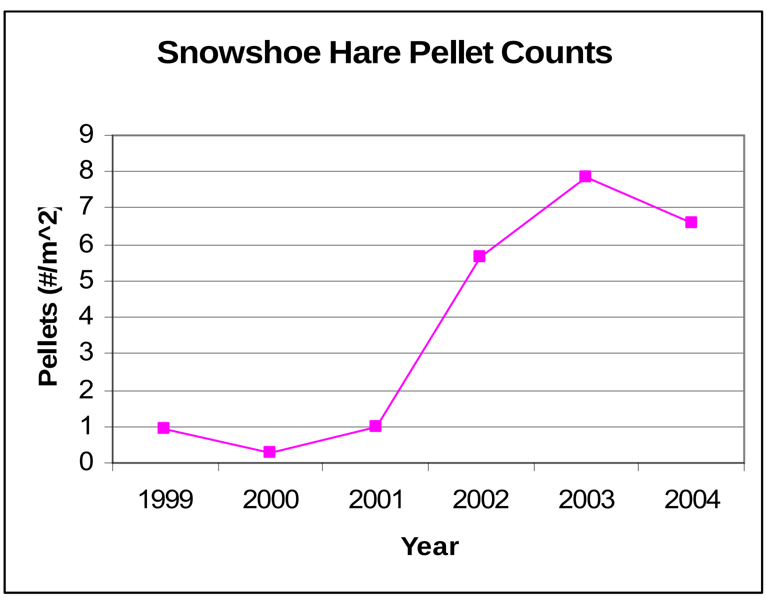


FIGURE 3-5
North Amazon Basin Snowshoe Hare Trend

Pellet count data (North Amazon Basin information) suggest that the snowshoe hare population was stable or displayed very little change from summer 1998 through summer 2001. From the summer/fall of 2001, the data suggest an increase in snowshoe hare numbers with a possible peak between summer/fall 2002 and summer 2003. Numbers for the period between summer/fall 2003 and summer 2004 remained high, but displayed a slight decrease from the prior year. A one-year decrease, however, does not indicate a trend, and 2004 numbers are still above the 1999 through 2001 numbers.

Beaver—Riparian

Beaver occur in permanent, slow-moving streams, ponds, small lakes, and reservoirs. They play an important role in maintaining and enhancing riparian and aquatic ecosystems (Olsen and Hubert 1994), and are important for the creation of habitat for several species of fish, big game, waterfowl, and neo-tropical birds.

In favorable habitat, the density of beaver colonies ranges from 0.4 to 0.8 per km^2 (1.0 to 2.0 per/mi^2). Home range is greatly affected by the water system in which the colony lives with colonies in the best habitat occurring as close as 300 meters (328 yds) apart (Ministry of Environment 1998).

A beaver colony is typically about 5 to 6 beavers and consists of an adult pair, the present year young, and the young of the previous year. To maintain a colony, a beaver requires a minimum of 0.5 mile of stream channel. A beaver colony often has more than one dam.

The W-CNF has two distinct geographic areas that can be assumed to support two distinct beaver populations. These are the Uinta Mountains and the Wasatch/Bear River ranges. Not only are these areas spatially separated but they are also in different moisture regimes.

Monitoring Results and Trend for Uinta Mountains Population

The baseline monitoring protocol is based upon sampling (as opposed to a complete census) to estimate beaver population at the spatial scale of the Forest. To achieve an unbiased, well-distributed sample, sample units are systematically selected sections (1 section = 1 m^2 = 640 acres). With a 10 percent sampling intensity, every 10th section is sampled (the first section sampled was selected randomly, and then every 10th section was systematically selected) (see Table 3-19). Only complete sections of National Forest System lands are sampled. By surveying active dams, the number of colonies can be determined and then converted into the number of beaver by estimating 5 beaver per colony.

TABLE 3-19
Forest-Wide Beaver Monitoring

Population/District	No. of Sections
Wasatch/Bear River	
Salt Lake	14
Ogden	17
Logan	32
Total for population	63
Uinta Mountains	
Kamas	15
Evanston	10
Mountain View	12
Total for population	37

Table 3-20 displays the results of surveys conducted. Surveys to complete baseline information for the two populations (Uinta Mountains and Wasatch/Bear River Range) are being completed during the summer/fall of 2005. Without baseline and subsequent years' data, no trend determination can be made using data from Forest Service monitoring.

TABLE 3-20
Population Estimates

Population	Active dams	# of colonies	Individuals	Estimated No. of beavers/mi*
Wasatch/Bear River	19	8	40	0.63*
Uinta Mountains	16	7	35	0.95

Because not all of the sections have been surveyed, the initial determination may not represent a true estimate.

While the baseline information is being collected, there is UDWR information to aid in the assessment of historical beaver trends for the Forest. The 1979-80 and 1998-1999 Furbearer Harvest Reports (State of Utah, 1980 and 1999, respectively) and the 1971-1982 Beaver Distribution, Habitat and Population Survey (State of Utah 1993) provide relevant information about beaver (Table 3-21). The 1979-80 Harvest and 1971-82 Survey Reports display beaver estimations by "units" while the 1998-1999 Harvest Report considers regions (Great Basin, Rocky Mountain, Uintah Basin, and Colorado Plateau). The survey restates the trend from the 1979-1980 report.

Eleven trapping units include some National Forest System lands administered by the W-CNF. UDWR beaver units include all land ownerships.

TABLE 3-21
UDWR Units Occurring (at least partially) on National Forest Service Lands

Unit	Unit Location	Status of Beaver Population 81’
Wasatch/Bear River Population		
2	North 1/2 Cache County	Static
3	Rich County	Static
5	South 1/2 Cache County	Static
6	West Weber County	Static
7	East Weber County	Static
8	Davis County	Static
9	Morgan County	Static
10	Northern 3/4 Summit County	Static
11	Southern 1/4 Summit County	Increasing
14	Southwest Salt Lake County	Static
15	Southeast Salt Lake County	Increasing
Uinta Mountains Population		
10	Northern 3/4 Summit County	Static
11	Southern 1/4 Summit County	Increasing

Source: State of Utah 1993: 1971-1982 Beaver Distribution, Habitat and Population Survey (published 1993)

With the exception of a few specific locations, Forest Service management of suitable beaver habitat within National Forest boundaries has not changed significantly from 1980 to the present. Therefore, until Forest Service monitoring yields data for population trends, it is assumed that the determinations made in the State of Utah Survey Report remain valid for both populations on the Forest.

3.3.4 Ecosystem Function

3.3.4.1 Analysis Method

Basic ecological principles form the basis for describing the affected environment and for providing background information for assessing potential project effects on ecosystem function in Chapter 4.

3.3.4.2 Analysis Area

The analysis area is the entire W-CNF, which is included in the Overthrust Mountains, Bonneville Basin, and Uinta Mountains ecological sections.

3.3.4.3 Existing Conditions

Key ecosystem functions are processes that limit or control biological diversity, resilience to disturbance, and biotic productivity (Quigley and Arbelbide 1997). These include energy flow, the hydrologic cycle, the carbon and nutrient cycles, ecosystem food webs, and evolution. The energy flow function operates mostly at the global scale and evolution is more directly tied to long-term change. The hydrologic cycle, carbon and nutrient cycles, and ecosystem food webs are most closely tied to regional/local scales and are addressed in this document. Native plant communities on the W-CNF positively affect these cycles by contributing to available water storage and subsequent groundwater discharge during drier times of the year, the beneficial use of space and nutrients, and enhanced plant diversity, complexity, and ecosystem viability. Current weed infestations on the W-CNF affect each of these cycles to some degree in localized areas by decreasing available water storage and subsequent groundwater discharge, outcompeting native plant species for space and nutrients, and reducing plant diversity, and thus the complexity and viability of the ecosystem food web.

3.3.4.3.1 Hydrologic Cycle

Native plant communities on the W-CNF positively affect the hydrologic cycle, which involves the movement of water and its associated nutrients and energy. Water evaporates from water bodies (hydrosphere), precipitates over terrestrial areas, enters fluvial systems via runoff and groundwater discharge, and returns to the ocean. Native plant communities on the W-CNF benefit this cycle through the presence of a diversity of species that provide ecosystem complexity and stability, multiple complex canopies and root structures, uninhibited infiltration of water into the soil, minimization of sediment delivery to drainages, and a high soil water-holding capacity. Healthy riparian systems in native plant communities typically exhibit a sponge effect, storing water early in the year then discharging it as late-season base flows to streams that provide year-round habitat for aquatic resources. In contrast, weed infestations on localized areas of the W-CNF can affect hydrologic function through changing vegetation patterns, which in turn change the way water moves through the W-CNF. As diverse, multi-layer native plant communities are changed to monotypic (one species) or reduced species weed stands having only a single canopy layer and simplified root structures, the patterns of runoff change. Infiltration of water into the soil tends to decrease, increasing the risk of “flashy” runoff events and increased potential for sediment delivery to streams. Water storage in the soil is reduced and late-season stream flows can decrease as late-season groundwater discharge slows from historical conditions. As noted previously, riparian systems are particularly important since they store water from spring runoff and slowly release it the rest of the growing season. Transpiration, the return of water vapor to the atmosphere from plant metabolism, also decreases as the plant community changes to less diverse populations.

3.3.4.3.2 Carbon and Nutrient Cycles

Healthy native plant communities on the W-CNF provide continuous carbon and nutrient cycling through plant productivity, mortality, and decomposition. These cycles are closely tied to the hydrologic cycle, as primary productivity is dependent on water. Fire is

important to this cycle, because fire rapidly releases nutrients and carbon into the ecosystem. The carbon and nutrient cycles determine the productivity of biotic systems. The ability of a natural community to recover from disturbance is dependent on the level of productivity inherent to a community. Weed infestations on localized areas of the W-CNF can influence carbon and nutrient cycles in a variety of ways through disruption of native plant communities. Less diverse plant communities will have lower rates of carbon production and decomposition, leading to reduced carbon and nutrient cycles.

3.3.4.3.3 Ecosystem Food Webs

As native plant communities (primary producers) increase in complexity on the W-CNF, the base of the food web also increases in complexity as well as stability and sustainability. This increased complexity in the food web base ripples throughout the food chain by providing higher levels of inputs and increased structure to support higher levels of organisms. Weeds tend to lower the complexity of plant communities and thus the ability to support a diversity of higher level organisms. Health of plant communities also depends on a healthy soil environment. Reductions in water infiltration and reduced amounts of organic matter stored in the soil through reduced decomposition rates, as a result of weed infestations on localized areas of the W-CNF, reduce soil health and subsequently reduce the rate of primary productivity.

3.4 Physical Resources

3.4.1 Soils and Geology

Soils and geology were not identified as a significant issue during public scoping. However, soil properties can be affected by weeds and weed treatments. The existing conditions are presented here as background data for analysis of soils and geology and other resource areas such as hydrology in Chapter 4.

3.4.1.1 Analysis Method

The following documents, information, and data analysis sources were reviewed and/or used in the preparation of this *Soils and Geology* section. This information provides the basis for describing the affected environment and providing background information for the analysis contained in Chapter 4. No significant issues were identified for soils and geology; therefore, these resource areas will not be evaluated in Chapter 4.

- *W-CNF RFP* (Forest Service 2003a).
- *W-CNF Noxious Weed Strategy* (Forest Service 2004a).
- Forest Service/CH2M HILL Project Meeting and Field Reconnaissance Notes (January 10, 2005) (Forest Service 2005c).
- Forest Service data and expertise, including published documents, GIS data, field data, observations gathered for this and other projects, and interviews of other personnel experienced in the area.

- Data associated with Utah Division of Water Quality's Water Quality Monitoring Program.

3.4.1.2 Analysis Area

3.4.1.2.1 Overthrust Mountains

Soil hydrologic groups are mainly B and C with some D, and are generally deep to moderately deep and moderately well to somewhat excessively drained. Permeability is slow to moderately rapid and runoff varies from slow to rapid. Sediment production is generally low to moderate and the primary geomorphic processes are fluvial, colluvial, glacial, and peri-glacial with significant occurrences of stream cutting and mass wasting along the southern half of the analysis area.

3.4.1.2.2 Uinta Mountains

Soil hydrologic groups are mainly B and C and are generally deep to moderately deep and well to excessively drained. Permeability is very slow to very rapid and runoff varies from slow to medium. Sediment production is generally low and the primary geomorphic processes are fluvial, colluvial, glacial, and peri-glacial with significant occurrences of stream cutting and mass wasting along the western edge of the analysis area.

3.4.1.2.3 Stansbury Mountains

Soil hydrologic groups are mainly B and C and are generally deep to moderately deep and moderately well to somewhat excessively drained. Permeability is slow to moderately rapid and runoff varies from slow to rapid. Sediment production is generally moderate and the primary geomorphic processes are fluvial, glacial, and nivational.

3.4.1.3 Existing Conditions

Soil resource inventories have been prepared for most of the W-CNF. Approximately 90,000 acres of National Forest land are not covered by a modern soil survey. Areas not covered include the Bountiful Front of the Wasatch Mountains from North Ogden to North Salt Lake, and the Curtis Ridge area of the Ogden Ranger District.

Soil and geologic resources are described in the following text in the context of the W-CNF Management Areas identified in the Forest Plan. Mineral resources are described on a Forest-wide basis.

3.4.1.3.1 Soils and Geology

Bear Management Area

Soils. Soils are deep to moderately deep at elevations from 6000 to 12000. Slopes are mostly steep to very steep with some slightly steep slopes on the alluvial fans along the foothills. The soils are moderately well to somewhat excessively drained. Permeability is slow to moderately rapid. Runoff is slow to rapid and sediment production is low to moderate. The hydrologic groups are mainly B and C.

Geology. The *Bear River Highlands* are gently sloping, eastward tilting uplands at elevations ranging from 5200 to 9500. The structure is a plateau-like surface of uplifted portions of overthrust fault zone and the lithology is Wasatch limestone, dolomite, and quartzite with Cambrian rocks (Tintic quartzite, Maxfield limestone) on the west side. Geomorphic processes are fluvial and glacial; peri-glacial features are widespread.

The *Monte Cristo-Weber Valley Hinterlands* are a modified ridge and valley network between the Wasatch Front and the high Wyoming Basins at an elevational range of 5400 to 9000. The structure is graben-like and the lithology is Wasatch sandstone, limestone, conglomerates with pockets of Tertiary volcanics, and Precambrian crystalline rocks. Alluvium is in the valleys and drainage ways. The geomorphic processes are fluvial and colluvial.

Cache–Box Elder Management Area

Soils. Soils are deep to moderately deep at elevations from 4300 to 12000 and slopes that are rolling to very steep. On some low elevation areas, slopes are nearly level to gently sloping, but have some steep terrace escarpments. The soils are moderately well to somewhat excessively drained. Permeability is slow to rapid. Runoff is slow to rapid and sediment production is moderate to low. The hydrologic groups are mainly B and C.

Geology. The *Bear River Highlands* are gently sloping, eastward tilting uplands at an elevational range of 5200 to 9500. The structure is a plateau-like surface of an uplifted portion of overthrust fault zone and the lithology is Wasatch limestone, dolomite, and quartzite with Cambrian rocks (Tintic quartzite, Maxfield limestone) on the west side. Geomorphic processes are fluvial and glacial; peri-glacial features are widespread.

The *Cache Front* is wall-like mountain slopes and ridge systems along the east edge of Cache Valley at elevations ranging from 5000 to 10000. The structure is an up-thrown side in a block fault and the lithology is dolomite, sandstone, limestone, mudstone, and tuffaceous sediments. Geomorphic processes are fluvial, colluvial, glacial, and peri-glacial.

The *Wellsville Mountains* are a narrow ridge system forming the north end of the Wasatch Front at an elevational range of 5000 to 9000. The structure is a fault block ridge with numerous lateral faults and the lithology is quartzite, dolomite, and limestone. The geomorphic process is fluvial and nivational on the upper east slopes.

The *Monte Cristo-Weber Valley Hinterlands* is a modified ridge and valley network between the Wasatch Front and the high Wyoming Basins at elevations ranging from 5400 to 9000. The structure is graben-like and the lithology is Wasatch sandstone, limestone, conglomerates with pockets of Tertiary volcanics, and Precambrian crystalline rocks. Alluvium is in the valleys and drainage ways. The geomorphic processes are fluvial and colluvial.

Central Wasatch Management Area

Soils. Most of the soils are shallow to deep soils at elevations from 5800 to 12000 and slopes that are rolling to very steep. They are moderately well to somewhat excessively

drained. Permeability is slow to rapid. Runoff is slow to rapid and sediment production is moderate to low. The hydrologic groups are mainly B, C, and D.

Geology. The *Central Wasatch* are rugged ridges, scenic canyons, and high basins forming a front along the east side of the Salt Lake Valley and northern Utah Valleys at elevations ranging from 5000 to 11300. The structure is an uplifted fault block with numerous internal faults and plutonic stock; the lithology is granite, quartzite, argilite, tillite, and limestone. The geomorphic processes are glacial, stream cutting, and mass wasting.

Eastern Uintas Management Area

Soils. Most of the soils are deep to moderately deep soils, 30 to 36 inches deep, at elevations ranging from 8000 to 11000 and slopes that are rolling to very steep, mainly 15 to 65 percent. They are well to excessively drained. Permeability above bedrock is very slow to very rapid. Runoff is slow to medium and sediment production is low. The hydrologic groups are mainly B and C.

A small area of the very northeast part of the W-CNF contains soils that are shallow to deep and moderately deep at elevations ranging from 6000 to 7000. The rock outcrop is exposed, bare sandstone. These soils are well drained and permeability is moderate to slow. Runoff is medium and sediment production is moderate. The hydrologic groups are mainly D for the Lithic Argiborolls and C for the Typic Argiborolls.

Rock land is located in the High Uinta Mountains. This land type is mainly on steep to very steep, rocky, colluvial areas that are above timberline, usually elevation 11000 to 13500. Rock land occupies about 70 percent of the area, and the other 30 percent is shallow to very shallow, stony soils. Because of their high elevations, these areas are important watersheds. They receive large amounts of precipitation, much of it as snow; and these snowfields are important sources of late summer stream flows.

Geology. The *High Uintas* are the glaciated center of the Uinta Mountains with elevations ranging from 8000 to 13578. The structure is a broad, arculate, anticlinal fold slightly overturned to the north; the lithology is quartzite and shale of the Uintah Group with Mississippian limestone, Weber sandstone, and extensive glacial and fluvial deposits. The geomorphic processes are glacial and peri-glacial with secondary fluvial action.

The *North Slope Outwash* are gently sloping benches and valleys forming the lower north slopes of the Uinta Mountains at elevations ranging from 8000 to 10000 feet. The structure is benches on a north anticline limb and the lithology is quartzite, conglomerates with thick glacial outwash overburden extending out into the Wyoming Basin. The geomorphic process is fluvial over earlier glaciation.

The *Phil Pico Highlands* is a series of hogback ridges along the north flank of the Uinta anticline with an elevational range of 6500 to 9000 feet. The structure is a hogback ridge and the lithology is limestone, siltstone, shale, and sandstone. The geomorphic processes are colluvial with fluvial being secondary.

North Wasatch–Ogden Valley Management Area

Soils. These are deep to moderately deep soils at elevations ranging from 5200 to 10000 feet on slopes that are steep to very steep with some that are gently rolling. The soils are moderately well to somewhat excessively drained. Permeability is moderately slow to rapid. Runoff is slow to rapid and sediment production is low to moderate. The hydrologic groups are mainly B and C with some D.

Geology. The *Monte Cristo-Weber Valley Hinterlands* is a modified ridge and valley network between the Wasatch Front and the high Wyoming Basins at an elevational range of 5400 to 9000. The structure is graben-like and the lithology is Wasatch sandstone, limestone, conglomerates with pockets of Tertiary volcanics and Precambrian crystalline rocks. Alluvium is in the valleys and drainage ways. The geomorphic processes are fluvial and colluvial.

The *Northern Wasatch* are a bold, straight mountain front crossed by large east-west canyons at elevations ranging from 5000 to 9700. The structure is an uplifted fault block; the lithology is mostly Farmington Canyon crystalline rocks, gneiss, quartzite, and dolomite. The geomorphic processes are fluvial, glacial, and colluvial.

The *Wellsville Mountains* are a narrow ridge system forming the north end of the Wasatch Front at an elevational range of 5000 to 9000 feet. The structure is a fault block ridge with numerous lateral faults and the lithology is quartzite, dolomite, and limestone. The geomorphic process is fluvial and nivational on the upper east slopes.

Stansbury Management Area

Soils. Soils are deep to moderately deep at elevations from 6000 to 12000 feet. Slopes are mostly steep to very steep with some slightly steep slopes on the alluvial fans along the foothills. The soils in this association are moderately well to somewhat excessively drained. Permeability is moderately rapid to slow. Runoff is slow to rapid and sediment production is moderate. The hydrologic groups are mainly B and C.

Geology. The *Stansbury Range* is a fault block mountain range in the eastern Great Basin at elevations ranging from 5500 to 11100 feet. The structure is a tilted block with western dip slopes and eastern scarp face and the lithology is mostly Prospect Mountain quartzite and rocks (limestone, dolomite, and shale) of the Oquirrh Group. The geomorphic processes are fluvial, glacial, and nivational.

Western Uintas Management Area

Soils. Most of the soils are deep to moderately deep, 30 to 36 inches deep, at elevations of 8000 to 11000 and slopes that are rolling to very steep, mainly 15 to 65 percent. The soils are well to excessively drained. Permeability above bedrock is very slow to very rapid. Runoff is slow to medium and sediment production is low. The hydrologic groups are mainly B and C.

Soils in the lower elevations of the Weber River and Beaver Creek drainages are deep to moderately deep at elevations from 5200 to 8000 on slopes that are steep to very steep but with gently rolling included. The soils are well drained to somewhat excessively

drained. Permeability is slow to moderately rapid. Runoff is medium and sediment production is low. The hydrologic groups are mainly B and C.

Rock land is located in the High Uinta Mountains. This land type is mainly on steep to very steep, rocky, colluvial areas that are above timberline, usually elevation 11000 to 13500. Rock land occupies about 70 percent of the area, and the other 30 percent is shallow to very shallow, stony soils. Because of their high elevations, these areas are important watersheds. They receive large amounts of precipitation, much of it as snow; these snowfields are important sources of late summer stream flows.

Geology. The *West Flank Uintas* are ridges, valleys, and benches forming the west end of the Uinta Mountains at elevations ranging from 7000 to 12000. The structure is an anticline with exposed curve; the lithology is Uinta quartzite, with glacial deposits in the center and limestone and Weber sandstone mostly on the sides. The geomorphic processes are glacial, peri-glacial, stream cutting, and mass wasting.

The *High Uintas* are the glaciated center of the Uinta Mountains with elevations ranging from 8000 to 13578. The structure is a broad, arculate, anticlinal fold slightly overturned to the north. The lithology is quartzite and shale of the Uintah Group with Mississippian limestone, Weber sandstone, and extensive glacial and fluvial deposits. The geomorphic processes are glacial and peri-glacial with secondary fluvial action.

The *North Slope Outwash* comprises gently sloping benches and valleys forming the lower north slopes of the Uinta Mountains at an elevational range of 8000 to 10000. The structure is benches on a north anticline limb and the lithology is quartzite, conglomerates with thick glacial outwash overburden extending out into the Wyoming Basin. The geomorphic process is fluvial over earlier glaciation.

3.4.2 Surface and Groundwater

3.4.2.1 Sources of Information

The following documents, information, and data analysis sources were reviewed and/or used in the preparation of the *Surface and Groundwater Section*. This information provides the basis for describing the affected environment and the baseline for analyzing and comparing potential effects in Chapter 4 of the Proposed Action and alternatives on surface water resources in the analysis area.

- *W-CNF RFP* (Forest Service 2003a).
- *Wasatch-Cache National Forest Noxious Weed Strategy* (Forest Service 2004a).
- Forest Service/CH2M HILL Project Meeting and Field Reconnaissance Notes *(*January 10, 2005) (Forest Service 2005c).
- Forest Service data and expertise. This is composed of published documents, GIS data, field data, observations gathered for this and other projects, and interviews of other personnel experienced in the area.
- *Final EIS Noxious Weed Management Program, Salmon-Challis National Forest* (Forest Service 2003b).

- Compendium of Pesticide Common Names *(http://www.hclrss.demon.co.uk/ index.html).*
- *Wasatch Canyon Goals and Recommendations.* Prepared by the Canyon Advisory Committee of the Salt Lake County Council of Governments (April 1983). Accessed at Salt Lake City Department of Public Utilities.
- *Salt Lake City Watershed Management Program: 1897-1997*. Prepared by Leroy W. Hooton, Jr. Accessed at Salt Lake City Department of Public Utilities.
- Salt Lake City Ordinance 17.04.371 "Watershed Ordinance."
- *Little Cottonwood Creek TMDL (Utah Department of Water Quality [UDWQ]* March 2002).
- *East Canyon Creek TMDL* (UDWQ [April] 2000).
- *Little Bear River TMDL*. (UDWQ) Unknown Date.
- Data associated with Utah Division of Water Quality Water Quality Monitoring Program.
- *Utah Division of Administrative Rules, Rule R317-2, Standards of Quality for Waters of the State (*February 2005).
- *Wyoming's Surface Water Quality Standards, Chapter 1 of Wyoming's Water Quality Rules and Regulations* (2004).

3.4.2.2 Analysis Area

At the broad biophysical scale, the analysis area for the W-CNF Noxious Weed Management Program consists of three distinct geographic areas: the Wasatch and Bear Mountain Ranges, the Uinta Mountains, and the Stansbury Mountains. McNab and Avers (1994) classified each of these three areas as a "section": respectively, as the Overthrust Mountains Section, the Uinta Mountains Section, and the Bonneville Basin Section, based on the unique geology, climate, vegetation, wildlife, and associated ecologies within each (see Figure 3-1). Consequently, each section has unique geomorphic and hydrologic characteristics that influence the water quality and aquatic habitat of each section. A brief description of the geomorphic and hydrologic characteristics for each section follows.

3.4.2.2.1 Overthrust Mountains

The analysis area located within the Overthrust Mountains Section is typically steep and rugged with elevations between 5000 and 11300. Soil hydrologic groups are mainly B and C with some D, and are generally deep to moderately deep and moderately well to somewhat excessively drained. Permeability is slow to moderately rapid and runoff varies from slow to rapid. Sediment production is generally low to moderate and the primary geomorphic processes are fluvial, colluvial, glacial, and peri-glacial with significant occurrences of stream cutting and mass wasting along the southern half of the analysis area.

This analysis area receives large amounts of precipitation (16 to 40 inches annually), much of it as snow; these snowfields are important sources of late summer stream flow and are typically the source of spring snowmelt flooding. This analysis area consists of

9 major drainages (Fifth Field HUCs) (Logan, Blacksmith Fork, and Little Bear to the north; Weber, Ogden and Lost Creek located centrally; and Big Cottonwood, Little Cottonwood, and Mill creeks to the south); several smaller streams draining from Emigration, Red Butte and City Creek canyons (which are important public water supplies); and the headwaters for streams flowing into the Bear River and Bear Lake.

3.4.2.2.2 Uinta Mountains

The analysis area located within the Uinta Mountains Section is typically steep and rugged with elevations between 7000 and 13600. Soil hydrologic groups are mainly B and C and are generally deep to moderately deep and well to excessively drained. Permeability is very slow to very rapid and runoff varies from slow to medium. Sediment production is generally low and the primary geomorphic processes are fluvial, colluvial, glacial, and peri-glacial, with significant occurrences of stream cutting and mass wasting along the western edge of the analysis area.

This analysis area receives large amounts of precipitation (8 to 35 inches annually), much of it as snow; these snowfields are important sources of late summer stream flow and are typically the source of spring snowmelt flooding. The eastern half of this analysis area consists of 4 major drainages (Fifth Field HUCs) (Blacks Fork, Smith Fork, Upper Henrys Creek, and Cottonwood Creek). The western half of this analysis area is drained by the headwaters of the Beaver, Weber, Duchesne, and Provo rivers, which are all important supplies for drinking and irrigation water.

3.4.2.2.3 Bonneville Basin

The analysis area located within the Bonneville Basin Section is typically steep and rugged with elevations between 5500 and 11000. Soil hydrologic groups are mainly B and C and are generally deep to moderately deep and moderately well to somewhat excessively drained. Permeability is slow to moderately rapid and runoff varies from slow to rapid. Sediment production is generally moderate and the primary geomorphic processes are fluvial, glacial, and nivational.

This analysis area is in a mountain range of the Great Basin west of Tooele, Utah. Average annual precipitation is typically low, between 4 and 10 inches; consequently, there are no large rivers flowing in this area and the largest streams are about 10 to 20 feet wide. There are no large bodies of water in the area, although Grantsville Reservoir is located in the Willow Creek drainage off of the Forest.

3.4.2.3 Existing Conditions

Watersheds contain terrestrial, aquatic, riparian, and wetland resources that include both physical and biological components. They provide critical habitat for wildlife and serve as important links between upland sites and streams by providing shade, bank stability, and pollution filtration. Watersheds are dynamic systems that respond to disturbances by both human and natural agents. Significant disturbances, whether caused naturally (landslides, stand-replacement fires, or floods) and/or by human impacts (roads, large-scale timber removal, or ground disturbance), can cause direct impacts such as flow

reduction, wetland loss, and bank instability, or can produce indirect impacts in the uplands of a watershed, such as soil loss or landslides that introduce sediment to the stream. Often a watershed will recover from such disturbances with a balance of vegetation cover and stream flow. However, chronic impacts that severely impair watershed recovery can affect the long-term health of watershed resources as well as their benefits to ecosystems and human settlements.

This section describes the surface water resources and existing conditions with respect to surface water quality largely in terms of sediment delivery and the designated beneficial uses within the W-CNF.

3.4.2.3.1 Surface Water Hydrology

The W-CNF is within 15 fourth-order watersheds, 28 fifth-order watersheds, and 119 sixth-order watersheds. The W-CNF straddles the Colorado River Basin and the Great Basin Watersheds. The Henrys Fork, Smiths Fork, Blacks Fork, Muddy Creek, and upper Duchesne River watersheds drain into the Colorado River Basin. The upper Bear River, Weber River, Ogden River, Provo River, and Jordan River drain into the Great Basin Watershed.

The W-CNF contains more than 1,178 miles of perennial streams and numerous natural springs and seeps. The drainage patterns are typically dendritic or “leaf vein” as streams flow from their sources down to the valley bottoms. All of the watersheds on the W-CNF include the headwaters (source stream reaches), which then become lower-gradient transport stream reaches. Relatively few miles of low-gradient streams (response stream reaches) occur on the W-CNF, compared to the higher-gradient transport and source stream reaches.

Many small natural lakes and reservoirs supplying water for wildlife, grazing animals, recreation sports fisheries, and irrigation are found in the Uinta Mountains. Several of the natural lakes in the system have been dammed and converted to reservoirs. Large reservoirs of more than 1,000 acre-feet of volume are Pineview, Causey, Meeks Cabin, Beaver Meadow, Whitney, Hoop Lake, Washington Lake, Trial Lake, and Smith and Morehouse. These reservoirs store more than 176,000 acre-feet of water and have a surface area greater than 4,500 acres. Many small reservoirs are located throughout the Forest. In addition, several key public supply watersheds exist whose source partially, or almost entirely, drains from the W-CNF.

The main watersheds supplying water for public consumption are the Provo River, Weber River, Big Cottonwood Creek, Ogden River, and Logan River. Almost 60 percent of the watersheds draining from the Forest provide water for public drinking water needs. Many of the watersheds supply drinking water from springs and well developments. These watersheds are located in major population areas such as Salt Lake City, Ogden, and Logan—all of which are currently experiencing a steady increase in population growth.

As an example of the importance of Forest water supplies, currently within the Jordan River Basin (primarily Salt Lake County), only 26 percent of presently developed water supply for municipal, industrial, irrigation, domestic, and stock-watering purposes is from groundwater sources (State of Utah 1997). The remaining 74 percent is from surface water sources, most of which originate from the mountains draining into the Jordan River

Basin. The protection of the large amount of drinking water sources that originate on the W-CNF is very important to the adjacent communities.

Public supply water is used on the Forest for campgrounds, picnic areas, and administrative sites. Public supply water used at these sites are transient water sources that are used less than 6 months out of the year to supply a small amount of water—for example, providing water needs for 2 to 68 units per campground.

3.4.2.3.2 Surface Water Quality

Beneficial Uses

Overall, water quality is good. However, within the Little Cottonwood Creek watershed, active and inactive mining sites have contributed to degradation of water quality within the Forest. Other impacts to water quality are associated with natural debris flows, roads, water diversions and augmentation, livestock grazing, and recreation activities.

The State of Utah has designated the waters above the Forest boundary as Antidegradation Segments, which indicates that the existing water quality is better than the established standards for the designated beneficial uses, and that the water quality is required by state regulation to be maintained at this level. The beneficial uses of streams within the Forest, as designated by the Utah Department of Environmental Quality, Division of Water Quality, are broadly defined as follows:

- Class 1—protected for use as a raw water source for domestic water systems
- Class 2—protected for recreation and aesthetics
- Class 3—protected for use by aquatic wildlife
- Class 4—protected for agricultural uses

The State of Wyoming has similar designated beneficial uses, which are defined as:

- Class 1—outstanding waters (similar to Utah's anti-degradation segments)
- Class 2—fisheries and drinking water
- Class 3—aquatic life other than fish
- Class 4—agriculture, industry, recreation, and wildlife

Most water bodies on the W-CNF are fully supporting their beneficial uses. Those streams that are not fully supporting their beneficial uses are on the 303(d) list.

303(d) Stream Segments

Every 2 years, the UDEQ submits a report to the EPA that contains a list of those water bodies in Utah that are considered impaired and not meeting their beneficial uses. Streams that are documented as not fully supporting their beneficial uses are listed on Utah's 303(d) list. 303(d) refers to a section in the federal Clean Water Act (CWA) relating to the protection of beneficial uses of surface waters. In April 2004, Utah submitted its 2004 303(d) list to the EPA for review and approval. As stated previously, most water bodies on the W-CNF are fully supporting their beneficial uses. Table 3-22 documents those water bodies, and their pollutant(s), that are on the W-CNF and are part of Utah's 2004 303(d) list.

TABLE 3-22
Streams, Rivers, Lakes, and Reservoirs on the Wasatch-Cache National Forest that are on Utah's and Wyoming's 2004 303(d) List

Waterbody	HUC	Pollutant or Stressor
East Fork Smiths Fork (in Wyoming)	14040107	Habitat degradation
West Fork Smiths Fork (in Wyoming)	14040107	Habitat degradation
Willow Creek (in Wyoming)	14040107	Habitat degradation
Bridger Lake	14040107	Dissolved oxygen
China Reservoir	14040107	Dissolved oxygen
Marsh Lake	14040107	Dissolved oxygen
Lyman Lake	14040107	Dissolved oxygen
Mirror Lake	14060003	Dissolved oxygen
Tony Grove Lake	16010203	Dissolved oxygen, total phosphorus, pH
Pine View Reservoir	16020102	Temperature
Emigration Creek	16020204	Fecal coliform

State Water Quality Standards

As stated earlier, both Utah and Wyoming have similar beneficial use designations. Most water bodies within the W-CNF are designated as supporting cold water fisheries, aquatic wildlife, or drinking water beneficial uses. In general, Utah and Wyoming have similar water quality standards for dissolved oxygen, water temperature, pH, and turbidity; however, the specific Utah, Wyoming, and EPA narrative and numeric water quality standards relative to herbicides are given below.

State of Utah Narrative Water Quality Standard

The State of Utah's Narrative Water Quality Standard (2005) is defined as:

> *It shall be unlawful, and a violation of these regulations, for any person to discharge or place any waste or other substance in such a way as will be or may become offensive, such as unnatural deposits, floating debris, oil, scum, or other nuisances such as color, odor or taste; or may cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or which may result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish or other desirable aquatic life; or, which may result in undesirable human health effects, as determined by bioassay or other tests performed in accordance with standard procedures.*

State of Wyoming Narrative Water Quality Standard (Section 13-Toxic Material and Section 21-Protection of Aquatic Life)

The State of Wyoming's Narrative Water Quality Standard (2001) is defined as:

> *Except for those substances referenced in Sections 21 (e) and (f) of Wyoming's water quality rules and regulations, toxic materials attributable to or influenced by the activities of man shall not be present in any Wyoming surface water in concentrations or combinations which constitute "pollution."*

In addition, for those pollutants not listed in Appendix B or C of Wyoming's Water Quality Rules and Regulations, maximum allowable concentrations in Class 1, 2, and 3 waters shall be determined through the bioassay procedures outlined in the references listed in Appendix E of these same regulations.

Numeric Water Quality Standards

Table 3-23 contains a description of numeric water quality standards.

Salt Lake City Watershed Ordinance - (17.04.375 Herbicide, Pesticide and Fertilizer Restrictions)

Salt Lake City has adopted a watershed ordinance (2004) addressing the management and protection of the City's primary source of drinking water. The portion of the ordinance relating to the application of herbicides within the watershed is given in the following text:

> *Herbicides and pesticides are to be applied by licensed applicators only. The following herbicides and pesticides are approved for use in the watershed, if used according to the product label. The listed herbicides and pesticides should be applied in a manner so as not to allow drift or over spray to hit open water. Conservative application methods are to be used in all watershed areas. Hand sprayers and spot spraying are recommended for application sites around stream banks. Spraying plans should be canceled and active spraying should be discontinued if rain is anticipated within twenty four (24) hours of application. Designated watershed areas are listed on GIS maps for ease of locating areas of special concern.*
>
> - *Azafenidin*
> - *Chlorsulfuron*
> - *Glyphosage*
> - *Metsulfuron*
> - *Pendimenthalin*
> - *Prodiamine*
> - *2,4-d-amine*
> - *3,6-dichloro-o-anisic acid*

TABLE 3-23
Numeric Water Quality Standards and Toxicity

Herbicide (Chemical Name)	Wyoming Aquatic Wildlife[a]	Wyoming Human Health Value Fish and Drinking Water[a]	Utah Aquatic Wildlife[b]	Utah Coldwater Fisheries[b]	Drinking Water [a,b]		LD50: Fish[d,e]
					Utah Standards[b]	EPA Standards[c]	
2,4 D (2,4-dichlorophenoxy acetic acid)		0.3 ug/L 790 ug/L (fish only)	290 ug/L	290 ug/L	77 ug/L	70 ug/L	263,000 ug/L
Amitrol (1H-1,2,4-triazol-3-amine)							
Chlorsulfuron (2-chloro-N-[(4-methoxy-6-methyl-1,3,5-triazin-2-yl) aminocarbonyl] benzenesulfonamide)							
Clopyralid (3,6-dichloro-2-pyridinecarboxylic acid)							
Dicamba (3,6-dichloro-2-methoxybenzoic acid)							135,000 ug/L
Glyphosate (N-(phosphonomethyl) glycine)		700 ug/L				700 ug/L	86,000 ug/L
Hexazinone (3-cyclohexyl-6-dimethylamino-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione)							320,000 ug/L
Imazapic ((±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-methyl-3-pyridinecarboxylic acid)							
Imazapyr (2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid)							
Metribuzin (4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one)							76,000 ug/L
Metsulfuron methyl (methyl-2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl) amino]carbonyl]amino] sulfonyl]benzoic acid)							150,000 ug/L
Metsulfuron (2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl) amino]carbonyl]amino]sulfonyl]benzoic acid)							
Picloram (4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid)		500 ug/L				500 ug/L	19,300 ug/L
Sulfometuron methyl (methyl 2-[[[[4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]benzoate)							12,500 ug/L
Tebuthiuron (N-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]-N,N′-dimethylurea)							87,000 – 144,000 ug/L
Triclopyr ([(3,5,6-trichloro-2-pyridinyl)oxy]acetic acid)							117,000 ug/L
WOW (corn gluten meal)							

[a]State of Wyoming Water Quality Rules and Regulations
[b]State of Utah Administrative Rules (R317-2), Standards of Quality for Waters of the State
[c]National Revised Primary Drinking Water Regulations 965 FR 76748, Dec. 7, 2000
[d]Rainbow trout
[e]Data taken from the Extension Toxicology Network at Oregon State University (http://extoxnet.orst.edu/)

Sediment Delivery

Sediment production rates within the analysis areas appear to be low based on the small number of impaired stream segments on the W-CNF (Table 3-22) (Forest Service 2003a); however, as discussed earlier, both episodic and chronic disturbances have the potential to deliver excess sediment to the stream network. For example, episodic storm events may result in landslides and/or debris flows that have the potential to deliver large amounts of sediment to the stream network. Conversely, anthropogenic watershed disturbances, such as timber removal, forest roads, recreational facilities, grazing, etc., have the potential to deliver both episodic and chronic supplies of sediment to the stream channel. Excessive sediment delivery has the potential to impair the designated beneficial uses of a stream channel.

The W-CNF conducted a course filter assessment at the watershed scale to identify the probable condition of watersheds; to identify locations of critical water-dependent resource values at risk needing priority protection; and to identify locations of damaged soil, riparian, and aquatic resource values needing to be restored (Forest Service 2003a). Watersheds that are highest priority for improvement are those that have water quality impairment: those with the greatest threat to riparian health and aquatic habitat conditions. Poor riparian and stream conditions are those that have conditions such as high streambank instability, areas with a lot of trampling within riparian areas, or low vegetative cover—all of which can result in increased sediment delivery to the channel. In addition, those watersheds that have partnership opportunities to accomplish restoration work also are high priority watersheds. The most common resource concern is poor riparian conditions resulting from roads, grazing, and heavy all-terrain vehicle/off-road vehicle (ATV/ORV) use followed by channel scour from tie-hacking (Forest Service 2003a). However, these areas of resource concern are typically very site specific.

3.4.2.3.3 Groundwater Quality

Forest snowmelt recharges ground-water aquifers. Recharge to deep, confined aquifers occurs almost exclusively near or at mountain fronts. Streams originating on the Forest contribute to the recharge of aquifers within and outside the Forest boundary.

Although little data is available, and based on the small number of 303(d) listed springs and streams on the W-CNF (Table 3-22), groundwater quality on the W-CNF is assumed good to excellent (Forest Service 2003a). Groundwater wells are used for domestic purposes at campgrounds and administrative sites, and groundwater from springs is used for domestic livestock and wildlife. Typical Forest management activities have limited impact on groundwater. Activities that pose the greatest risk to groundwater quality are hard rock mining and oil and gas development. In the late 1800s, hard-rock mining in Big and Little Cottonwood Canyons exposed mineral bearing ore in underground shafts and admits causing increased metals concentrations in groundwater. As a result, the groundwater flows to the surface into Little Cottonwood Creek cause zinc concentrations to exceed state standards for aquatic life. No effects are known to have occurred to the groundwater from oil and gas development along the north slope of the Uinta Mountains on the Evanston/Mountain View Ranger District.

3.4.3 Air Quality

3.4.3.1 Analysis Method

The following documents, information, and data analysis sources were reviewed and/or used in the preparation of the *Air Quality Section.* This information provides the basis for describing the affected environment and the baseline for analyzing and comparing potential effects in Chapter 4 of the Proposed Action and alternatives on air quality in the analysis area.

- *W-CNF RFP* (Forest Service 2003a).
- *Wasatch-Cache National Forest Noxious Weed Strategy* (Forest Service 2004a).
- Forest Service/CH2M HILL Project Meeting and Field Reconnaissance Notes (January 10, 2005) (Forest Service 2005c).
- Forest Service data and expertise. This consists of published documents, GIS data, field data, observations gathered for this and other projects, and interviews of other personnel experienced in the area.

3.4.3.2 Analysis Area

The analysis area for air quality is the airshed associated with the W-CNF in northeastern Utah and southwestern Wyoming. The following text describes conditions across all three ecological areas. In general, air quality is lowest in the Overthrust Mountains area because of the metropolitan Wasatch Front. Air quality in the Bonneville Basin and Uinta Mountains is of better quality due to lack of air pollutant sources. Fires and wind-blown soil are the two factors of most concern in the Bonneville Basin and Uinta Mountains areas.

3.4.3.3 Existing Conditions

3.4.3.3.1 Background

The Clean Air Act (1967) and amendments (1972, 1977) protect and enhance the quality of the Nation’s air resources and protect public health and welfare. The Act requires that the federal government comply with all federal, state, tribal, interstate, and local air quality standards, regulations, and requirements. The Act established National Ambient Air Quality Standards (NAAQS) and gave the States primary responsibility for air quality management through development of a State Implementation Plan (SIP) (Forest Service 2000c).

The 1977 Clean Air Act Amendment designated areas of the country as Class I, II, and III airsheds to prevent significant deterioration. Class I protects pristine lands by severely limiting the amount of additional human-caused air pollution that can be added to these areas. There are five Class I areas in Utah: Bryce Canyon, Zion, Arches, Capitol Reef, and Canyonlands National Parks. The rest of Utah, including Forest Service Wilderness areas, is classified as Class II (Forest Service 2000c).

3.4.3.3.2 Monitoring Sites

An Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring site is located near Timpanogos National Monument in American Fork Canyon near Orem, Utah. In addition, qualitative visibility monitoring sites have been in operation on the Ashley National Forest and W-CNF. The Ashley National Forest manages a visibility site near Mill Park in the High Uintas Wilderness area. The W-CNF collected visibility data between 1995 and 1997 from two monitoring sites located near the Snowbird top tram terminal. Cameras took photographs to the west toward Salt Lake City and to the south toward Mt. Timpanogos to qualitatively assess the visibility across Salt Lake Valley and across the Wasatch Mountains near Salt Lake and Provo, Utah. These sites give an indication of the haziness of the atmosphere.

3.4.3.3.3 Air Quality Conditions

Sources of air pollution occur from activities both on and off the W-CNF. Impacts to air quality on the Forest include regional haze, caused by transported pollutants from large urban areas adjacent to the Forest, including industry and manufacturing, traffic, and wood-burning stoves. Localized air pollution occurs from heavy traffic during peak hours and from skiers driving to resorts in Big and Little Cottonwood Canyons in the winter months. Air pollutants of concern include fine particulate matter, nitrogen oxides, sulfates, and carbon monoxide. These pollutants can affect human health, reduce visibility, and lead to acidic deposition in high-elevation lakes.

Most lands managed by the Forest currently are in attainment of national ambient air quality standards (NAAQS). Part of the Salt Lake Ranger District is in non-attainment areas for PM_{10} (particulate matter less than 10 microns in diameter), sulfur dioxide, and ozone. Salt Lake County is a non-attainment area for PM_{10}, sulfur dioxide, and ozone. Davis County is a non-attainment area for PM_{10} (State of Utah 2000). Land-use practices within or adjacent to this non-attainment area are closely scrutinized by local and state regulatory agencies to ensure that further violations do not occur.

The visibility-monitoring IMPROVE site in American Fork Canyon represents conditions near the Lone Peak Wilderness. The site has collected data (Copeland *et al.* 2001) since 1993 and complete seasonal data are available for 3 years from 1996-98. Interpretations discussed in the following text are based on 1996-98 since data are complete for each season during this period.

Data from the IMPROVE site show that the winter season has the greatest extremes in visibility. Winter has the cleanest of the “clean” days (average visibility of about 120 miles) and the dirtiest of the “dirty” days (average visibility of about 38 miles). The cleanest of the “clean” days is above the estimated natural mean visibility in the West, which is 110 to 115 miles. In comparing winter to other seasons, poor visibility for the dirtiest 20 percent of days is attributed primarily to increases in nitrates and sulfates. The visibility of the mean of the median 20 percent of days in 1997 to 1998 showed very little difference among seasons. Average annual visibility for 1996 to 1998 of the mean of the median 20 percent of days is about 75 miles. This is less than the best current mean visibility in the Intermountain West and Great Basin regions, which is 90 miles.

3.5 Economic and Social Resources

3.5.1 Economic Resources

3.5.1.1 Analysis Method

Economic resources on the W-CNF are examined at the county level for the affected environment and include the available information on the population and economy in and around the W-CNF. The primary document used to describe the affected environment is the *Wasatch-Cache National Forest Noxious Weed Strategy* (Forest Service 2004a).

3.5.1.2 Analysis Area

The W-CNF administers National Forest System lands in all counties within the regional study area. Table 3-24 displays the acres of National Forest System lands and total county acres. The amount of National Forest System land in each county varies significantly. Other federal lands (lands managed by the Department of Defense, the BLM, and the Caribou, Sawtooth, Ashley, and Uinta National Forests) also make up substantial portions of Box Elder, Tooele, Rich, and Uinta counties.

TABLE 3-24
Area Figures for Counties Within the Regional Study Area (Forest Service 2003a)

County	County Total Land Base (acres)	National Forest Lands (acres)	Wasatch-Cache Forest Lands (percent of total)
Box Elder, UT	3,592,960	24,328	<0.1
Cache, UT	749,440	267,827	35.7
Davis, UT	171,520	37,580	21.9
Morgan, UT	385,920	13,996	3.6
Rich, UT	661,760	49,398	7.5
Salt Lake, UT	488,960	95,533	19.5
Summit, UT	1,183,360	501,871	42.4
Tooele, UT	4,430,720	150,234	3.4
Uinta, WY	1,336,417	37,762	2.8
Weber, UT	412,160	67,805	16.5

3.5.1.3 Existing Conditions

3.5.1.3.1 Population

Counties

Ten counties are included in the analysis that may be affected by the proposed project: Box Elder, Cache, Davis, Morgan, Rich, Salt Lake, Summit, Tooele, Uinta, and Weber (Table 3-24). These counties are referred to collectively as the regional study area.

Wasatch and Duchesne counties have not been included in the analysis, as the acreages of W-CNF lands within these county boundaries are small—21,173 and 29,709 acres respectively—and the culture and lifestyle of the counties are more associated with the Uinta National Forest (Forest Service 2003a). The Social and Economic Analysis section in the W-CNF RFP (Forest Service 2003a) provides additional information on the economic characteristics, as well as lifestyle and quality of life, of the counties in the analysis area.

American Indians

The W-CNF is very interested in cultivating good relationships with American Indian groups. National Forest lands and resources represent significant cultural and economic values to American Indians and to the other citizens of the United States. Several land management issues and concerns are of mutual interest to tribes and the Forest Service (Forest Service 2003a).

In Utah, Forest Supervisors are responsible for implementing government-to-government communications and coordination with federally recognized tribes. District Rangers also interact with tribes on day-to-day matters, under the authority of the Forest Supervisor. In the past year, the Forest Supervisor, Deputy Forest Supervisor, and District Rangers have met directly with tribal leaders to develop understanding of their interests or concerns regarding National Forest lands (Forest Service 2003a).

Three American Indian tribes are closely related to land areas of the W-CNF. These are the Skull Valley Band of Goshute Indians, the Northwestern Band of Shoshoni, and the Northern Ute. While these Tribes' reservations are within areas where they lived historically, Shoshonean and Ute groups once ranged freely over much larger areas—covering millions of acres of land that is now in federal, state, local, and private ownership. As sovereign governments, American Indians have status equal to or above that of state and county governments. Because of the unique trust relationship between the federal government and tribes, Indian Nations and tribal members are distinguished as different from the general public. Treaties, statutes, and executive orders often reserve off-reservation rights and address traditional interests relative to the use of federal lands (Forest Service 2003a). American Indian Tribes are discussed further in *Section 3.5.6, Indian Trust Assets/Treaty Rights*.

3.5.1.3.2 Economics

Annual per capita personal income in Utah in 2000 was $23,436, slightly lower than the national average of $29,469. Because per capita income is a measure of both income and population, smaller counties in Utah often show a lower change or growth than either the state or national average, because of large family sizes. Summit County has a per capita income much higher than other counties in the analysis area, the state of Utah, and the national average (Forest Service 2003a).

3.5.1.3.3 Poverty

In 1997, 8.9 percent of Utah's population was in poverty with only 3.6 percent receiving public assistance. Only six other states had lower poverty rates. Utah has the eleventh highest percentage of homeowners in the nation at 72.5 percent (State of Utah 2001). Both these conditions indicate a relatively high standard of living (Forest Service 2003a).

3.5.1.3.4 Forest Resource Related Industries and Resources

Wood products, mining/processing, recreation and tourism, and grazing are the four industries that are directly dependent on Forest-related resources and are the most likely to be impacted (positively or negatively) by W-CNF management. These industries' production activities occur inside and outside the Forest, and in many cases, the Forest is not the only source of the Forest-related resources (Forest Service 2003a).

Within the analysis area, the employment estimated to be directly related to W-CNF activity is about 14 percent. The majority of Forest-related employment is within tourism-related activities. It is difficult to estimate all effects specifically related to Forest management, because this analysis is likely a conservative estimate of employment. Those counties, with infrastructure for support and processing Forest outputs, are more likely to be affected by changes in management. Summit County in terms of mining and recreation/tourism facilities, Uinta County in terms of grazing and wood production on the Forest, and counties with developed tourism opportunities also have specific interests in W-CNF management (Forest Service 2003a).

The outputs provided and wildlife watching are popular in Wilderness areas. Native trout exist in the Forest and are important to individual businesses and local communities, but in terms of the functioning economy surrounding the W-CNF, Forest-related outputs account for about 10 percent of the labor income. The difference between the employment portion and labor income is likely the differences in wages associated with the sectors. The recreation/tourism industry opportunities tend to be more seasonal and part-time in nature with lower wages, accounting for less of the labor income than employment. The mining and manufacturing sectors tend to be the opposite, contributing the same portion or more labor income than employment because of higher wages and full-time, year-round employment.

3.5.1.3.5 Cooperative Partnerships

Cooperative partnerships known as Cooperative Weed Management Areas (CWMAs), which are aimed at the active coordination of weed management efforts among public and private land managers, exist or are planned in or near the analysis area. CWMAs potentially involve all landowners in a watershed or region, development of IWM Plans, and defining roles and partnerships that allow for the treatment of weed infestations across jurisdictional lines of ownership to optimize cooperative efforts to eradicate and control noxious weeds. Each CWMA works with state, federal, and county officials, and neighboring CWMAs to coordinate weed management efforts. Currently, the W-CNF is an active participant in two CWMAs, the Utah & Idaho CWMA, and the Weber River CWMA. In addition, relationships are being developed for CWMAs in Summit County and the Bonneville Basin. CWMAs have proven their ability to acquire grants and

leverage existing money to complete priority noxious weed abatement projects on the ground (VanBebber 2003 *in* W-CNF 2004).

Figure 3-6 depicts locations by county of noxious weed infestations that are known to occur on the W-CNF. Known weed infestations or the extent of weed infestations on the W-CNF appear to be greatest in portions of Weber, Davis, Cache, Rich, Summit, and Uinta Counties. Figure 3-2 and text in *Section 3.3.1, Vegetation Resources and Noxious Weeds*, depicts locations by ecological section (Overthrust Area, Bonneville Basin, and Uinta Mountains) and provides additional discussion on the distribution of noxious weeds known to occur on the W-CNF.

3.5.2 Recreation and Visual Resources

3.5.2.1 Analysis Method

The following documents, information, and data analysis sources were reviewed and/or used in the preparation of the *Recreation and Visual Resources Section*. This information provides the basis for describing the affected environment and the baseline for analyzing and comparing potential effects in Chapter 4 of the Proposed Action and alternatives on recreation and visual resources in the analysis area.

- *W-CNF RFP* (Forest Service 2003a).
- *Wasatch-Cache National Forest Noxious Weed Strategy* (Forest Service 2004a).
- *Forest Service/CH2M HILL Project Meeting and Field Reconnaissance Notes.* January 10, 2005 (Forest Service 2005c).
- Forest Service data and expertise. This consists of published documents, GIS data, field data, observations gathered for this and other projects, and interviews of other personnel experienced in the area.

3.5.2.2 Analysis Area

The analysis area for recreation and visual resources consists of the lands administered by the six W-CNF Ranger Districts: the Salt Lake, Ogden, and Logan Ranger Districts in the Overthrust Mountains; the Kamas, Evanston, and Mountain View Ranger Districts in the Uinta Mountains; and the Salt Lake Ranger District, which also administers the Bonneville Basin. The following text discusses recreation and visual resources at the W-CNF level for all three ecological areas (Overthrust Mountains, Bonneville Basin, and Uinta Mountains). Discussion is structured by Ranger District. While the W-CNF is known for its snow, and skiing and snowmobiling terrain, the discussion will not include winter recreation activities. Ski areas are discussed in the context of summer use and management.

Click here to view Figure 3-6 (0.3 MB)

3.5.2.3 Existing Conditions

3.5.2.3.1 Recreation Resources

Background

The W-CNF is a worldwide attraction for visitors seeking a variety of recreation settings. Recreation is currently the predominant use in the Forest. A visitor use survey conducted in 2002 through 2003 (Forest Service 2004a) found that the W-CNF ranked first in total national forest visits in the Intermountain Region and fifth in the nation within the National Forest system. Providing quality natural and natural-appearing settings has long been a focus of management to promote a quality recreational experience on the W-CNF.

Because of the W-CNF's adjacent relationship to urban communities it is highly influenced by the rapid population increases occurring in the area. As recreation use has increased, so have potential vectors and seed sources for the spread of noxious weeds within and adjacent to the Forest. This increased potential includes new user-created routes (both motorized and non-motorized), crowded trailheads and developed facilities, and dispersed areas of hunting, camping, and picnicking.

Forest-Wide Recreation

The W-CNF is unique in several recreation aspects. Recognized as an urban Forest, the W-CNF is the backyard to nearly 1.7 million people living near the Forest. These people bring with them a wide range of recreational interests. People can drive 15 to 30 minutes from their homes and be at a ski area, developed recreation facility, trailhead, or Wilderness area. This part of the Forest is most commonly visited for day use or short trips. Generally, these areas are more developed and have more RVDs than other parts of the Forest.

The backsides of the Wasatch Front, including areas around Kamas, Logan, the north slope of the Uintas, and the Stansbury Mountains are generally less developed and provide fewer RVDs. Visits are of longer duration and rural values influence the desired opportunities.

The variety of Forest-wide recreation opportunities and users, together with the large nearby population center, represent a broad range of potential vectors and seed sources for the continued introduction and spread of noxious weeds on the W-CNF. Those areas of the Forest that are more developed or receive more RVDs, such as heavily used, developed, or dispersed recreation areas and corridors, would have a greater potential for noxious weed introduction and spread. However, there also is the potential, although comparatively less, for the introduction and spread of noxious weeds from recreational pursuits in more remote Forest settings, such as Wilderness areas. Examples include the dispersal of weed seed on the boots and clothing of backpackers, campers, hunters, and anglers, and from the use of horses and potentially their feed in backcountry areas.

Types and Levels of Recreation Use

The National Visitor Use Monitoring (NVUM) project was implemented as a response to the need to better understand the use and satisfaction of National Forest recreation opportunities. The survey for recreation use on the W-CNF was conducted from October 2002 through September 2003, and recorded 4.9 million visits. A National Forest visit is

defined as one person entering the National Forest to participate in recreation activities for an unspecified period of time. The top five recreation activities of the visitors to the W-CNF were (see Table 3-25):

1) viewing natural features
2) relaxing
3) hiking/walking
4) viewing wildlife
5) downhill skiing

Each visitor also picked one of these activities as the primary activity for their current recreation visit to the Forest. The top five primary activities were:

1) hiking/walking
2) downhill skiing/snowboarding
3) relaxing/hanging out
4) fishing
5) viewing natural features

TABLE 3-25
W-CNF Activity Participation and Primary Activity

Activity	Percent Participating	Percent as Main Activity*
Developed Camping	7.54	3.27
Primitive Camping	2.51	1.00
Backpacking	1.76	0.55
Resort Use	4.34	0.05
Picnicking	13.03	2.05
Viewing Natural Features	73.97	4.83
Visiting Historic Sites	1.67	0.00
Nature Center Activities	4.91	0.08
Nature Study	4.44	0.00
Relaxing	65.68	8.74
Fishing	9.58	5.41
Hunting	4.08	2.63
OHV Use	3.58	2.64
Driving for Pleasure	16.76	1.44
Snowmobiling	2.95	2.38
Motorized Water Activities	1.07	0.90
Other Motorized Activity	0.00	0.00
Hiking/Walking	50.10	27.80
Horseback Riding	1.98	1.00
Bicycling	1.73	1.19

TABLE 3-25
W-CNF Activity Participation and Primary Activity

Activity	Percent Participating	Percent as Main Activity*
Non-motorized Water	1.15	0.97
Downhill Skiing	28.53	27.73
Cross-country Skiing	4.27	3.18
Other Non-motorized	4.88	1.82
Gathering Forest Products	1.70	0.49
Viewing Wildlife	49.01	0.75

*This column may total more than 100% because some visitors chose more than one primary activity.
Source: National Visitor Use Monitoring Results, Wasatch-Cache National Forest, June 2004.

While not identified in the top five activity categories, some activities and trends are of additional management concern for weed spread. Mountain biking and off-highway vehicles (OHVs) can transport seed in tire tread from private land to the Forest.

Recreation Demand

The W-CNF is a primary provider of outdoor recreation settings for Northern Utah. In general, there is a continuing and growing demand for a diversity of recreation opportunities on public lands. As the population continues to grow (predicted to increase by 1 million by 2020 (EU 2002), it is expected that the demand for outdoor recreation will increase at a similar or greater rate (Forest Service 1995). The potential for the introduction of noxious weeds to the W-CNF would be expected to increase as outdoor recreation increases.

Managers know that undeveloped recreation use is increasing. According to Cole (1996), in an analysis of National Wilderness and Park Service use data, backcountry recreation use has increased at an average annual growth rate of 11.4 percent per year since 1990. This rate is likely even higher because the analysis did not include day use, which is believed to be increasing rapidly, nor did it include motorized undeveloped recreation. Increased backcountry recreation and use would increase the potential for the introduction and spread of noxious weeds in such areas. As discussed previously, examples of vectors in backcountry areas include the dispersal of weed seed on the boots and clothing of backpackers, campers, hunters, and anglers, and from the use of horses and, potentially, their feed.

Developed Recreation

Developed recreation sites are those areas containing a concentration of improvements, facilities, and services that are built primarily to invite, encourage, or enhance participation in a recreation activity or visitor experience, as opposed to providing facilities just for resource protection. Improvements that are considered developed sites could range from campgrounds with water systems, flush toilets, and showers, to small trailheads with bulletin boards or barrier rocks, to delineated parking lots. Table 3-26 shows the number of developed recreation sites by Ranger District on the W-CNF.

TABLE 3-26
Number of Developed Recreation Sites by Ranger District on the W-CNF and the Number of People at One Time (PAOTs) Sites are Designed to Accommodate

Site Type	SLRD (D1)	KRD (D3)	ERD (D4) / MVR(D5)	ORD (D6)	LRD (D7)	Forest Totals
Publicly Developed Facilities						
Campgrounds	13/3,205	19/3,572	15/1,995	13/1,935	16/2,355	76/13,062
Picnic Areas	19/2,105	6/435	1/45	3/1,190	10/605	39/4,380
Interpretive/Observation	2/410	7/326	5/125	2/70	15/325	31/1,256
Boat Launch/Swim				3/758		3/758
Trailheads	10/904	16/1,653	13/1,322	10/640	18/1,497	67/6,016
Angler Parking		10/693		2/120		12/813
Winter Resorts	4/na			1/na		5/na
Winter Play Area			1/420			1/420
Privately Developed Facilities (Under Special Use Permit)						
Recreation Residences	142/710	41/205	40/200	45/225	83/415	351/1,790
Organization Camps	1/50	2/100	1/50	2/100	2/100	8/400
Clubs	2/100	1/50		1/50	2/100	6/300
Restaurants	1/100					1/100
Stores	1/25					1/25
Outfitters and Guides	6/na	3/na	1/na	0/na	5/na	15/na

In light of the population growth projections for the state, visitation to developed recreational facilities is expected to continue to increase. This would result in an increased potential for the introduction and spread of noxious weeds at or in the vicinity of developed recreation sites. Increased visitation also would cause some weekend visitors to be displaced or unable to find their desired recreation setting or experience. Some of these visitors will be displaced to less developed or undeveloped areas where increasing concentrations of human use are more likely to cause unacceptable resource impacts, possibly including the introduction and spread of noxious weeds to these areas as well.

Figure 3-7 shows the location of developed recreation areas and locations of weed infestations that are known to occur on the W-CNF. The occurrence of developed recreation areas near large infestations of noxious weeds is most apparent in the central portion of the Overthrust Mountains Area of the W-CNF where large infestations of Dyer's woad are found.

Undeveloped Recreation

Concentrated Use Areas are areas where undeveloped site(s) are located and management focuses on resource protection rather than user convenience. As developed campgrounds fill on summer weekends, visitors are displaced, often to undeveloped camping areas. Many other visitors choose an undeveloped setting for their desired activities or

experiences. Some visitors, such as horseback and OHV groups, are often restricted from developed sites and must choose undeveloped recreation sites. These groups often select trailheads for their camp. Hunting is a seasonal and intense activity that places a high demand on undeveloped recreation settings. Fishing use occurs over a longer period with peak use on weekends.

While the aerial extent of these activities in relation to the total size of the W-CNF is small, their localized effects can cause unacceptable impacts to valued biophysical or social resources in the vicinity of the undeveloped recreation site. Also, as noted for the other categories of recreational use, activities associated with undeveloped recreation sites can result in the introduction and spread of noxious weeds. The rates of weed introduction and infestation spread would potentially increase with increased levels of recreation use.

Trails Management

The trail system is another important component of undeveloped recreation on the W-CNF and a pathway by which weed seeds are introduced and weed infestations established on the Forest. Trails provide visitors, which represent potential vectors for weed introduction, access away from developed recreation sites and support many recreation activities such as backcountry camping, hiking, hunting, horseback riding, OHV riding, and mountain biking. Most of the trails on the W-CNF receive very high use, except for a few more remote, low maintenance trails. Many trails now receive year-round use. Hiking, horseback riding, biking, and motorized use of trails are popular in the summer. Weeds can be introduced along trails and spread to adjacent areas from seeds present on the boots and clothing of backpackers, campers, hunters, anglers, and other trail users, on the frames of bikes and motorized vehicles, and from the use of horses and potentially their feed.

Figure 3-8 shows the locations of trails and roads (discussed separately, later in this section) and locations of weed infestations that are known to occur on the W-CNF. Data indicate an association between travel corridors and known weed infestations in at least some portions of the W-CNF. Information about the miles, relative abundance, and types of use of trails on the W-CNF Ranger Districts also provides an indication of where the potential for future weed introductions may be greatest. There are 1,808 miles of system trails on the Forest. Motorized use by ATVs is also allowed on most of the approximately 1,600 miles of road within the Forest, many of which are relatively primitive and provide a rugged motorized experience.

Recreation Special Uses

Many uses on the W-CNF require formal management authorization, and all commercial uses are regulated. These uses are generally authorized by Special Use Permits. Recreation special uses range from agreements with private entities to manage publicly developed facilities such as campgrounds and picnic areas to agreements regarding private facilities or activities such as ski areas, recreation residences, or outfitters and guides (refer to Table 3-26 for uses under permit). Many of the activities associated with recreation special uses represent potential pathways, vectors, and seed sources for the introduction and spread of noxious weeds within and adjacent to the Forest.

Ski Area Management

Five ski areas operate on National Forest System Lands administered by the W-CNF: they are Alta, Snowbird, Solitude and Brighton in Salt Lake County, and Snowbasin in Weber County.

Disturbances associated with ski area development, such as conversion of ski run vegetation, slope shaping, equipment installation, snow making, establishment of roads and trails, and presence of weed seed vectors (boots and clothing of workers and on construction equipment) can result in the introduction and spread of noxious weeds to adjacent areas. Also, where present, noxious weeds often out-compete native species and become established in disturbed areas. Potential noxious weed introduction during ski area development is unique because the disturbance occurs in higher elevation areas that otherwise would not have much disturbance that would allow for weed introduction.

Recreation by Ranger District

Each Ranger District on the W-CNF offers unique recreation opportunities dependent on the physical setting, access systems, customer preferences for different types of recreation, and the relationship of recreation to other uses or management concerns. The following brief profiles describe the variety in recreation uses for the W-CNF Ranger Districts. The variety and amount of recreation is considerable compared to most other National Forests. As discussed previously, because of the variety of Forest-wide recreation opportunities and users and the large nearby population center, there are numerous potential vectors and seed sources for the continued introduction and spread of noxious weeds on the W-CNF.

Overthrust Mountains and Bonneville Basin

Salt Lake Ranger District

The Salt Lake Ranger District (SLRD) manages recreation use in the Central Wasatch, North Wasatch–Ogden Valley (Overthrust Mountains), and the Stansbury Management Areas (Bonneville Basin). Managers consider three distinct areas on the SLRD: the Wasatch Front, Davis County, and the Stansbury Mountains.

Recreation use along the Wasatch Front is seasonal with distinctive peaks in both summer and winter. Summer use occurs from May to October, with a shorter season at higher elevations. Popular activities include hiking, camping, backpacking, picnicking, rock climbing, driving for pleasure, fishing, and mountain biking. Local watershed protection regulations preclude horses and dogs from most Wasatch Front recreation areas.

Recreation use in Davis County and the Stansbury Mountains also occurs year-round, with most use occurring from May to October. Popular activities include hiking, mountain biking, equestrian use, OHV use, hunting, and camping.

Click here to view Figure 3-7 (0.2 MB)

Click here to view Figure 3-8 (0.8 MB)

Ogden Ranger District

The Ogden Ranger District (ORD) is adjacent to the northern edge of the dense population areas of the Wasatch Front. The ORD manages parts of the North Wasatch–Ogden Valley, Bear, and Box Elder-Cache Management Areas. Recreation management is complicated by the extensive amount of intermingled public and private land ownership. The ORD is primarily a day-use area. May through September is the busiest season on the ORD, with developed facilities full every weekend. Popular summer activities include camping, scenic driving, hiking, biking, boating, swimming, bird watching, hunting, and fishing. Pineview is managed as a day-use reservoir with restrictions on camping.

Logan Ranger District

The Logan Ranger District (LRD) manages most of the Cache–Box Elder and part of the Bear Management areas. The LRD shares management of these areas with the Ogden Ranger District. The LRD is located in Cache Valley, Utah with a population nearing 80,000. It is within a 1.5-hour drive of the Wasatch Front urban center.

Visitors to the LRD participate in world-class rock climbing, mountain biking, horseback riding, canoeing, and kayaking, as well as the more traditional uses like hunting and fishing.

Uinta Mountains

Kamas Ranger District

The Kamas Ranger District (KRD) manages uses on a portion of the Western Uintas Management Area. July through September is the busiest season on the KRD, with campgrounds full nearly every weekend. Popular activities include camping, scenic driving, rock climbing, hunting, fishing, hiking, horseback riding, and backpacking. There are two permitted organization youth camps and two outfitters and guides that provide youth at-risk programs.

Evanston and Mountain View Ranger Districts

The Evanston and Mountain View Ranger Districts (E&MVRD) are managed as one district. They manage a portion of the Western Uintas and the entire Eastern Uintas Management Areas. These areas are the farthest from the Wasatch Front urban center and parts of the Mountain View Ranger District are in Wyoming. With a relatively short season of warm weather, campgrounds and trailheads are full most weekends during July, August, and September. Popular activities include camping, fishing, horse use, hiking, backpacking, and ATV and mountain bike riding. In the fall, hunting season for two states (Utah and Wyoming) and four species of big game has a huge impact.

3.5.2.3.2 Scenic Resources

Background

The scenery visible to people visiting or living by the W-CNF constitutes the analysis area’s visual or scenic resources. Scenery is described as the general appearance of a place or landscape, or the features of a landscape. The character of the landscape varies by location and is dependent on natural features such as geology, vegetation, water features, landforms, natural disturbances, and human alterations. Forest management activities have the potential for directly, indirectly and cumulatively affecting scenic resources through various actions, such as vegetation management and treatment of noxious weeds, facility construction, road building, fire, and other human interactions with the Forest.

The W-CNF is the scenic backdrop and playground to the populace of the Wasatch Front, Cache Valley, and other basin communities in Utah and Wyoming. People view these scenic resources from their residences, special places, and travel-ways that meander through the Forest. The W-CNF scenic image has been recognized nationally for its landscapes viewed from its Scenic Byways, travel-ways, Wilderness backcountry, recreation facilities, overlooks, and canyon resorts. Viewing scenery is one of the most popular recreation activities in the nation and on the W-CNF.

The present W-CNF landscape is a result of the interactions of existing vegetation and landforms on line, form, color, and texture of the viewed scenery. The existing landscape character varies by location and is dependent on such influences as geology, water, vegetation, landforms, and human developments and activities. The scenic landscape is a dynamic medium and is continuously modified by both human and natural causes.

Geologic events, wildland fire, and human developments and activities including wildland fire exclusion have altered much of the landscape on the W-CNF. Some of these altered landscapes are not obvious to casual viewers because they still present a natural appearance, or cultural modifications appear to be part of the valued image people are expecting in a landscape. This is especially true when looking at some of the vegetation conditions that have resulted from fire exclusion.

For planning purposes, the W-CNF is divided into five Landscape Character Themes (LCT), each with varying degrees of human alteration. They range from the subtle changes found in a Natural Evolving LCT (25 percent of the Forest) to the highly modified LCT of Water Recreation Rural Appearing (0.3 percent of the Forest) found in Ogden Valley’s Pineview Reservoir, which is located in a rural culture setting of farms, tree-lined fields, and a patch work of fenced pastures. A majority of the Forest’s LCT is Natural Appearing (72 percent) where the altered landscape appears natural to the casual visitor and valued amenities such as trailheads, campgrounds, and historic uses are evident.

Adjacent to the scenic byways on the Forest are landscapes that have moderate to high densities of developed Forest facilities in a natural setting and are described as Developed Natural Appearing (2 percent). The five ski areas comprise the remainder of the Forest where mountain villages, base facilities, ski runs, and trails mimic abstract characteristics

of color and forms found in the surrounding landscape. The ski areas are described as Resort Natural Appearing (0.5 percent).

For the W-CNF, providing pleasing landscapes with appropriate protection for supporting resource elements has always been a major consideration in larger allocation decisions and at the project level.

3.5.3 Wilderness Resources

3.5.3.1 Analysis Method

The following documents, information, and data analysis sources were reviewed and/or used in the preparation of the *Wilderness Resources Section*. This information provides the basis for describing the affected environment and the baseline for analyzing and comparing potential effects in Chapter 4 of the Proposed Action and alternatives on wilderness resources in the analysis area.

- *W-CNF RFP* (Forest Service 2003a).
- *Wasatch-Cache National Forest Noxious Weed Strategy* (Forest Service 2004a).
- Forest Service/CH2M HILL Project Meeting and Field Reconnaissance Notes (January 10, 2005) (Forest Service 2005c).
- Forest Service data and expertise. This consists of published documents, GIS data, field data, observations gathered for this and other projects, and interviews of other personnel experienced in the area.

3.5.3.2 Analysis Area

The analysis area for wilderness resources consists of the lands administered by the six W-CNF Ranger Districts: Salt Lake, Kamas, Evanston, Mountain View, Ogden, and Logan.

3.5.3.3 Existing Conditions

3.5.3.3.1 Background

A long-term management goal of the W-CNF is to maintain wilderness, where ecosystems are primarily influenced by the forces of nature; provide a diversity of opportunities for public use, enjoyment, and understanding of wilderness; and preserve a high quality wilderness resource for present and future generations. The Wilderness Act of 1964 emphasizes the protection of pristine areas and recognizes recreational values of public benefit. Wilderness provides outstanding opportunities for solitude and for primitive and unconfined recreational experiences. Since the Wilderness Act became law in 1964, millions of people have visited designated Wilderness for solitude, recreation, spiritual enhancement, and natural appreciation. Recreation is just one way that wilderness resources are used and valued. Wilderness is important as a sanctuary for undisturbed ecosystems, for maintenance of species diversity, protection of threatened and endangered species, as well as non-endangered plants and animals, protection of watersheds and clean water, protection of airsheds and clean air, scientific research, and

various social values. Wilderness is a benchmark for determining our nation's environmental and spiritual health. Local communities receive some economic benefits from Wilderness designation through tourism and recreation.

3.5.3.3.2 Wilderness Areas

Seven designated Wilderness areas, totaling 309,079 acres, exist on the W-CNF. This represents approximately 25 percent of W-CNF acreage and 38 percent of all designated Wilderness areas in Utah. The Wilderness areas on the W-CNF are Lone Peak, Twin Peaks, Mount Olympus, Deseret Peak, Wellsville Mountains, Mount Naomi, and High Uintas. Lone Peak is shared with the Uinta National Forest and the High Uintas is shared with the Ashley National Forest. Lone Peak became a Wilderness in 1978 with the Endangered American Wilderness Act and the other six areas became Wilderness in 1984 with the Utah Wilderness Act of 1984. Table 3-27 lists Wilderness acreages and the associated W-CNF Ranger Districts. Wilderness areas on the W-CNF are described below.

TABLE 3-27
Wilderness by District and Acreage

Name	District	W-CNF Wilderness Acres	Total Wilderness Acres
Overthrust Mountains			
Twin Peaks	Salt Lake	11,495	11,495
Mount Olympus	Salt Lake	15,300	15,300
Lone Peak	Salt Lake	9,747	30,578
Mount Naomi	Logan	44,523	44,523
Wellsville Mountains	Logan	22,986	22,986
Bonneville Basin			
Deseret Peak	Salt Lake	25,215	25,215
Uinta Mountains			
High Uintas	Kamas, Evanston, Mt View	179,813	453,664

Overthrust Mountains

Mount Naomi. This Wilderness is on the Logan Ranger District and part of the Cache-Box Elder Management Area with elevations up to 9980 at Naomi Peak. Use is a collection of day visitors, backpackers, and horseback riders, while the winter receives cross-country ski and snowshoe users. Key access is off the Logan Canyon Highway, along the Logan Front, and reaching the high country is popular from the Tony Grove Lake area. Included in the area is the Mount Naomi Peak National Recreation Trail. Use varies from low to high, depending on location and season. The area has important wildlife and ecosystem values.

Wellsville Mountains. This Wilderness is on the Logan Ranger District and part of the Cache-Box Elder Management Area with up to elevation 9372 at Box Elder Peak. Almost all of the Wellsville Mountains are part of the Wilderness, but the trail system and access are limited. The area also is known for its raptor migrations. Use varies, but is generally on the lower side.

Mount Olympus, Twin Peaks, and Lone Peak. These three Wilderness areas are on the Salt Lake Ranger District and in the Central Wasatch Management Area adjacent to the Salt Lake metropolitan area. Lone Peak is also located on the Uinta National Forest, which shares in its management (W-CNF has 9,747 acres of 30,578 total acres). Use is extremely high year-round. Some solitude can be found in the off-trail and more rugged sections. These Wasatch Front Wilderness areas are somewhat unique as wilderness in that 90 percent plus of their use is from day visitors. Backpacking opportunities are somewhat limited. Horseback riding and dogs are limited to the Mill Creek side of Mount Olympus, because of important watershed values. Access is very easy with many trailheads and access points from Mill Creek Canyon, Little Cottonwood Canyon, Big Cottonwood Canyon, and along the Wasatch Front. Elevation high points are 10246 at Gobblers Knob (Mount Olympus), 11330 at Twin Peak (Twin Peaks), and 11326 at Little Matterhorn Peak (Lone Peak). The area offers critical wildlife habitat, because of its adjacency to urban development. These areas are critical watershed for the Salt Lake area.

Bonneville Basin

Deseret Peak. This Wilderness is on the Salt Lake Ranger District and the Stansbury Management Area in the Stansbury Mountains near the Tooele area. It is a desert mountain island in the Great Basin with up to elevation 11031 at Deseret Peak. Use in the past has been low, but is now increasing because of growth in the Tooele area and crowded conditions in the Wasatch Front Wilderness areas. Use is a combination of day hikers and backpackers with some horseback riding. The area also is known for its ecosystem and wildlife values.

Uinta Mountains

High Uintas. This Wilderness is on the Kamas, Evanston, and Mountain View Ranger Districts, but much of it is on the Ashley National Forest, which shares in management of the area (W-CNF has 179,813 acres of 453,664 total acres). The High Uintas Wilderness is in both the Western Uintas and Eastern Uintas Management Areas. It is the largest Wilderness area in the state with up to elevation 13528 at Kings Peak, which is the highest mountain in the state. Use varies from low to high depending on location and season, but the area is extremely popular and well known throughout the state and nation. The High Uintas Wilderness attracts a high volume of backpackers and horseback riders. Hiking is popular from access off of Mirror Lake Highway and the Forest Service North Slope road. The area is popular for visits by groups and organizations such as Boy Scouts, church groups, and hiking clubs. Winter access is somewhat limited, but the winter recreation visitation is increasing. The High Uintas Wilderness is known for its outstanding scenery, ecosystem, and wildlife values.

3.5.3.3.3 Biological Diversity of Wilderness

Air Quality

Wilderness areas on the W-CNF are rated as Class II areas. Visibility in long distance views is often a problem in the Wasatch Front Wilderness areas, because of their adjacency next to the Salt Lake metropolitan area.

Water Quality

Wilderness areas on the W-CNF are important critical watersheds for communities and wildlife needs. Most of the three Wasatch Front Wilderness areas are watersheds for Salt Lake City, while other Wilderness areas are important watersheds for other local communities.

Vegetation

Much of the Wilderness acreage on the W-CNF is higher elevation, but it can vary from elevation 5000 to over 13000, thus supporting diverse vegetation types including grass/forbs, brush types, conifer, aspen, and alpine.

Livestock Grazing

Three Overthrust Mountains Wilderness areas (Mount Olympus, Twin Peaks, Lone Peak) have no grazing allotments. The other four Wilderness areas (Mount Naomi and Wellsville Mountains in the Overthrust Mountains, Deseret Peak in the Bonneville Basin, and High Uintas in the Uinta Mountains) have some cattle and sheep allotments (Table 3-28). Some of the allotments in the High Uintas Wilderness are vacant or closed.

TABLE 3-28
Grazing Allotments in Wilderness Areas

Wilderness	Number of Allotments
High Uintas	19
Mount Naomi	3
Wellsville Mountains	3
Deseret Peak	5

Wildlife and Fisheries

The Wilderness areas provide relatively undisturbed habitats for wildlife, including several at-risk species. Possibly some Wilderness areas could offer potential habitat for rare species, including large predators. Much of the area is summer range, but the lower slopes offer some critical remaining winter range. Big game includes deer, elk, and moose. Bighorn sheep inhabit the Hole-in-Rock/Hoop Lake area near the High Uintas, and mountain goats have been introduced. Predators include coyote, bobcat, cougar, and black bear. Many non-game, small game, bird species, reptiles, and amphibians use and live in Wilderness areas. The Utah Division of Wildlife Resources has historically stocked many lakes and streams with trout, and native trout exist in the Wilderness areas. Hunting and fishing opportunities and wildlife watching are popular in Wilderness areas.

Fire

Within the Wilderness areas in the past, primary management action for fires has been suppression, which has led to vegetation conditions that differ from those resulting from natural processes. It is now recognized that fire benefits ecological and habitat values. Fuel buildups are high in many areas, increasing the potential of severe fires next to developed areas and creating suppression needs to protect private property and watershed values. Currently, only the High Uintas Wilderness (Uinta Mountains) has a wildland fire use plan. The W-CNF does not have any fire plans for the W-CNF portion of the Lone Peak Wilderness. Prescribed burns are not allowed by the current Forest Plan on the W-CNF side. The Uinta National Forest does have a wildland fire use plan on its portion of the Lone Peak Wilderness. The goal of wildland fire use within the Wilderness is to allow natural disturbances to play their natural role in ecosystem cycles.

Insects and Disease

Snags and stands of dead trees remain from various insects and disease epidemic attacks in the past. These have included mountain pine beetles in the lodgepole stands in the High Uintas and mistletoe outbreaks in small stands along the Overthrust Mountains Wilderness areas. Because natural processes are allowed to function in Wilderness, no management actions are under way or planned.

Undesired Species

Noxious weeds in Wilderness areas including Dyer’s woad, leafy spurge, and Canada thistle are an increasing problem and starting to spread to new areas. The Mount Naomi Wilderness area in the Overthrust Mountains especially has had noxious weed invasions. Certified weed-free feed is required in the National Forest to prevent additional infestations from stock feed. Figure 3-9 depicts Wilderness areas and locations of noxious weed infestations that are known to occur on the W-CNF. While noxious weeds have or are starting to spread into some Wilderness areas, Figure 3-9 indicates that most of the known noxious weed infestations on the W-CNF currently occur outside of Wilderness areas.

3.5.3.3.4 Special Designations in Wilderness

There are no designated Wild and Scenic Rivers on the W-CNF, but there are eligible segments of rivers in the Wild and Scenic River inventory within W-CNF Wilderness. There are also no registered National Historic sites within Wilderness on the W-CNF, but there are some sites that are eligible for the National Register of Historic Places. The Mount Naomi Wilderness (Overthrust Mountains) has the Mount Naomi Peak National Recreation Trail.

3.5.4 Roads and Roadless Areas

3.5.4.1 Analysis Method

The following documents, information, and data analysis sources were reviewed and/or used in the preparation of the *Roads and Roadless Areas Section*. This information

provides the basis for describing the affected environment and the baseline for analyzing and comparing potential effects in Chapter 4 of the Proposed Action and alternatives on roads and roadless areas in the analysis area.

- *W-CNF RFP* (Forest Service 2003a).
- *Wasatch-Cache National Forest Noxious Weed Strategy* (Forest Service 2004a).
- Forest Service/CH2M HILL Project Meeting and Field Reconnaissance Notes (January 10, 2005) (Forest Service 2005c).
- Forest Service data and expertise. This consists of published documents, GIS data, field data, observations gathered for this and other projects, and interviews of other personnel experienced in the area.

3.5.4.2 Analysis Area

The analysis area for roads and roadless areas consists of the lands within management areas administered by the six W-CNF Ranger Districts: Salt Lake, Kamas, Evanston, Mountain View, Ogden, and Logan.

3.5.4.3 Existing Conditions

3.5.4.3.1 Background

Transportation facilities are essential in providing access to and through the Forest. They provide access for administration and for Forest visitors for recreation, driving for pleasure, hunting and fishing, and economical livelihood use. Most of the transportation system is in place and generally appears to be serving the Forest well. However, roads can provide a pathway for the introduction and spread of noxious weeds. Because of the W-CNF's adjacent relationship to urban communities, it is highly influenced by the rapid population increases occurring in the area. As the road use has increased, so have potential vectors and seed sources for the spread of noxious weeds within and adjacent to the Forest.

Two important rules provide direction on roads and roadless areas on National Forest System lands. The National Forest System Road Management and Transportation System, Final Rule and Policy, which was approved January 12, 2001, provides direction for a road system that is safe, responsive to public needs, environmentally sound, and affordable and efficient to manage. The purpose is to help ensure that additions to the National Forest System network of roads are those deemed essential for resource management and use; that construction, reconstruction, and maintenance of roads minimize adverse environmental impacts; and that unneeded roads are decommissioned and restored.

In May 2005, a Roadless Area Management Rule replaced the 2001 Roadless Area Conservation Rule. The 2005 Rule establishes a process for governors who have National Forest System-inventoried roadless areas in their states to petition the Secretary of Agriculture to establish or adjust management requirements for these areas. The RFP (Forest Service 2003a) provides management direction for inventoried roadless areas. Until such time that the Governor of Utah petitions the Secretary of Agriculture to adjust any or all of this direction, the RFP will continue to be followed in all project planning and activities.

Click here to view Figure 3-9 (0.5 MB)

3.5.4.3.2 Roads

A road is a motor vehicle route more than 50 inches wide, unless designated and managed as a trail. There has been a steady increase in road miles in the Forest Service since the 1940s. Some of that increase is due to better inventory and classification of existing roads. Many of the roads were constructed to support timber harvest activities, as well as other commodity uses (mining, grazing, special uses). Today, recreation is the largest single use of National Forest System roads, accounting for most of their use.

Roads can have both beneficial and negative effects. Roads provide access for multiple uses, access to private lands, and firebreaks, and if properly constructed, can mitigate negative effects of past roading. They can have undesired effects on: hydrology; sedimentation; source of human-caused fires; habitat fragmentation; predation; road kill; invasion by exotic species, including noxious and invasive weeds; dispersal of pathogens; some recreational experiences; water quality and chemical contamination; soil productivity; and biodiversity (Forest Service 2000d). Figure 3-8 shows the locations of roads and trails (discussed previously in *Section 3.5.3.2.1, Recreation Resources*) and locations of weed infestations that are known to occur on the W-CNF. Data indicate an association between travel corridors and known weed infestations in at least some portions of the S-CNF.

The W-CNF transportation system contains about 1,500 miles of Forest roads under Forest Service jurisdiction that provide access to and through National Forest System lands. Most of the administrative, commercial, and public travel on the Forest occurs on roads. The extent of the road system varies by management area. The Western Uintas (419 miles of roads), Eastern Uintas (370 miles), and Cache-Box Elder (307 miles) Management Areas have the largest mileage of District travel plan roads, while the Central Wasatch (92 miles) and Stansbury (42 miles) Management Areas have the fewest travel plan road miles. Management areas that are smaller in size and have a high amount of wilderness and roadless acreage tend to have fewer roads.

3.5.4.3.3 Roadless Areas

Roadless areas are areas without constructed and maintained roads, and are substantially natural. Some types of improvements and past activities are acceptable to be included in roadless areas. Roadless areas have significant ecological and social values. Roadless areas are often aquatic strongholds for fish, and they provide critical habitat and migration routes for many wildlife species, especially those requiring large home ranges and key watershed areas for communities and wildlife. The recognition of the values of roadless areas is increasing, as the population continues to grow and as the demand for outdoor recreation and other uses of the forests increases. These unroaded and undeveloped areas provide the Forest with opportunities for potential wilderness areas, non-motorized and limited motorized recreation, and other commodity and amenity uses.

There are 34 roadless areas on the W-CNF, totaling approximately 606,400 acres and representing almost half of the W-CNF. The Cache-Box Elder (178,200 acres of roadless areas) and Western Uintas (171,200 acres) Management Areas have the most acres; the Bear (20,600 acres) and Central Wasatch (35,000 acres) Management Areas have the fewest acres of roadless areas. Figure 3-10 shows the locations of inventoried roadless

areas and locations of weed infestations that are known to occur on the W-CNF. The occurrence of inventoried roadless areas near large infestations of noxious weeds is most apparent in the central portion of the Overthrust Mountains Area of the W-CNF where large infestations of Dyer's woad are found.

Inventoried roadless areas of the Forest that allow for the construction and reconstruction of roads or allow for motorized use, particularly near large population centers that receive heavy recreational use, would have a greater potential for noxious weed introduction and spread. The potential for the introduction and spread of noxious weeds in more remote inventoried roadless areas would be comparatively less. However, non-motorized vectors of noxious weed seed spread—such as the boots and clothing of backpackers, campers, hunters, and anglers—could result in the establishment of weeds in backcountry roadless areas.

3.5.5 Human Health and Safety

3.5.5.1 Analysis Method

Human health and safety on the W-CNF are examined at the Forest-wide level for the affected environment. The analysis of potential impacts on human health presented in Chapter 4 of this EIS is examined through potential exposure scenarios and exposure conditions of existing user groups on the Forest, which are described in the following text under Existing Conditions. The primary document used to describe the affected environment is the following:

- *Wasatch-Cache National Forest Noxious Weed Strategy* (Forest Service 2004a).

3.5.5.2 Analysis Area

The analysis area for the proposed project includes the lands managed by the W-CNF as well as those municipal watersheds within W-CNF lands.

3.5.5.3 Existing Conditions

Emphasis on noxious weeds has increased significantly in recent years, as more people recognize invasive species' effects on other resource areas. In addition to the national emphasis, locally the W-CNF RFP (Forest Service 2003a) provides clear, increased direction on noxious weed management.

Current weed management on the W-CNF consists of very limited treatment of noxious weeds in areas identified through past project activities and treated primarily through spot treatment with herbicides or hand-pulling. Traditionally, the weed program for the W-CNF has been associated with other activities and areas easily accessed while performing other work. There has been no systematic approach Forest-wide to weed treatment objectives and priority setting. Tables 2-3 through 2-5 in Chapter 2 show the weed treatment acres on the W-CNF recorded in 2004. They consisted of approximately 111 acres treated chemically (ground-based spot treatments with herbicides), 3 acres treated mechanically (handpulling/digging), and 12 acres treated by grazing. All herbicide applications were in accordance with label instructions and were conducted or supervised by State-certified employees. Current weed management on the Forest also includes the non-treatment elements of an IWM program described in Chapter 2.

Click here to view Figure 3-10 (0.4 MB)

Currently, the Forest is an active participant in two CWMAs: the Utah and Idaho CWMA and the Weber River CWMA. The CWMAs are local organizations that integrate all noxious weed management resources across jurisdictional boundaries in order to benefit entire communities (Forest Service 2003a). CWMAs have proven their ability to acquire grants and leverage existing money to complete priority noxious weed abatement projects on the ground (VanBebber 2003 *in* W-CNF 2004).

3.5.5.4 Potentially Affected Human Resources

Based on current and future land uses in the affected area, the human user groups that could potentially be affected by noxious weeds or by methods used for the eradication and/or control of noxious weeds in the analysis area are presented in Table 3-29.

TABLE 3-29
W-CNF Potential Human Land User Groups

User Group	Specific User/Activity
Recreationists	Hunting, fishing, wildlife viewing, camping, picnicking, backpacking, hiking, OHV riding, mountain biking, boating, etc.
Residents	Gardening, farming, and those using waters originating from W-CNF lands.
Grazing Permittees	Sheepherders, riders, and permittees conducting livestock grazing operations.
Native American Tribal Members	Hunting, fishing, gathering plants, ceremonial activities.
Government Workers	Forest Service workers, federal and state resource agency fish and wildlife workers.
Other Workers	Timber harvesting, county herbicide application workers, county road maintenance workers, concessionaires, Special Use permittees.

3.5.5.5 Potential Human Exposure Scenarios

The potentially affected human user groups and alternative weed management strategies analyzed in Chapter 4 are used to define the potential exposure routes, frequency and duration of exposure, and ultimately the risks to human health associated with noxious weed infestation and control measures. The most plausible human health exposure scenarios include the following:

- **Government Workers.** This category includes Forest Service workers, federal and state resource agency fish and wildlife workers, etc., who could intermittently visit and work in the analysis area and could potentially be exposed through dermal contact, inhalation (aerosols or dusts), or incidental ingestion of herbicide residuals (i.e., incidental ingestion of pesticide mist during spraying or of residuals on hands).
- **Recreationists.** This category includes people who intermittently visit the analysis area for hunting, fishing, wildlife viewing, camping, picnicking, backpacking, hiking, OHV riding, mountain biking, boating, or any other recreational activity, and who could potentially be exposed through dermal contact, inhalation of dust, or incidental

ingestion of herbicide residuals, and through ingestion of herbicides accumulated in fish, game, or vegetation (for example, berries picked in the Forest).

- **Other Workers, Including Grazing Permittees.** This category includes Forest workers who could intermittently use parts of the analysis area for recreation concessions, timber harvest, livestock grazing, contracted and county herbicide application workers, Special Use permittees, etc., and could potentially be exposed through dermal contact, inhalation (aerosols and dusts), or incidental ingestion of herbicide residuals.
- **Native American Tribal Members.** This category includes American Indian Tribal members who hunt, fish, gather plants, and/or participate in ceremonial activities in the analysis area.
- **Residents**. This category includes the human population (both adult and children) that resides within the analysis area and could potentially be exposed through dermal contact, inhalation (aerosols and dusts), or incidental ingestion of herbicide residuals. This category also includes those people potentially affected who are using municipal water supplies that originate on W-CNF lands.

As an example of a human exposure scenario, a contracted Forest Service worker using a ground-based application of herbicides could have short-term (acute) herbicide exposure through inhalation, dermal contact, or incidental ingestion during a seasonal application. For each exposure scenario, the risk is influenced by two primary factors: toxicity (the amount of the selected herbicide needed to elicit an adverse effect) and exposure (the amount of the selected herbicide actually contacted and absorbed). If the potential for exposure is found to be less than the reported level of toxicity, it can be concluded that risks are acceptable.

There are generally two exposure conditions for humans in the analysis area: 1) those that can result in acute health effects; and 2) those that can result in chronic health effects. Both of these risk scenarios are broadly discussed below.

3.5.5.6 Acute Health Effects

Acute health effects can occur following either acute or chronic chemical exposures. Generally, acute risks are believed to occur from a short-term exposure to a high concentration of a particular chemical. For example, accidental ingestion of a highly toxic herbicide could result in death. Additionally, acute health effects could result from exposure to low chemical concentrations over a longer duration. For example, following intermittent dermal contact with some cholinesterase-inhibiting pesticides, acute symptoms can result once a critical threshold level for enzyme inhibition is reached.

3.5.5.7 Chronic Health Effects

Generally, chronic health effects occur from a long-term exposure to lower concentrations of a particular chemical. For example, long-term consumption of food items containing excessive residual levels of a carcinogenic herbicide could pose risks from delayed health effects, such as cancer.

3.5.6 Cultural Resources

Cultural resources are managed within the context of overall Forest management for the long term benefits of all Americans. The management direction of heritage resources in the W-CNF is under federal regulatory guidelines. Over the years, the federal government has passed legislation and several Presidents have enacted Executive Orders (EOs) to protect heritage “cultural resources.” These regulatory documents are discussed below.

A variety of national laws have been passed to protect cultural resources. The National Historic Preservation Act of 1966 (NHPA), as amended, protects historic and archaeological properties during the planning and implementation of federal projects. The Federal Land Policy and Management Act (FLPMA) requires public lands be managed in a manner that will protect the quality of scientific, historical, archaeological, and other values. It also requires federal agencies to preserve and protect lands in their natural condition, where appropriate. The Native America Graves Protection and Repatriation Act (NAGPRA) established regulations to protect American Indian burials and sacred items. The Archaeological Resources Protection Act (ARPA) makes it illegal to excavate or remove any archaeological resources from federal or Indian lands without a permit. It also provides for criminal penalties for the vandalism, alteration, or destruction of historic and prehistoric sites on federal and Indian lands, as well as for the sale, purchase, exchange, transport, or receipt of any archaeological resource if that resource was excavated or removed from public lands or Indian lands or in violation of state or local law. The American Indian Religious Freedom Act (AIRFA) seeks to protect and preserve traditional Native American spiritual beliefs practices by providing access to sites and providing for the use and possession of sacred objects.

Presidents have issued several EOs to protect heritage cultural resources. EO 12875 provides direction to federal agencies to enhance intergovernmental partnership to encourage government-to-government relations with American Indians. EO 13007 requires federal agencies to accommodate access and ceremonial use of sacred sites and to avoid adverse effects on the physical integrity of these sites. The 1996 EO 13007 requires federal agencies to protect and make accessible Indian sacred sites on public lands for Indian religious practitioners.

3.5.6.1 Analysis Method

The following document and sources of information were reviewed and/or used in the preparation of this section. This information provides the basis for describing the affected environment and the baseline for analyzing and comparing potential effects in Chapter 4 of the Proposed Action and alternatives on the cultural resources in the analysis area.

- *South Fork Salmon River Subbasin Noxious Weed Management Draft EIS. Payette and Boise NFs* (Forest Service 2005d).
- Forest Service data and expertise that consists of published documents and information provided by the Wasatch-Cache archaeologist.

3.5.6.2 Analysis Area

The analysis area for Cultural Resources consists of the lands within management areas administered by the six W-CNF Ranger Districts: Salt Lake, Kamas, Evanston, Mountain View, Ogden, and Logan.

3.5.6.3 Existing Conditions

3.5.6.3.1 Background

Cultural resources are defined as evidence of past human activity at least 50 years of age, and are both the physical remains of and knowledge about past human activity. These may include prehistoric artifacts; prehistoric village sites or objects; rock inscription; human burial sites or earthworks; pioneer homes, buildings, or old roads and trails; and structures with unique architecture. Cultural resources are nonrenewable resources that often yield unique information about past societies and environments, and provide answers for modern day social and conservation problems. Although many have been discovered and protected, numerous forgotten, undiscovered, or unprotected cultural resources remain to be identified (U.S. Department of Agriculture, undated).

Cultural resources within the W-CNF range in age from about 8,000 to 50 years and are nonrenewable because of their specifics to the temporal cultures that created them. Only a small portion of the W-CNF (about 4percent) has been inventoried for heritage resources. Inventoried areas indicate that the primary site types (62 percent) are historic and the remaining (38 percent) are prehistoric sites. In addition, Traditional Cultural Properties (TCPs) have not been identified on the Forest.

3.5.6.3.2 Archaeological Sites

Over the years, the W-CNF has inventoried selected parcels of land under their management for cultural resources. Most of the inventoried parcels were in support of other projects, such as timber harvest or recreation.

The analysis area for the W-CNF contains approximately 461 recorded archaeological sites. These sites represent prehistoric and historic type cultural resources and are generally classified in two major categories, Native American and Euro-American sites, with the majority being historic Euro-American. Native American sites recorded in the W-CNF include short-term campsites and/or plant processing areas, animal butchering locations, rock art, or other areas associated with the cycle of life.

Euro-American sites include mining, tie-hackers camps and dams, logging camps, water control features, livestock grazer’s camps, and Forest management facilities. Many of these sites are recorded within the Forest and could be adversely affected depending on the preferred weed management method. Two sites exist on the NRHP: the Howe Flume Historic Logging District and the Tony Grove Guard Station. Many of the other historic era sites would be eligible and the Forest is currently in the process of nominating them.

Although only a small portion of the W-CNF has been inventoried for cultural resources,, current information indicates that some areas have higher site densities, allowing some predictions about the effects of alternatives on these areas and the sites they contain.

3.5.7 Environmental Justice

3.5.7.1 Analysis Method

The following documents, information, and data analysis sources were reviewed and/or used in the preparation of the *Environmental Justice Section*. This information provides the basis for describing the affected environment and the baseline for analyzing and comparing potential effects in Chapter 4 of the Proposed Action and alternatives on environmental justice in the analysis area.

- *W-CNF RFP* (Forest Service 2003a).
- *Wasatch-Cache National Forest Noxious Weed Strategy* (Forest Service 2004a).
- Forest Service/CH2M HILL Project Meeting and Field Reconnaissance Notes (January 10, 2005) (Forest Service 2005c).
- Forest Service data and expertise. This consists of published documents, GIS data, field data, observations gathered for this and other projects, and interviews of other personnel experienced in the area.

3.5.7.2 Analysis Area

The analysis area for environmental justice includes any identified minority or low-income populations within or outside the boundaries of the WCNF who are likely to be affected by implementation of the proposed project.

3.5.7.3 Existing Conditions

Environmental justice is considered one of the critical elements of the human environment that must be addressed in an EIS. Executive Order No. 12898 on Environmental Justice (issued February 11, 1994) requires that each federal agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. Where possible, measures should be taken to avoid negative impacts to these communities or mitigate the adverse affects.

As discussed in the February 2003 Affected Environment section of the W-CNF RFP (Forest Service 2003a), there are few minorities within the WCNF analysis area and no communities are considered low-income. While there are individual households that are either minority or low-income, the communities as a whole are not.

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This chapter describes the environmental consequences that would result from implementing the No Action Alternative (Alternative 1), the Proposed Action (Alternative 2), or the Weed Treatment Excluding Herbicide Use Alternative (Alternative 3) for the proposed Wasatch-Cache National Forest (W-CNF) Noxious Weed Management Program. These alternatives were described in detail in *Chapter 2, Alternatives*. Impacts from the three alternatives are evaluated and compared in terms of the effects on issues and indicators identified for various resources during public scoping (as listed in Table 2-1 in Chapter 2) that would result from the weed treatment actions. The effects of weeds on the various resources, issues, and indicators also are addressed. The No Action Alternative is discussed first and provides an environmental baseline or benchmark for comparison to the Proposed Action and Alternative 3.

The impact analysis addresses weed infestations on Forest Service-managed lands contained within the W-CNF boundary. Figure 3-1 in Chapter 3 depicts Forest Service-managed lands, as well as State Department of Defense (DOD) or private lands that also are contained within the W-CNF boundary. The impact analysis follows the same general outline for resources discussed in *Chapter 3, Affected Environment*. It addresses direct, indirect, and cumulative effects on those significant issues, indicators, and aspects of the biological, physical, and economic and social resources most likely to be affected by the proposed project. Potential effects of the proposed project on threatened, endangered, and Forest Service sensitive species are also described here in *Chapter 4, Environmental Consequences*. W-CNF resources that are unlikely to be affected or would be affected minimally by the proposed project are discussed only briefly in this chapter. This focus on potential substantive beneficial and adverse project effects associated with significant issues and indicators provides a basis for comparing the alternatives and is consistent with Council on Environmental Quality (CEQ) guidelines for implementing the provisions of National Environmental Policy Act (NEPA).

The impact analysis also considers project-related best management practices (BMPs) and mitigation measures that would be implemented as integral parts of the Proposed Action or one of the alternatives. BMPs and mitigation measures were described in detail in *Section 2.3.6, Management Practices and Mitigation Measures for All Alternatives* (in Chapter 2). They are designed to avoid or minimize the potential for adverse effects on W-CNF resources and would be applied to all projects. Mitigation needed to compensate for unavoidable adverse impacts would be developed on a project-specific basis.

Table 4-1 lists the projects that were considered in the analysis of cumulative impacts. These include relevant past and ongoing projects together with reasonably foreseeable future projects identified in recent quarterly listings on the Schedule of Proposed Actions (SOPA) for the W-CNF. Projects anticipated to have no cumulative effects when combined with the effects of the proposed project are noted in Table 4-1.

TABLE 4-1
Projects Considered in the Cumulative Effects Analysis for the W-CNF Noxious Weeds Projects

Project Category and Type	Description	Cumulative Effects Expected	
		Yes	**No**
Past and Ongoing Projects			
Permitted Activities	***Indicators***		
Outfitting Activities (Winter)	Snowmobiling, cross-country skiing, yurt system, educational programs, and highway grooming.		✓
Outfitting Activities (Summer)	Ranches, guiding, Outward Bound, educational programs, mountain biking.	✓	
Skiing and Snowmobiling	Trail grooming.		✓
Utility Corridors	Overhead and underground telephone and power lines.	✓	
Commercial Products	Timber sale, tree removal and thinning, and juniper posts.	✓	
Personal Use Products	Personal use firewood, post and pole sales, personal use permits for Christmas trees, limbs, rocks.	✓	
Rented Facilities	Guard station.	✓	
Ditches and Diversions	Culinary water pipeline, irrigation ditches and canals, water storage, reservoirs and lakes.	✓	
Other Permits	Archery ranges, campgrounds, picnic areas, day-use areas, trailheads, yurts, non-commercial group sites, rendezvous, races, summer homes, youth camps, maintenance, and communication sites.	✓	
Road, Campground, or other Facility Reconstruction	Campgrounds, picnic areas, sewer/toilet, water system, bridge, overlook.	✓	
Mining Oil and Gas			
Active Oil and Gas Operations	Oil field, oil well.	✓	
Mining	Gravel pits, mine core drilling.	✓	

TABLE 4-1
Projects Considered in the Cumulative Effects Analysis for the W-CNF Noxious Weeds Projects

Project Category and Type	Description	Cumulative Effects Expected: Yes	Cumulative Effects Expected: No
Grazing Permits			
Allotments	Sheep and cattle.	✓	
FS Routine Activities and Projects			
Road Maintenance and Reconstruction	Highway signage; Forest road maintenance.	✓	
Road Decommissioning	Road retirement.	✓	
Noxious Weed Treatments/Pesticide Treatments	Roadside and backpack treatments on Forest.	✓	
Prescribed Fire	Designated prescribed burns.	✓	
Trail Maintenance/Relocation	Motorized and non-motorized trails.	✓	
Campground and Trail Maintenance	Trailheads, campgrounds, day-use areas, picnic areas, parking areas, interpretive sites, overlooks, maintenance facilities, recreation complexes, fee stations, dispersed campsites.	✓	
Watchable Wildlife Sites	Wildlife viewing locations.		✓
Tree Planting	Plant trees.	✓	
Fish/Wildlife/Watershed Improvement Projects	Fish barriers, vegetation management, habitat rehabilitation and monitoring, guzzlers, spring enclosures.	✓	
Forest Service Administrative Work	Cross-country ski trail grooming, sensitive species surveys and monitoring, fee compliance checking.		✓
Reasonably Foreseeable Projects			
Pacificorp Vegetation Maintenance in Powerline ROWs	Use herbicides in conjunction with currently approved manual and mechanical methods to manage undesirable vegetation in powerline rights-of-way that traverse National Forest System lands.	✓	

TABLE 4-1
Projects Considered in the Cumulative Effects Analysis for the W-CNF Noxious Weeds Projects

Project Category and Type	Description	Cumulative Effects Expected: Yes	Cumulative Effects Expected: No
Outfitter and Guide Permit	Issue a 5-year Outfitter and Guide Special Use Permit.		✓
West Bear Vegetation Management Project	Silivcultural treatment to restore age class diversity and species composition, construction and reconstruction of roads, and rehabilitation of dispersed recreation area.	✓	
Murdock Thinning	Several stands of lodgepole pine in the Murdock Basin area are experiencing increasing levels of mountain pine beetle activity, creating further risk for infestation and high mortality. The proposal is to thin these stands with a commercial timber sale.	✓	
Ponderosa Pine Restoration	Ponderosa pine is limited to small stands (about 1-10 acres) along the Mirror Lake Highway. They total about 200 acres scattered over about 1,000 acres. The proposal involves removal of juniper, oak, and lodgepole followed by a low intensity burn.	✓	
Roadside Hazard Tree Removal	The Forest Service proposes to remove hazardous dead and dying trees along Highway 150 and higher standard roads on the District that are a hazard for public and traveler safety. The hazardous trees are a result of the continuing beetle infestation.		✓
Taylor Fork/Cedar Hollow ATV Access and Camping	Provide camping opportunities in the Cedar Hollow area. Remove campsites in Taylor Fork Campground that are encroaching on Beaver Creek Wetlands and/or convert to tent camping only.	✓	
Beaver Creek Snowmobile O&G Permit	Permittee proposes to renew his expiring permit, expand the area of operation and increase maximum party size from 9 to 12. The renewal would change from a 5-year to a 10-year permit per the Special Uses Handbook, FSH 2709.11, Section 41.53c.		✓
Birch Glen River Vane	The proposal is to reinforce an existing rock vane and install an additional rock or tree vane to help protect the stream bank along the Logan River.		✓
Hells Hollow Prescribed Burn	The Forest Service proposes to reduce hazardous fuels and improve vegetation diversity and wildlife habitat over approximately 4,000 acres of aspen, sagebrush, and mountain brush communities.	✓	
Little Bear Trail Reconstruction	Re-align and reconstruct about 1 mile of Little Bear Trail for resource protection.	✓	
Murray Property Seeding	Proposal is to plant and seed native plant species on 100 acres of recently acquired agricultural land, for wildlife habitat and long-term seed collection.	✓	

TABLE 4-1
Projects Considered in the Cumulative Effects Analysis for the W-CNF Noxious Weeds Projects

Project Category and Type	Description	Cumulative Effects Expected	
		Yes	No
Powder Ridge Ski Touring O&G Permit Renewal	The permit holder proposes to renew the expiring outfitter and guide permit for the Powder Ridge Ski Touring operation. The renewal would change the permit from a 5-year to a 10-year permit per the Special Uses Handbook, FSH 2709.11, Section 41.53c.		✓
Richards Hollow Trail	Reconstruction and re-route of about 1,000 feet of the trail where it crosses a slickrock area. May need some minor blasting. Trail is too narrow for machine work, so reconstruction will be by hand tools.		✓
Beaver Meadows Reservoir Permit	The Forest Service proposes to renew the permit for use and maintenance of the Beaver Meadows Reservoir and Irrigation Ditch.		✓
Gourley Meadows Fuels Treatment	Private landowners have asked the Forest Service to consider creating a fuel break on National Forest adjacent to their property. This proposal would involve removing live conifers and heavy down woody material.	✓	
West Fork Blacks Fork Grazing Allotment	Develop an allotment management plan and authorize grazing.	✓	
West Fork Smiths Fork Land Exchange	Exchange of 1,585 acres of National Forest land for 1,560 acres of private land in an area with intermingled ownerships to increase public access and consolidate ownership.		✓
West Fork Smiths Fork Temporary Private Access	The Forest Service has received a request for temporary access to harvest timber on private land. The total length of access is less than 1/2 mile.	✓	
Crawford Vegetation Management Project	This project is proposed as a stewardship opportunity to improve and/or restore aspen and sage brush stands. Mechanical treatments will either directly initiate new aspen age classes or provide opportunities for prescribed burns.	✓	
Lightning Ridge Trail	The proposal is to construct a new non-motorized trail on a deeded public easement across a corner of private property owned by Deseret Land and Livestock (Deseret) to provide better access National Forest lands along Lightning Ridge.	✓	
Monte Cristo Campground Reconstruction	Most facilities at the campground were constructed over 40 years ago. The campground has paved roads that are aging. The proposal includes reconstructing facilities to better meet current water and sanitary guidelines.	✓	

TABLE 4-1
Projects Considered in the Cumulative Effects Analysis for the W-CNF Noxious Weeds Projects

Project Category and Type	Description	Cumulative Effects Expected	
		Yes	No
Monte Cristo Riparian Exclosures	Project will build riparian exclosure fences at Ranger Hollow, Randolph Creek and Red Rock Springs to protect three areas totaling about 20 acres.		✓
Mountain Green Fuel Treatment	Approximately 900 acres of fuel treatment of National Forest, state and private lands will be burned to help protect the community of Mountain Green from unwanted wildfire.	✓	
Pineview Summer Home Land Exchange	The Forest Service is proposing to exchange the lands of the Pineview Summer Home area for lands elsewhere.		✓
Pineview Yacht Club Permit Reissuance	An analysis will be conducted to determine if a long-term special use permit for the private marina and associated facilities at Pineview Reservoir should be reissued.		✓
Red Spur Repeater and Weather Station	The Forest Service is proposing to build a new repeater site for improved radio communication. It will also include a weather station to receive accurate weather data at a higher elevation on the Forest.	✓	
Snowbasin–Needles Connection Trail	A two-part proposal: The 1st part is to develop a walking only trail from Needles Lodge to the ridgeline. The 2nd part is a bike trail from John Paul Lodge that connects to existing bike trail near the face of Porky ski run.	✓	
Travel Plan Update	The proposal is to update the Ogden Ranger District portion of the existing travel plan. This will involve making minor changes to the plan.		✓
Uintah Highlands Mechanical Fuel Treatment	Project will reduce hazardous fuels on 40 acres of urban interface land by creating a shaded fuelbreak through cutting, thinning, and chipping. Additional fuels will be treated by 300 acres of prescribed burning.	✓	
Alta Ski Area Snowmaking	Expand snowmaking system in 3 areas by burying approximately 450 feet of pipe in each section in existing road corridors in Albion Basin and Collins Gulch.	✓	
Brighton Gaz-EX Avalanche Control System	Install three Gaz-Ex avalanche system exploders in Millicent Bowl.	✓	
Davenport Canyon Waterline Replacement	Issue a special use permit to repair an existing waterline.	✓	

TABLE 4-1
Projects Considered in the Cumulative Effects Analysis for the W-CNF Noxious Weeds Projects

Project Category and Type	Description	Cumulative Effects Expected	
		Yes	**No**
Developed Sites Filming Permits	District-wide analysis for filming special use permit authorizations.		✓
Jones & Malmborg Mine Reclamation	Reclamation of two abandoned mines.	✓	
Kays Creek Bonneville Shoreline Trail and Bridge Project	Construct a foot bridge across Kays Creek. Realign approximately 300 feet of trail around the Snowqualamie Reservoir.	✓	
LDS Girls Camp Lodge Addition	Expand the Camp's main lodge by approximately 700 sq. ft.	✓	
Lake Mary Trail Re-Route	Re-route approximately 1/2 mile of trail from a riparian corridor to an upland area.	✓	
Scott's Peak Communications Site Fence	Construct a security fence around the existing communications site.		✓
Snowbird Peruvian Lift Relocation and Access Tunnel	Relocate and extend the Peruvian lift to a high-speed quad terminating below the top of the ridge and constructing a connecting skier access tunnel to Mineral Basin.	✓	
Stansbury Juniper Burn	The proposal is to use prescribed fire and mechanical treatment to treat about 1,000 acres of juniper. Cooperating universities will research the conditions, under which non-natives will invade following natural and human-induced disturbance.	✓	
Wasatch Overland Race Permit	Issue a 5-year Outfitter and Guide Special Use Permit to replace expired permit for continuation of yearly race.		✓

Pacificorp's proposed right-of-way vegetation management project (Table 4-1) is of particular interest for this proposed project, in that is will apply herbidices to 87 acres of National Forest land. Table 4-2 shows the chemicals that would be used by Pacificorp.

TABLE 4-2
Proposed Herbicide Products and Active Ingredients to be Applied by Pacificorps on National Forest Land to Control Right-of-Way Vegetation

Application Type	Product Name	Active Ingredients
Stump	Accord	Glyphosate
	Garlon 4	Triclopyr
	Garlon 3A	Triclopyr
	Pathfinder II	Triclopyr
	Pathway	Picloram
Low Volume Basal	Garlon 4, 75% Basal Oil with Dye	Triclopyr
	Pathfinder II	Triclopyr
Foliage	Accord	Glyphosate
	Arsenal	Isopropylamine salt of Imazapyr
	Escort	Metsulfuron
	Garlon 3A	Triclopyr
	Garlon 4	Triclopyr
	Tordon 101	Picloram
	Tordon K	Picloram
Soil	Arsenal	Isopropylamine salt of Imazapyr
	Tordon 101	Picloram
	Tordon K	Picloram
	Sprakil	Tebuthiuron

This chapter concludes with discussions of the following subjects, as required under NEPA: 1) comparison of the effects of the alternatives; 2) probable adverse environmental effects that cannot be avoided; 3) consistency with the W-CNF Revised Forest Plan (RFP); 4) possible conflicts with planning and policies of other jurisdictions; 5) the relationship between short-term use and long-term productivity; and 6) any irreversible and irretrievable commitments of resources that would occur if either the Proposed Action (Alternative 2) or the other action alternative (Alternative 3) is implemented.

The analysis of potential impacts contained in this chapter is based on information contained in Tables 2-3, 2-4, and 2-5 (in Chapter 2). These tables present the acres of weed infestations proposed for treatment annually under each of the alternatives

according to treatment type, treatment priority, and ecoregion. The acres of current weed infestations that provided the basis for proposed levels of weed treatment under the Proposed Action and Alternative 3 were measured within mapped polygons containing known weed infestations on the W-CNF. The measured weed infestation might consist of patches of weeds irregularly distributed within the polygon, individual plants distributed within the polygon, or a linear weed infestation along a road or trail. On average for all cover types across the W-CNF, known measured weed infestations make up approximately 12 percent of the mapped polygons. Within the polygons, spot treatments would be more likely to affect only the immediate area around individual weed infestations, whereas block treatments would likely affect more non-target sites within the polygon. Additionally, because weeds are already present, native plant communities present within the polygons are at the highest risk of further degradation because of weed infestation. Therefore, such locations are a very high priority for treatment.

The following assessment of potential impacts assumes that full funding (as described in *Chapter 2, Alternatives*) and implementation of each weed treatment alternative would occur each year. It is also assumed for purposes of analysis that where one of several different treatment options could be implemented, the option that could potentially have the greatest impact on W-CNF resources would be used to treat weed infestations. These methods were described in *Chapter 2, Alternatives*. Unless used properly, the method generally considered to have the greatest potential for impacts is herbicide applications. These assumptions and approach to analyzing potential effects are believed to provide a worst-case analysis of the upper bounds of effects that could possibly occur on the W-CNF under each alternative. However, during actual program implementation at individual weed infestation sites, these conditions would very likely not occur because of the following reasons:

- Use of the Priority and Objectives setting approach, site-specific implementation process, Decision Tree (Figure 1-3 in Chapter 1), Treatment Options Table (Appendix C), and adaptive strategy described in previous chapters of this Draft EIS (DEIS) would not result in worst-case conditions. These site-specific processes are designed to avoid or minimize the potential for adversely affecting W-CNF resources, especially sensitive resources.
- The extensive list of BMPs and mitigation measures described in Chapter 2 that would be implemented as integral parts of the Proposed Action, other action alternative, and to a lesser extent the No Action Alternative would avoid or minimize the potential for worst-case adverse effects to occur.

4.2 Biological Resources

4.2.1 Vegetation Resources and Noxious Weeds

The effects of weed treatment options on vegetation resources are extremely important. Vegetation resources considered under the three alternatives are native plant community diversity, and rare plant populations, including threatened, endangered, sensitive and recommended sensitive and watch list species. This section of Chapter 4 discusses

treatment effects on at-risk plant species; *Section 4.2.4, Ecosystem Function and Biodiversity,* discusses the effects of noxious weeds on native plant diversity.

Concerns regarding vegetation resources are important because the results of doing nothing to stem the invasion of weeds are likely to be as bad or worse in the long term than the most aggressive weed treatment strategy. Biodiversity and plant species richness for native vegetation and plant communities, wildlife habitat values, and sensitive species populations are likely to be severely compromised by unchecked invasion of weeds. Likewise, these same vegetation resources can be compromised by unconstrained weed treatment efforts. The following discussion focuses on how these effects may differ among alternatives.

The W-CNF has 21 different plant cover types that are found in varying amounts in the Overthrust Mountains, Bonneville Basin, and Uinta Mountains ecological sections. These areas, or ecoregions, were defined and described in *Chapter 3, Affected Environment*, as was the current status of weed invasion in each of these areas. Although the Cache-Box Elder Management Area in the Overthrust Mountains currently is believed to have the greatest variety and concentration of weeds, susceptible plant communities occur across the entire project area. These same plant communities would have the greatest potential for habitat improvement if weed treatment regimes are successful. Plant communities with the greatest potential for weed treatment impacts based on current weed invasion and potential for future invasion include sagebrush-grassland, juniper or pinyon-juniper, mahogany, Gambel oak, tall forb, tall shrub-mountain brush, and bottomland hardwood communities. Other plant communities are expected to experience somewhat less impact from noxious weed treatment because they have lower weed infestation rates or a lower potential for weed invasion.

The following discussion focuses on how effects to vegetation may differ among alternatives. It does not specifically address individual plant communities because the differences among alternatives are a result of treatment methods and because the need for treatment would remain relatively equivalent for all community types among alternatives. The potential for significant impacts is considered to be small for non-target grasses and minimal for non-target shrubs. Potential resultant effects on wildlife associated with the different vegetation groups and cover types are discussed in *Section 4.2.3, Wildlife Resources*.

Significant issues and associated indicators identified during public scoping that are being addressed in this DEIS are listed in Table 2-1 (in Chapter 2). Issue No. 1 identified during public scoping is concerned with threatened, endangered, and sensitive (TES) plant species, as follows:

- Effects of weed treatments on at-risk plant species

The following indicator was used to evaluate the potential effects of Issue No. 1:

- Relative amount of weed treatment areas that will be in occupied W-CNF plant species at-risk habitat

Potential impacts were assessed by examining direct and indirect effects of weed treatments and weed infestations on habitat associated with at-risk plant species, and are discussed in the following text.

As noted previously, discussions of native plant diversity and associated issues and indicators are presented separately in *Section 4.2.4, Ecosystem Function and Biodiversity*, later in this chapter. However, some of the background discussion about potential direct and indirect effects of each alternative on at-risk plant species presented in the following text also is applicable to native plant diversity. This information is not duplicated in *Section 4.2.4* and should be reviewed below. Similarly, some of the background information on potential direct and indirect effects of each alternative on native plant diversity presented in *Section 4.2.4* informs the reader about broad effects to vegetation resources, including at-risk plant species. For these reasons, the reader is referred to *Section 4.2.4* for a companion discussion of potential treatment effects on vegetation resources and noxious weeds.

Noxious and invasive weed infestations have two important types of direct and indirect effects on vegetation biodiversity and rare plant species considered to be at risk. First are the direct effects that treatments to remove noxious weeds may have on native plant diversity and at-risk plant species. Second are the effects noxious weeds have on native plant community diversity and integrity and at-risk plant species when they invade an area. Direct effects to native plant communities can occur when treatments to kill noxious weeds in a given area also inadvertently kill or reduce native vegetation, particularly forbs. Most weed species are forbs and many herbicides have been chemically formulated to differentially impact forbs. An assortment of native plants—especially herbaceous species, which include forb species—on a given site may be impacted inadvertently by herbicide spraying of weed species. This results in a direct negative impact to biodiversity.

Indirect effects to native vegetation occur from weed invasions. Weeds, especially noxious weeds, have many mechanisms to out-compete native species: allelopathy, abundant seed production, fast growth rates, early growth, deep roots, no natural enemies, and avoidance by grazers that prefer native species (Sheley et al. 1999a). Weed invasions cause a decline in the diversity and integrity of existing vegetation and native plant communities. Over time, these indirect effects from weed invasion, which are a result of competition for moisture, space, and nutrients, displace and replace native vegetation. Indirect effects are usually slower acting than the direct killing of native vegetation from herbicide drift or elimination from large-scale mechanical treatments, but they are just as devastating to natural diversity and to populations of rare at-risk plant species.

4.2.1.1 Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects

At-Risk Plant Species

Under the No Action Alternative, at-risk plant species that currently have some population occurrences in the areas infested by weeds are: broadleaf penstemon (*Penstemon platyphyllus* , Burke's whitlow grass (draba) (*Draba burkei)*, Maguire's

primrose (*Primula maguirei)*, Rydberg's musineon (*Musineon lineare)*, Wasatch daisy (*Erigeron arenarioides* , Wasatch fitweed (*Corydalis caseana ssp. brachycarpa* , and Wheeler's angelica (*Angelica wheeleri* . Species that currently occur within weed-infested areas are most likely to be directly affected by weed treatment. Direct effects to populations would be mitigated through BMPs, but inadvertent affects may occur.

- **Broadleaf Penstemon.** Of the 23 known occurrences of broadleaf penstemon on the W-CNF, three are currently in weed-infested areas. Additionally, 12 of these 23 occurrences are in areas highly susceptible to weed invasion.
- **Burke's Whitlow Grass.** Of the 10 known occurrences of Burke's whitlow grass on the W-CNF, half (5) are in areas highly susceptible to weed invasion. Of these, three occurrences are in weed-infested areas.
- **Maguire's Primrose**. There are 14 known occurrences of Maguire's primrose on the W-CNF. Eight of these are in areas highly susceptible to weeds, and five of these occur in areas with weed infestations.
- **Rydberg's Musineon.** There are 24 known occurrences of this species on the W-CNF. Of these, ten are in areas highly susceptible to weed invasion and four of these are in weed-infested areas.
- **Wasatch Daisy.** This daisy is known from 15 occurrences on the W-CNF. Eight occurrences are in areas highly susceptible to weed invasion, although only one occurrence is currently known to be in a weed-infested area.
- **Wasatch Fitweed.** Of the seven occurrences of Wasatch fitweed on the W-CNF, three are in areas of high susceptibility to weed invasion. One of these is in a weed-infested area.
- **Wheeler's Angelica.** The two known occurrences of this angelica on the W-CNF are in weed-infested areas.

Direct effects from weed treatment impacts to these species are likely to be least under the No Action Alternative because of the limited number of total acres anticipated to be treated annually (up to 126 acres, with up to 111 of these acres treated with herbicides). The greatest impacts to at-risk plant species under the No Action Alternative are likely to result from indirect impacts caused by the continued spread of weeds, which is expected to occur under this alternative. Weed monocultures eventually crowd out and take over sites, and as discussed in *Section 4.2.4, Ecosystem Function and Biodiversity*, result in decreased plant diversity. Plant species that are already rare would be especially adversely impacted by the continued spread of weeds under the No Action Alternative. With the passage of time, it is likely that additional populations of rare plant species would be at higher risk because of the continued expansion of weed invasion expected to occur under the No Action Alternative.

Cumulative Effects

Cumulative effects resulting from treatments under the No Action Alternative are likely to be detrimental to native plant communities and at-risk species, particularly in the long term. For example, implementation of the proposed Gourley Meadows Fuels Treatment

plan would remove live conifers and downed woody debris in order to create a firebreak for private landowners. This project would disturb the soil and open up the canopy for weed invasion. Additional examples of actions that could result in cumulative effects include; building new roads for timber sales (e.g., the West Bear Vegetation Management Project and Murdock Thinning project); trail construction and reconstruction (e.g., Richard Hollow Trail construction and Little Bear Trail reconstruction); and prescribed burns (e.g., the Hells Hollow and Stansbury Juniper Burn projects). All of these are typical management decisions for the W-CNF, but under the No Action Alternative, which has such limited weed control efforts, they are expected to increase the potential for weed introduction, growth of weeds, and the need for weed control. The end result would be additional weed infestations, possibly even in new areas that currently are not considered highly susceptible to weed invasion.

4.2.1.2 Alternative 2: Proposed Action

Direct and Indirect Effects

At-Risk Plant Species

Proposed Action treatments would cover more acreage and therefore could potentially be more detrimental to at-risk plant species occurring in weed-infested areas. To avoid or minimize this potential, a site-specific implementation process, Decision Tree (Figure 1-3 in Chapter 1), and an approach geared to the most sensitive limiting factor—all of which were described in previous chapters of this DEIS—would require sensitive plant assessments or field surveys prior to implementation of treatment activities. If at-risk plant species are found within a proposed treatment boundary, non-herbicide treatments or herbicide treatment methods that would be highly selective to the species being treated (i.e. wicking application) would be considered as preferred methods. If the continued existence of the at-risk species were undermined by the noxious weed infestation, herbicide would only be used to remove weeds in that area if it were hand applied to the weeds in order to avoid or minimize risk to at-risk plant species.

After treatments have been implemented to remove weeds from a site, filling the open niche with native or approved vegetation through restoration activities where it has been determined necessary would be a crucial part of the Proposed Action. Restoration is one of the additional BMPs developed for the action alternatives in order to restore rare plant habitat, which would help maintain high diversity of plants. Site restoration activities for sites with at-risk species, such as seeding, transplanting, and fertilizing, would contribute to the goal of permanently removing weeds from treated sites. These restoration activities should result in no long-term negative impacts on native vegetation or habitat because seeding and transplanting activities would involve only limited soil disturbance.

Overall, the potential for adverse direct impacts from treatment protocols on native vegetation, especially upon at-risk plant species on the W-CNF, would be less under the Proposed Action compared to the No Action Alternative, because of operational and buffer zone BMPs described in text that follows. BMPs, a Decision Tree (Figure 1-3 in Chapter 1), and other management efforts under the Proposed Action would avoid direct effects to at-risk plant species from treatment options. BMPs have been specifically developed to protect at-risk plant species and to restore habitat for these species. Direct

impact potential is highest for the at-risk plant species that are currently in weed infested areas. (See the species list under the No Action Alternative.)

The Proposed Action would treat more acres of noxious weeds than the No Action Alternative. Therefore, indirect impacts under the Proposed Action are expected to be less than those under any other alternative because the curtailment of weed spread and control of current weed populations would be highest under this alternative. This alternative is expected to be the most beneficial because weed infestations are expected to decrease more compared to Alternative 3, and they would continue to increase under the No Action Alternative.

Cumulative Effects

Cumulative effects resulting from treatments under the Proposed Action are likely to be beneficial to native plant communities, particularly in the long term. This benefit would be a direct result of increased success at halting the exponential spread of noxious weeds on the W-CNF through their wide-spread eradication, containment, and control, including halting spread from W-CNF to adjacent lands. Under the Proposed Action, the spread of weeds on the W-CNF and perhaps on those non-National Forest lands immediately adjacent to the W-CNF would be expected to decline.

Potential cumulative adverse effects on native plant communities that were described for the No Action Alternative also may occur under the Proposed Action. These include the potential effects from increased grazing pressure on untreated use areas, such as on sheep and cattle allotments. Potential disturbance to native vegetation from heavy recreational use (various recreational activities that occur Forest-wide), the construction and use of roads and trails (e.g., Richard Hollow Trail and Little Bear Trail projects), prescribed burns (e.g., Hells Hollow and Stansbury Juniper Burn projects), or wild fires, and logging (e.g., West Bear Vegetation Management and Murdock Thinning projects) could also decrease the ability of native vegetation to overcome the impacts from possible herbicide application, inadvertent herbicide drift, or mechanical weed treatments. These effects, should they occur, would likely be short term and minimal in scope.

There would be no adverse cumulative impact of the proposed project with implementation of the PacifiCorp vegetation maintenance program. The Decision Notice for the PacifiCorp project found that there would be no significant environmental impacts (Forest Service 2005e). There are many BMPs associated with the PacifiCorp project that complement or are duplicative of BMPs associated with this proposed project, which further protect against cumulative impacts. Finally, the Decision Tree (Figure 1-3 in Chapter 1) used to assign treatments (Chapter 2) requires identification of previously applied chemicals to avoid interactions with other projects that would harm the environment.

In addition, those projects that would increase weed invasion potential and which are listed as examples above and under the Cumulative Effects section of the No Action Alternative would add to the burden of weed control for the W-CNF. However, under the Proposed Action, they are more likely to result in less invasion potential because of the

expanded weed treatment options when compared to either the No Action Alternative or Alternative 3.

4.2.1.3 Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects

At-Risk Plant Species

There is no potential for adverse direct effects on native vegetation, at-risk plant species, and wildlife habitat integrity as a result of treating noxious weeds with herbicides on the W-CNF, unlike with the No Action Alternative and the Proposed Action. The inability to use herbicides under this action alternative as compared to the Proposed Action would mean that large acreages on the W-CNF would be difficult to treat except with biological controls.

Some benefits that improve biodiversity of native vegetation, improve habitat for wildlife, and protect the integrity of ecological sites for sensitive plant species could still be achieved under Alternative 3. It would take much longer than under the Proposed Action to control the spread of weeds, but this alternative is expected to better curb the expansion of weeds than the No Action Alternative because more acres would be treated each year. It is likely that Alternative 3 may control the further spread of noxious weeds, but would either do little to eradicate large infestations currently in place or would reduce current infestations at such a slow rate that constant efforts would be needed to control the spread of weeds from currently infested sites.

Under Alternative 3, weed infestations that could potentially receive aerial spraying under the Proposed Action would instead receive a combination of primarily biological treatment and controlled livestock grazing. Not all species of weeds have biological controls, and grazing is not as effective at controlling some weed species as are herbicides. Both biological control and livestock grazing treatments can take longer to control weeds because of time constraints associated with these methods. Biological controls can have fewer impacts on native vegetation and at-risk plant species, but controlled livestock grazing can disturb soil and impact native vegetation. Additionally, there is a higher probability that current, large weed infestations, especially inaccessible infestations, could never be eradicated and restored to native vegetation under Alternative 3.

Overall, direct effects under Alternative 3 are potentially more detrimental to at-risk plant species present in weed infested areas compared to the No Action Alternative, and less than the Proposed Action. Grazing animals are not easily controlled and cannot distinguish between at-risk species and weeds at the level at which those applying herbicide can, and they are also more likely to eat everything palatable.

Indirect negative effects to at-risk plant species are likely to be less than under the No Action Alternative because more acres would be treated, but greater than under the Proposed Action because treatment methods without the use of herbicides are not as effective at controlling and removing many weed species from infested areas. Some weed

species with little coverage may be controlled, but other species are likely to continue invading, although at a slower rate than under the No Action Alternative.

Cumulative Effects

Adverse cumulative effects on vegetation resources associated with other ongoing activities or occurrences on the W-CNF (such as the examples given previously for recreation, roads, trails, livestock, wild fires, and logging), and from weed treatment activities that were described for the No Action Alternative and Proposed Action, also would occur under Alternative 3. Weed invasion impacts would not be expected to occur as rapidly as under the No Action Alternative, because of the additional acres that would be treated under Alternative 3. Weed invasion impacts would be expected to occur more rapidly than under the Proposed Action, because more acres of weeds would be treated each year and more treatment options are available with the Proposed Action than with Alternative 3.

4.2.2 Aquatic Resources

Herbicides are used to protect or enhance desired Forest resources and may be the most effective means for combating the invasion and spread of noxious weeds (Sheley and Petroff 1999). However, their use may have detrimental impacts on aquatic dependant species.

Issue No. 2 identified during public scoping regarding weed treatment effects on aquatic resources is as follows:

- Effects of treatment on aquatic and semi-aquatic species (fish and amphibians) including TES species

The following indicators were used to evaluate the potential effects of Issue No. 2:

- Estimated concentration of herbicides in receiving waters
- Ability to meet state water quality standards for cold water fisheries

The impact assessment of Alternatives 1, 2, and 3 presented in the following text considers the risk of chemical contamination, accidental spills, wind drift, and effects on fish, amphibians, and macroinvertebrates based on a risk analysis, as well as other potential treatment-related effects. This assessment is followed by a discussion of the ability to meet state water quality standards for cold water fisheries under the three alternatives (also expressed as an indicator above). Background information on herbicide concentrations that may occur in W-CNF water bodies under several worst-case situations is described in *Section 4.3.2*, *Surface Water and Groundwater Quality*, and provides the basis for aquatic resource risk assessments presented in the following text.

4.2.2.1 Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects

Estimated Concentration of Herbicides in Receiving Waters

The use of herbicides for treating noxious weeds contains some inherently associated risks to aquatic and semi-aquatic species when treating riparian areas. The continuation of current management practices would consist of very limited chemical, and, to a lesser extent, controlled livestock grazing and mechanical treatments of noxious weeds. Future treatment levels and weed species treated under the No Action Alternative would be similar to those treated in 2004 (Table 2-3 in Chapter 2). Because there has been no systematic approach to weed treatment across the W-CNF, the treatments have been associated with other activities and generally limited to areas easily accessed while performing other work. At present, only the Overthrust and Uinta mountains' ecoregions are treated using chemicals (spot treatment of weeds). These applications are spatially limited and represent the only areas potentially at risk of affecting aquatic and semi-aquatic species under the No Action Alternative (see Table 2-3 in Chapter 2).

Because weed management practices under the No Action Alternative would not deviate from current practices (as noted in the discussion in *Section 4.3.2, Surface Water and Groundwater Quality*), the estimated concentration of herbicides in receiving waters, the ability to meet state water quality standards, and the potential effects on aquatic resources would not be expected to change from current conditions. No data or reported instances indicate that any of the weed treatment activities on the W-CNF, including herbicide application, have or have not impacted aquatic resources and, therefore, they would not be expected to do so under the No Action Alternative. However, even the very limited spot treatment of weeds using herbicides in Forest management as proposed under the No Action Alternative could inadvertently result in the chemical contamination of aquatic habitat through an accidental spill of an herbicide. For reader convenience, potential effects of this worst-case situation (accidental spill) are discussed in *Section 4.2.2.2, Alternative 2: Proposed Action*, together with three other examples of worst-case situations that could potentially occur. The three other worst-case examples would occur under the Proposed Action, but not the No Action Alternative, because of the difference in extent and type of chemical treatments between these two alternatives.

There are, however, numerous examples of mitigation measures and BMPs, including buffer zones, which protect surface water quality during the aerial and ground-based application of herbicides to safely and effectively treat noxious weeds in the Western United States. For the Mormon Ridge Winter Range Restoration Project on the Lolo National Forest in western Montana, picloram (Tordon 22K) was applied aerially in 1997 on approximately 900 acres (TechLine 1998). Picloram was applied aerially at a rate of 1.5 pints per acre (approximately 0.37 pound per acre) using the same types of mitigation measures and BMPs that would be employed in aerial herbicide applications on the W-CNF, including a 300-foot, non-aerial treatment buffer to keep herbicides out of all fish-bearing water bodies (see Chapter 2). Water samples were collected from Mormon Creek prior to, during, 30 minutes after, and 60 minutes after aerial herbicide application (TechLine 1998). Water samples were tested for picloram at a detection level down to 0.01 parts per billion (ppb) (0.01 microgram per liter), which is far below any state water

quality standards (see Table 4-10). Picloram was not detected in any of the water samples, indicating the stream protection measures were effective. One year following treatment of the Morman Ridge site, weed production had declined 98 percent from 1,075 pounds per acre to 25 pounds per acre, while grass production had increased 714 percent from 350 pounds per acre to 2,850 pounds per acre (TechLine 1998).

Ability to Meet State Water Quality Standards for Cold Water Fisheries

Under the No Action Alternative, there would likely be no deviation from the existing condition related to the ability of W-CNF streams to meet state water quality standards. Those streams not currently supporting beneficial uses would remain so. *Section 3.4.2.3* in Chapter 3 describes the existing conditions for the state water quality standards and guidelines across the W-CNF. Most water bodies on the W-CNF are fully supporting their beneficial uses and those that are not are identified in the 303(d) list. Within the Little Cottonwood Creek watershed, inactive mining sites have contributed to degradation of water quality. Other impacts to water quality are associated with natural debris flows, roads, water diversions and augmentation, livestock grazing, and recreation activities.

It is unlikely that state water quality standards related to cold water fisheries would be exceeded under the No Action Alternative because 1) only a very small portion (up to 111 acres) of the W-CNF would be chemically spot-treated annually and the level of risk of chemical contamination to aquatic habitats across the W-CNF would be relatively low; 2) most of the treated areas are associated with roadways and timber sales, and treatments generally occur on uplands; 3) herbicide spot applications would be according to label instructions and conducted or supervised by state-certified employees using hand application methods; and 4) continued use of currently applied Forest-wide Standards and Guidelines (see *Section 2.3.6* in Chapter 2) would minimize the risk of chemical contamination by providing direction for chemical uses and application methods.

Cumulative Effects

Cumulative effects on noxious weeds resulting from treatments under the No Action Alternative, combined with treatments on lands adjacent to the W-CNF would generally be expected to result in some localized eradication, control, and containment of noxious weeds. Overall, however, weed infestation on the W-CNF would be expected to continue to increase under the No Action Alternative. This would reflect large-scale limitations to eradicating, controlling, or containing new weeds that have invaded the W-CNF from adjacent lands, or to preventing or reducing the risk of the invasion of adjacent lands by weeds presently occurring on the W-CNF. These limitations could adversely affect aquatic and riparian habitat and a range of sensitive and other aquatic species through the cumulative addition of sediment into drainages from increased erosion as a result of weed infestations (Lacey et al. 1989). Adverse cumulative effects on aquatic resources may be greatest in the west-central portion of the Overthrust Mountains ecoregion of the W-CNF and on adjacent non-National Forest lands because of extensive Dyer’s woad infestations. However, cumulative affects to naturally reproducing populations of native cutthroat may be greatest within the Logan River and Uinta Mountains, where population and metapopulation trends are flat or declining, and where weed infestations and spread may

further degrade spawning and rearing habitats. Potential cumulative effects on water quality are also discussed in *Section 4.3.2, Surface Water and Groundwater Quality*.

Additional cumulative effects on aquatic resources associated with other ongoing and reasonably foreseeable activities on the W-CNF (see Table 4-1) include the potential for erosion and sediment delivery. General examples of such actions include road and trail-related construction and maintenance activities, livestock grazing along drainages, and recreational activities adjacent to drainages. Specific examples include trail development and enhancement and bridge construction across Kays Creek. Also, short-term, localized increases in erosion and sediment delivery to drainages caused by mechanical treatments (soil disturbance) and chemical treatments (barren ground caused by weed removal) would cumulatively contribute to sediment arising from other ground-disturbing activities. These disturbed areas would be subject to erosion until native vegetation becomes re-established, after which time erosion and sediment delivery should be less than when weeds were present. This would represent an overall long-term cumulative benefit to aquatic habitat and resources. Finally, there is the possibility that herbicide application on the W-CNF, when combined with applications on adjacent areas could lead to adverse cumulative effects on aquatic resources; however, close coordination across jurisdictional boundaries through cooperative partnerships will likely remove the potential for adverse impacts. In addition, all such applications would be in accordance with Environmental Protection Agency (EPA) label guidelines, which are designed to protect aquatic organisms.

4.2.2.2 Alternative 2: Proposed Action

Direct and Indirect Effects

Estimated Concentration of Herbicides in Receiving Waters

The use of herbicides for treating noxious weeds on a scale necessary for an entire W-CNF program contains some inherently associated risks to aquatic and semi-aquatic species. Herbicides can enter water through surface runoff, leaching through soils, accidental spills, and wind drift. The potential impact of an herbicide on aquatic organisms depends on the toxicity characteristics and exposure concentration of that herbicide. *Appendix B, Characteristics of Herbicides*, contains detailed information about the characteristics, application rates, and toxicity of all of the herbicides proposed for use on the W-CNF. The Proposed Action includes the use of ground-based and aerial herbicide treatments, as well as mechanical, biological, and controlled livestock grazing treatments, or combinations of those treatments. The following analysis focuses on the chemical (herbicide) treatment methods.

Each of the chemical treatment methods can vary by weed species in effectiveness. Their use would be determined by application of the Decision Tree (see Figure 1-3 in Chapter 1) and treatment method most appropriate and protective of the specific treatment site and area. The treatment of known weed infestations is based on selecting the highest priority infestations using the Priority and Objectives setting approach described in Chapter 1, applying the Decision Tree (Figure 1-3 in Chapter 1) to take into account sensitive resource factors, and then selecting the most ecologically sound method that would achieve the management objective for that weed species and/or infestation

(see *Appendix C, Treatment Options Table*). Additionally, the potential for adverse direct and indirect effects on aquatic habitats resulting from the proposed use of aerial and ground application treatments on the W-CNF is minimized by the numerous BMPs and mitigation measures that would be applied (see *Section 2.3.6* in Chapter 2). Many of the RFP Standards and Guidelines, BMPs, and mitigation measures apply specifically to the use of herbicides in and around aquatic habitats, which further reduces the potential risk to these habitats from chemical treatment methods.

The assessment of potential effects of chemical contaminants on aquatic and semi-aquatic species uses two different, but complementary, approaches. The approaches analyze the possible direct and indirect impacts to aquatic resources using: 1) Worst-case Situations (that is runoff, leaching, spill, and drift situations); and 2) Risk Quotient Analysis (RQA). These approaches also have been used recently to examine the potential for impacts to aquatic species on the Salmon-Challis National Forest (Forest Service Draft Biological Assessment [BA], 2003b) and in the South Fork Salmon River Subbasin on the Payette and Boise National Forests Environmental Impact Statement (EIS) (Forest Service Draft EIS, 2005d). The scenarios examine examples of herbicide monitoring and the potential for chemical contamination from surface runoff, leaching, accidental spills, and wind drift, because these are the most likely modes of chemical transport to the streams given the BMPs and mitigation measures. The RQA approach examines possible direct risks to aquatic resources from herbicides proposed for use. This method assigns a risk quotient, or level of concern, to the use of a proposed herbicide.

Worst-Case Situation Summary

Section 4.3.2, Surface Water and Groundwater Quality, provides four worst-case situations as a method for evaluating the potential for chemical contamination of water resources under the Proposed Action. The situations include: 1) the inadvertent entry of herbicides into surface water or groundwater through surface runoff (two worst-case scenarios are examined for large watersheds and two worst-case scenarios are examined for small watersheds); 2) leaching through soils (two worst-case scenarios are examined); 3) accidental spills (also applies to the No Action Alternative); and 4) wind drift. These four situations are generally regarded as worst-case examples because of the extensive list of BMPs and mitigation measures (described in *Section 2.3.6, Management Practices and Mitigation Measures for All Alternatives*) that would be implemented as an integral part of the Proposed Action to avoid or minimize the potential for worst-case adverse effects to occur.

It also is unlikely that any of the worst-case situations would occur because of the use of a site-specific implementation process, Decision Tree (Figure 1-3 in Chapter 1), the treatment options table, and an adaptive strategy. If worst-case conditions did occur, the several scenarios described in *Section 4.3.2.2* involving herbicide runoff and possibly leaching of herbicides would result in concentrations that may adversely affect aquatic and semi-aquatic species. The potential for exceeding coldwater fisheries standards under worst-case situations for the Proposed Action is discussed further in the following text. Herbicide-specific buffers should reduce the moderate level of concern regarding the chance of a product entering the aquatic habitat and the potential of affecting aquatic and semi-aquatic species.

Potential short-term impacts to aquatic resources could occur under the Proposed Action and the No Action Alternative if there were an accidental spill of a relatively toxic herbicide in or near a stream, or if application rates greater than those recommended under the worst-case scenarios were to occur. Resultant effects may be localized depending on various factors, for example, the volume of spill, dilution by the receiving water, or soil type and precipitation events. Adherence to BMPs and mitigation measures would reduce the likelihood of such a spill occurring, plus they would minimize or avoid the potential occurrence of wind-drift-related impacts on aquatic resources.

The Proposed Action includes the implementation of BMPs and mitigation measures designed to minimize the potential for wind drift from herbicide applications. The prevention of herbicides from entering fish habitat as a result of wind drift depends on the implementation of protective features contained in the BMPs and mitigation measures. The effectiveness of these features in protecting aquatic habitat and species, particularly in riparian areas, is supported by the research of Rashin and Graber (1993), who examined both the effectiveness and ineffectiveness of BMPs associated with aerial spraying of herbicides in the State of Washington. They concluded that the most important factors influencing BMP effectiveness are as follows:

- Proximity of spray swaths to the streams (that is, buffer widths)
- Streamflow regimes as they relate to the dilution of the chemicals
- Equipment configuration and operation and the resultant droplet size
- Ability of the operator to identify surface flow in streams
- Weather conditions that include wind speed, direction, and precipitation
- Pesticide toxicity and environmental characteristics
- Topographic features affecting flight pattern and release height
- Presence of riparian vegetation and slash

Risk Quotient Analysis

A risk quotient was developed for rainbow trout and Daphnia (a zooplankter) against herbicides proposed for use on the W-CNF. Risk quotients were not developed for adjuvants because of a lack of information. However, potential effects and aquatic toxicity of adjuvants are discussed where data are available. Rainbow trout provide a good representation of potential impacts to salmonids, while Daphnia can represent an important food source for freshwater and coldwater fishes. These aquatic species are commonly used for determining toxicity values. However, sublethal effects to Forest Service sensitive fish species may not be adequately represented by the effects on rainbow trout.

The risk quotient was calculated from a safety factor that was derived from known toxicity values for each species divided by an “Expected Environmental Concentration” (EEC). The EEC, expressed in parts per million (ppm), was derived from the direct application of the active ingredient in an herbicide to a 1-acre, 1-foot-deep pond using the maximum rate specified on the herbicide label (Urban and Cook 1986). The EEC is an extreme level that is unlikely to occur during implementation of the Proposed Action and should be viewed as a worst-case situation. The risk quotient provides a reference from which a possible worst-case situation can be viewed: if the risk quotient is greater than 10, the level of concern is categorized as “low”; if the risk quotient is between 1 and 10,

the level of concern is “moderate”; and if the risk quotient is less than 1, the level of concern is “high.” The level of concern is based on the direct application of the active ingredient of a chemical product at its maximum allowable application rate to a 1 acre-foot pond. This reflects an extreme application, only remotely likely to occur during implementation of the Proposed Action on the W-CNF.

Available toxicity-related information for the seven herbicides analyzed and proposed for use on the W-CNF is summarized in the following text.

Clopyralid (Transline). Clopyralid appears to be relatively nontoxic to aquatic animals. The potential for substantial effects on non-target species appears to be remote. Clopyralid does not bind tightly to soil. This lack of adsorption means that it can possibly leach into surface water and groundwater (Forest Service 2005a). Clopyralid is more persistent than 2,4-D amine (2,4-D) but less persistent than picloram (Forest Service 2001a). The Forest Service (1999a *in* Faurot and Burns 2002) found that the potential for adverse effects of clopyralid on other non-target species appears to be remote and that the weight of evidence suggests that no adverse effects in terrestrial or aquatic animals are plausible using typical or even very conservative worst-case exposure assumptions. Faurot and Burns (2002) concluded that use of clopyralid as a component of chemical noxious weed control, with protective project design features (PDFs), may affect, but is not likely to adversely affect, fish species.

2,4-D Amine (Weedar 64, Amine 4). 2,4-D forms (which are proposed for use on the W-CNF) are generally nontoxic to fish (http://infoventures.com/e-hlth/pestcide/24d.html). Several formulations, including Weedar 64, are registered for use near water. Despite this certification, however, label information indicates that Weedar 64 is moderately toxic to aquatic invertebrates. 2,4-D amine is unlikely to be a groundwater contaminant because of rapid degradation in most soils and rapid uptake by plants (Forest Service 2005b). Further indication of its nontoxicity is that the terms and conditions cited for chemical weed treatments within the Frank Church River of No Return Wilderness in Idaho recommended the use of only Weedar 64 and Rodeo (discussed below) within 50 feet of stream channels, in addition to other protective measures (NOAA Fisheries 2003a).

Glyphosate (Rodeo). Glyphosate is relatively nontoxic to fish (Forest Service 1999a *in* Forest Service 2003b). Several formulations of the herbicide, including Rodeo, which do not contain the surfactant included in Roundup, are labeled for use adjacent to water. Glyphosate readily binds to organic matter in soil and is easily broken down by microorganisms. This herbicide is especially appropriate where low soil mobility and short-term persistence are desired to alleviate environmental concerns (Forest Service 2001a). At the proposed application rates, adverse effects from the application of Rodeo are not likely for fish, aquatic macrophytes, or aquatic invertebrates (http://infoventures.com/e-hlth/pestcide/glyphos.html). The Forest Service (1999a) glyphosate Risk Assessment, cited in Faurot and Burns (2002), found that there is not much evidence that aquatic animals or plants would be affected adversely by normal applications of glyphosate and for most aquatic species, glyphosate levels of 1 mg/L are not likely to cause adverse effects. Further indication of its nontoxicity is that the terms and conditions cited for chemical weed treatments within the Frank Church River of No

Return Wilderness recommended the use of only Rodeo and Weedar 64 (discussed above) within 50 feet of stream channels, in addition to other protective measures (NOAA Fisheries 2003a).

Metsulfuron methyl (Escort). Metsulfuron methyl has a low order of toxicity to fish. Similarly, aquatic invertebrates do not appear to be sensitive to the product (Forest Service 1999a; http://infoventures.com/e-hlth/pestcide/metsulf.html). The herbicide is broken down in the soil by the action of microorganisms and by the chemical action of water. Faurot and Burns (2002) provide an additional excerpt from a Forest Service Risk Assessment for metsulfuron methyl (Forest Service 1999a), as follows:

> *Peak water levels of approximately 0.003-0.006 mg/L can be anticipated under worst-case conditions and concentrations on the order of 0.001 mg/L or more could be anticipated under a variety of conditions when rainfall rates equal 25 to 50 inches per year. These concentrations are far below the level that would have any plausible direct toxic effect on fish or aquatic invertebrates. Notwithstanding the above risk characterization, adverse effects on fish and invertebrate populations are plausible, secondary to the toxicity of metsulfuron methyl to aquatic plants that could adversely affect aquatic animals through a decrease in food availability or a change in habitat.*

Picloram (Tordon). Picloram is moderately to slightly toxic to freshwater fish and slightly toxic to aquatic invertebrates (http://infoventures.com/e-hlth/pestcide/picloram.html). It does not bioaccumulate in fish. Picloram can leach into groundwater in soils that have low organic content and where the water table is very shallow (Forest Service 1999). Further, picloram was identified specifically within the Frank Church River of No Return Wilderness Biological Opinion (BO) terms and conditions as a chemical not to be transported over water, with extreme caution being used to prevent contamination of water (NOAA Fisheries 2003a). Faurot and Burns (2002) provide an excerpt from a Forest Service Risk Assessment for picloram (Forest Service 1999a), as follows:

> *Picloram appears to be more toxic to trout than to an aquatic invertebrate, Daphnia magna, a commonly used test species in toxicity studies. Based on a standard set of assumptions used in constructing accidental spill scenarios, some fish mortality would be expected and could be substantial if picloram were spilled into a relatively small body of water with a low water turnover rate. This characterization of risk, however, is dominated by arbitrary or situational uncertainty.*

Imazapic (Plateau). Aquatic animals appear to be relatively insensitive to imazapic exposure, relative to both direct toxicity and reproductive effects (Forest Service 1999a; http://infoventures.com/e-hlth/pestcide/imazapyr.html).

Dicamba (Banvel). Dicamba is slightly toxic to fish and amphibians and is practically nontoxic to aquatic invertebrates (http://infoventures.com/e-hlth/pestcide/dicamba.html). Dicamba does not accumulate or build up in aquatic animals. Dicamba is moderately persistent in soils and slightly soluble in water (Forest Service 2002).

Using the active ingredients described above, the results of the RQA (see Table 4-3) indicate rainbow trout are at a low level of concern for injury with the direct application of five of the herbicides. The RQA results indicate that two products (picloram and dicamba) create a moderate level of concern to rainbow trout, and though Weedar 64 is labeled as safe to use near aquatic environments, 2,4-D creates a low-moderate level of concern for rainbow trout. Results of the RQA for Daphnia indicate four products at low levels of concern to the species and three (2,4-D, picloram, and dicamba) at moderate concern. Again, the levels of concern are based on the direct application of the herbicides. Given the limited use of herbicides in and around aquatic habitats that would occur under the Proposed Action, the risk of adverse affects to aquatic dependant species is further reduced.

TABLE 4-3
RQA Results and Level of Concern Assessment for Rainbow Trout and Daphnia Using Herbicides Proposed for Use Within the W-CNF

Active Ingredient	Product Name	Species Tested	Risk Quotient and Level of Concern*	Species Tested	Risk Quotient and Level of Concern
Clopyralid	Transline	Rainbow trout	28 (low)	Daphnia	63.0 (low)
2,4-D amine	Amine 4, Weedar 64	Rainbow trout	11 (low)	Daphnia	8.3 (moderate)
Glyphosate	Rodeo	Rainbow trout	36 (low)	Daphnia	33.7 (low)
Metsulfuron-methyl	Escort	Rainbow trout	163 (low)	Daphnia	13.0 (low)
Picloram	Tordon 22K	Rainbow trout	2 (moderate)	Daphnia	9.2 (moderate)
Imazapic	Plateau	Rainbow trout	18 (low)	Daphnia	18.1 (low)
Dicamba	Banvel	Rainbow trout	1.9 (moderate)	Daphnia	6.8 (moderate)

*See discussion above for method of calculating and interpreting the risk quotient and level of concern values.

Overall, the RQA results suggest that levels of concern for direct impacts to fishes and macroinvertebrates from chemical contamination range from low to moderate (Table 4-3). Picloram and dicamba appear to present a moderate level of concern in tests on rainbow trout and Daphnia, while 2,4-D also presents a moderate level of concern to Daphnia. These concern levels for direct effects would be mitigated by BMPs, mitigation measures, and Forest management direction described in Chapter 2 that should minimize the potential for direct impacts on aquatic species of all herbicides used within the project area.

Inert Ingredients. The designation as "inert" does not mean an additive is chemically inactive, and it does not convey any information about the toxicity of the ingredient (Tu et al. 2003, EPA 2003). An inert ingredient is simply any ingredient in the product that is not intended to affect a target pest (EPA 2005). Because many manufacturers consider inert ingredients in their herbicide formulations to be proprietary, they do not list specific chemicals. Listed inert ingredients for the herbicide formulations being considered for use on the W-CNF include water, ethanol, isopropanol, isopropanolamine, kerosene, polyglycol 26-2, and polyoxyethylamine (Forest Service 1992, Forest Service 2001d, NOAA Fisheries 2002). None of these chemicals are listed as Level 1 (*Inert Ingredients of*

Toxicological Concern) or Level 2 (*Potentially Toxic Inert Ingredients)* compounds (EPA 2003). While there is some concern regarding the toxicity of polyoxyethylamine (POEA), a surfactant included in a formulation of glyphosate, no increase in toxicity of the glyphosate formulation is anticipated as a result of POEA (Forest Service 2000b).

Adjuvants. Adjuvants are solution additives that are mixed with a herbicide solution to improve performance of the spray mixture and can make a significant difference on how well the herbicide treatment works (Soll 2004). Adjuvants can either enhance activity of a herbicide's active ingredient or offset any problems associated with spray application, such as adverse water quality or wind. Adjuvants are also referred to as surfactants, anti-foaming agents, crop oil or crop oil concentrates, drift retardants, compatibility agents, and pH buffers (Soll 2004). Spray adjuvants that may be used within the W-CNF include Activator 90, Spread 90, L1700, Syl-tac, R11, and MSO. Activator 90, Spread 90, and LI700 are non-ionic surfactants, meaning they have no ionic charge and are hydrophilic (water-loving). Table 4-4 describes the ecological and aquatic toxicity information on these six adjuvants.

TABLE 4-4
Aquatic Environment Information for Identified Adjuvants That May Be Used Within the W-CNF

Adjuvant	Mix Rate	Environmental Information	Aquatic Toxicity			Additional Information
			Species	LC_{50}	No Effect	
Activator 90[a]	N/A[b]	Dike to prevent from entering water	Daphnia	24-hour; 5.2 mg/L	24-hour; 1 mg/L	May be appropriate where direct risks are not involved[b]
Spread 90	N/A	Dike to prevent from entering water	N/A			N/A
LI 700	N/A	N/A	Rainbow Trout	24-hour; 140 mg/L 48-hour; 130 mg/L 96-hour; 130 mg/L	96-hour; <100 mg/L	Considered most salmon safe by NOAA Fisheries[b]
			Daphnia	24-hour; 450 mg/L 48-hour; 170 mg/L	48-hour; 100 mg/L	
Syl-Tac	N/A	Dike to prevent from entering water	N/A			Good for use away from water[b]
R11	N/A	Dike to prevent from entering water	N/A			May be appropriate where direct risks are not involved [c]
MSO	N/A	N/A	N/A			N/A

[a] Oregon Department of Forestry (2005)
[b] (N/A = information not available)
[c] Soll (2004)

The risk of a direct chemical application to aquatic habitat would be mitigated by selecting the appropriate application techniques and applying buffers adjacent to water, and taking into account such factors as chemical volatility, wind speed and direction, temperature, precipitation, and ground slope. The above worst-case analysis indicates that

under the Proposed Action, the use of herbicides would pose little to no risk to aquatic and semi-aquatic species.

The Proposed Action is more likely to result in worst-case scenarios than the No Action Alternative because it proposes a more extensive and effective use of herbicides in the effort to eradicate, control, and/or contain weeds on the W-CNF. However, risk of chemical contamination to aquatic and semi-aquatic species from a worst-case scenario remains low under the Proposed Action because: 1) only a small portion of the W-CNF would be chemically treated annually (up to 1,433 acres out of approximately 1.25 million acres [or 0.1 percent]) and, therefore, the level of risk of chemical contamination to aquatic habitats across the W-CNF would be relatively low; 2) the bulk of the chemical treatments would be ground-based spot applications and application is easier to control; 3) herbicide applications are conducted or supervised by state-certified employees; and 4) the extensive list of BMPs, mitigation measures, and use of the IWM approach are designed to protect sensitive resources like aquatic and semi-aquatic species from chemicals.

Overall, the direct and indirect effects of chemical treatments under the Proposed Action would be expected to result in long-term improved streambank and riparian habitat conditions, and water quality. However, short-term disturbances may occur from vegetation removal and may have a slight negative effect on either water quality or aquatic resources at site-specific areas. However, it is uncertain if the negative effect would be measurable.

In summary, the Proposed Action provides an expanded, and more effective use of chemical treatments in the effort to combat noxious weeds on the W-CNF. The expanded use of chemicals is accompanied by an increased potential threat to aquatic and semi-aquatic species. The implementation of BMPs and mitigation measures, and use of a site-specific implementation process, Decision Tree (Figure 1-3 in Chapter 1), a treatment options table, and an adaptive strategy, would minimize the potential for chemical contamination from both ground-based and aerial applications under the Proposed Action. The possibility of herbicides entering fish habitat as a result of effects such as wind drift is dependant on implementation of the protective features. The effectiveness of these measures in protecting aquatic habitats is supported by the research of Rashin and Graber (1993) (discussed previously) in that the features are included to protect aquatic species and habitats.

Ability to Meet State Water Quality Standards for Cold Water Fisheries

Compared to the No Action Alternative, the Proposed Action provides an expanded and more effective, use of chemical treatments in the effort to combat noxious weeds on the W-CNF. The expanded use of chemicals would be accompanied by an increased potential risk to exceed water quality standards for coldwater fisheries under worst-case situations. The coldwater fisheries standards for 2,4-D in Utah and Wyoming would be exceeded under the surface runoff worst-case scenario when aerially treating 500 acres of Dyer's woad in the Ogden River HUC5 in 1 day and severe runoff occurs (see this worst-case discussion in Section 4.3.2). The implementation of BMPs and mitigation measures, and use of a site-specific implementation process, Decision Tree (Figure 1-3 in Chapter 1), a treatment options table, and an adaptive strategy, would minimize the potential for

chemical contamination from both ground-based and aerial herbicide applications under the Proposed Action, especially for the occurrence of worst-case situations. The prevention of herbicides from entering fish habitat as a result of worst-case effects such as drift, accidental spills, leaching, or surface runoff is dependant on the implementation of these protective features. The effectiveness of these measures in protecting aquatic habitats is supported by the research of Rashin and Graber (1993) discussed above.

Cumulative Effects

Cumulative effects from treatments under the Proposed Action, combined with weed treatments in areas adjacent to the W-CNF, would result in benefits to aquatic habitat and resources compared to the No Action Alternative through the widespread eradication, control, and containment of noxious weeds. Under the Proposed Action, weed infestations on the W-CNF would progressively decline. This cumulative effect could potentially benefit aquatic and riparian habitat and a range of sensitive or aquatic MIS through reduced erosion and sediment delivery to drainages.

No adverse downstream cumulative effects on non-National Forest land would be expected from worst-case situations involving herbicide runoff or leaching because of extremely low concentrations. Potential for downstream adverse effects on aquatic and riparian resources exists if a herbicide spill or wind-drift-related impact occurs close to Forest Service boundaries. Increased stream flows proceeding downstream would further dilute the herbicide. Weed management BMPs and mitigation measures described previously are designed to prevent or reduce the risk of these types of impacts from occurring.

Additional cumulative effects on aquatic resources associated with other ongoing and reasonably foreseeable actions on the W-CNF (see Table 4-1) and described for the No Action Alternative would also occur under the Proposed Action. Examples include the potential for erosion and sediment delivery from road- and trail-related construction and maintenance activities (for example, Little Bear and Snowbasin-Needles connected trails construction and reconstruction), livestock grazing along drainages, and recreational activities adjacent to drainages. Also, short-term. localized increases in erosion and sediment delivery to drainages caused by slightly more extensive mechanical treatments (soil disturbance) and much more extensive chemical treatments (barren ground caused by weed removal) than under the No Action Alternative would cumulatively contribute to sediment arising from other ground-disturbing activities. These cumulative impacts may be greatest in areas proposed for logging/vegetation management projects or prescribed burning (listed in Table 4-1), but only if weed infestations are heavy after these large-scale disturbances. These areas would be subject to erosion until native vegetation becomes re-established, after which time erosion and sediment delivery should be less than when weeds were present and provide correspondingly greater benefits than under the No Action Alternative. This would represent an overall long-term cumulative benefit to aquatic habitat and resources. Finally, there is the possibility of herbicide application on the W-CNF and in adjacent areas and, thus possible cumulative effects on aquatic resources; however, close coordination across jurisdictional boundaries exists through cooperative partnerships. In addition, all such applications would be in accordance with EPA label guidelines, which are designed to protect aquatic organisms.

The Forest Service (2001d) discussed the potential for two additional types of cumulative effects on aquatic organisms in northern Idaho from herbicide application. These are the potential for the bioconcentration of herbicides in aquatic organisms and the possibility of synergistic, combined effects on aquatic organisms when several herbicides are present. For bioconcentration to occur, a pollutant must be present in a high concentration for an extended period of time, the organism must be exposed to the pollutant, and the pollutant must have a high resistance to breakdown or excretion by the organism to allow a sufficient uptake period that would result in an elevated bioconcentration. The Forest Service (2001a) concluded that the risk of bioconcentration would be low because of the relatively small amount and timing of herbicide application. The risk of herbicide bioconcentration in aquatic organisms on the W-CNF also would be expected to be low because of the extremely low concentrations of herbicides to which aquatic organisms would be briefly exposed during even a worst-case situation. In addition, the herbicides proposed for use on the W-CNF do not bioaccumulate in fish and/or have very little persistence in the environment (Information Ventures, Inc. 2002). Furthermore, weed management BMPs and mitigation measures described previously are designed to prevent or reduce the risk of herbicide-related impacts. In particular, herbicide application within the Salt Lake City watershed would comply with City Ordinance 17.04.375 (described in Chapter 2); consequently, picloram would not be used in the Salt Lake City watershed.

The Forest Service (2001a) concluded that no synergistic effects from herbicide application would occur. This is because: 1) the EPA currently supports an additive model in predicting synergistic effects; 2) relatively small amounts of herbicides would be applied; and 3) where more than one herbicide is applied, the amount of each chemical applied would typically be reduced. This same rationale and conclusion regarding the potential for synergistic effects on aquatic resources also applies to the W-CNF. In addition, because the chances of multiple, different herbicide activities taking place in the same drainage on the same day are unlikely, the potential for cumulative synergistic effects on aquatic organisms on the W-CNF would be minimal.

Finally, there would be no cumulative effect on aquatic resources due to Pacificorp's application of herbicides on the Forest as discussed in *Section 4.2.1.2*.

4.2.2.3 Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects

Estimated Concentration of Herbicides in Receiving Waters

Alternative 3 responds to concerns about potential effects of herbicides by excluding the use of chemicals from the options available for weed treatment. The treatment of areas with known weed infestations under this alternative is based on selecting the highest priority infestations using the Priority and Objectives setting approach defined in Chapter 1, applying the Decision Tree (Figure 1-3 in Chapter 1) to take into account sensitive resource factors, and then selecting the treatment practice most effective for that weed species infestation and which takes into account sensitive resources (using *Appendix C, Treatment Options Table*), but excluding herbicide use. Consequently, there would be no risk of herbicides affecting aquatic resources on the W-CNF under this alternative. However, Alternative 3 would be less effective in treating weeds than the

Proposed Action and likely not keep pace with the spread or introduction of weeds across the W-CNF.

Ability to Meet State Water Quality Standards for Cold Water Fisheries

There would be no risk of herbicides affecting existing water quality standards for cold water fisheries or aquatic resources on the W-CNF under this alternative.

Cumulative Effects

The success of any cooperative W-CNF and adjacent weed treatment programs across jurisdictional boundaries would be limited under Alternative 3. It would take longer to achieve a lesser level of success because of the absence of the application of herbicides. In some instances, these long-term results may include the expected gradual decline in noxious weeds and some resultant gradual benefits to aquatic and riparian habitat and to fish, aquatic invertebrates, and amphibians on and possibly adjacent to the W-CNF. Adverse cumulative effects under Alternative 3 would be greater than those described for the Proposed Action (see examples of types of potentially impacting projects and resultant effects), and would include sediment delivery from other ongoing W-CNF activities, as well as the creation of some disturbed and barren areas from the mechanical treatment of weeds. Under Alternative 3, there would be no potential for adverse cumulative effects on the W-CNF or adjacent non-National Forest lands from herbicide application, bioconcentration, or possible synergistic interactions, or from the creation of barren areas because of weed removal using herbicides.

4.2.3 Wildlife Resources

This section addresses the effects of weed treatment on terrestrial wildlife resources. Issue No. 3 identified during public scoping relative to wildlife is as follows:

- Effects of alternatives on terrestrial wildlife species.

These topics are discussed in the following text for each alternative. General effects of weed treatment are discussed first under the No Action Alternative, followed by a discussion of the relative effects of weed treatment under the Proposed Action and Alternative 3. Three of four indicators (Indicators 1, 2, and 3) used to evaluate Issue No. 3 are discussed together for each alternative because of the similarity of effects. The three indicators discussed together are:

- Percent of total and distribution of TES species habitats lost to or modified by treatment
- Percent of total and distribution of neotropical migratory bird habitats lost to or modified by treatment
- Percent of total and distribution of MIS habitats lost to or modified by treatment

The fourth indicator (Indicator 4) is discussed separately later in this section:

- Percent of total and distribution of big game winter ranges lost to or modified by treatment

The specific effects discussed for the indicators are the direct and indirect effects of weeds and weed treatment on selected wildlife and wildlife habitats, and the relative amounts and distribution of unaffected habitats available.

4.2.3.1 Alternative 1: No Action (Continuation of Current Management)—Indicators 1, 2, and 3

Direct and Indirect Effects

General Effects

The general effects of weed treatment and infestation on TES species habitats; MIS habitats; and neotropical migratory bird habitats are discussed below. Effects on this wide array of species are often related to habitat loss, degradation, and fragmentation. Therefore, these types of effects of weeds are discussed for all of these species in a general sense. Specific differences in terms of habitat preference or occurrences are presented. The following discussion of the types of effects on TES habitats, MIS habitats, and neotropical migratory bird habitats uses the acronym TES/MIS to refer to all of these species when appropriate. (Note: MIS are not usually, but can be, "at-risk" species.) All species of native wildlife are dependent on appropriate amounts of suitable habitat for survival; therefore, the initial discussion of the effect of weeds on TES/MIS focuses on plant communities.

As described in *Section 4.2.1, Vegetation Resources and Noxious Weeds,* and *Section 4.2.4, Ecosystem Function and Biodiversity* (see *Section 4.2.4.2.1, Native Plant Diversity*), plant communities most susceptible to weed infestation and, for the most part, communities with the largest current infestations, include sagebrush-grassland, pinyon-juniper, mountain mahogany, Gambel oak, tall forbs, tall shrub-mountain brush, and bottomland hardwood. The cover types rated as highly susceptible to weed infestation occur mostly in the Overthrust Mountains and Bonneville Basin. Habitats in the Uinta Mountains are rated mostly as low and moderately susceptible to weed infestation. Other cover types occurring on the W-CNF are less susceptible to weed infestation (Table 4-5). Known weed infestations currently occupy 3,543 acres of Forest Service-administered land within the W-CNF, which includes 2,780 acres, or 0.7 percent of the 400,400 acres of highly susceptible cover types.

TABLE 4-5
Cover Types, Susceptibility to Weed Infestation, Known Infested Area, and Total Area of Polygons* with Weed Infestations in the W-CNF

Cover Types and Susceptibility to Weed Infestation	Total Acres of Cover Type on the W-CNF	Total Polygon* Area with Weed Infestations	Total Infested Polygon* Area as a Percent of Total Cover Type Area	Total Acres Currently Infested with Weeds	Infested Area as a Percent of Total Cover Type Area
High Susceptibility					
Ponderosa Pine	540	0	0	0	0.00%
Gambel Oak	91,300	9,649	10.6%	1,300	1.43%
Tall Shrub	22,200	2,105	9.5%	300	1.38%
Mahogany	13,900	600	4.3%	90	0.66%

TABLE 4-5
Cover Types, Susceptibility to Weed Infestation, Known Infested Area, and Total Area of Polygons* with Weed Infestations in the W-CNF

Cover Types and Susceptibility to Weed Infestation	Total Acres of Cover Type on the W-CNF	Total Polygon* Area with Weed Infestations	Total Infested Polygon* Area as a Percent of Total Cover Type Area	Total Acres Currently Infested with Weeds	Infested Area as a Percent of Total Cover Type Area
Pinyon-Juniper	79,000	2,401	3.0%	300	0.39%
Sagebrush Grassland	190,700	4,699	2.5%	660	0.35%
Tall Forb	3,200	1	0.0%	0.1	0.00%
Bottomland Hardwood	3,500	922	26.4%	130	3.76%
Subtotal Area	404,340	20,377	5.0%	2,780	0.69%
Moderate Susceptibility					
Aspen Conifer	56,100	150	0.3%	20	0.04%
Aspen	102,700	360	0.4%	30	0.03%
Conifer Aspen	47,000	171	0.4%	20	0.04%
Douglas-fir	87,600	2,928	3.3%	430	0.49%
Mixed Conifer – Bear River and Wasatch Mountains	15,900	14	0.1%	2	0.01%
Mixed Conifer – Uinta Mountains	136,600	10	0.0%	1	0.00%
Bigtooth Maple	14,600	676	4.6%	100	0.72%
Willow	4,400	7	0.2%	1	0.02%
Wet Meadow	17,500	9	0.1%	1	0.01%
Subtotal Area	482,400	4,325	0.9%	605	0.13%
Low Susceptibility					
Alpine	19,700	0	0.0%	0	0.00%
Barren	101,900	989	1.0%	140	0.14%
Limber Pine	11,600	69	0.6%	1	0.01%
Lodgepole Pine	61,400	5	0.0%	10	0.02%
Spruce-Fir	153,500	57	0.0%	7	0.00%
Subtotal Area	348,100	1,120	0.3%	158	0.05%

*For mapping purposes, the W-CNF drew polygons around the extent of infestations. Weed infestations might consist of patches of weeds irregularly distributed within the polygon, individual plants distributed within the polygon, or a linear weed infestation along a road or trail. On average for all cover types across the W-CNF, known measured weed infestations make up approximately 12 percent of the mapped polygons within which the infestations occur.

For mapping purposes, the W-CNF drew polygons around the extent of infestations. Weed infestations might consist of patches of weeds irregularly distributed within the polygon, individual plants distributed within the polygon, or a linear weed infestation along a road or trail. On average for all cover types across the W-CNF, known measured weed infestations make up approximately 12 percent of the mapped polygons within which the infestations occur. For high susceptibility cover types, the total area of these polygons within which known weed infestations occur occupies approximately 22,700 acres, or 5.6 percent, of the highly susceptible cover types (Table 4-5). Gambel oak, followed by sagebrush grassland, has the largest infested areas while bottomland hardwood has the highest percent of total area infested of these cover types (Table 4-5). For high susceptibility cover types, the total area of the polygon with weed infestations occupies more than 10 percent of the total area of four of the cover types (Table 4-5), including Gambel oak (10.6 percent), tall shrub (10.5 percent), mahogany (10.5 percent), and bottomland hardwood (36.5 percent).

Direct and indirect effects of noxious weeds on TES/MIS are roughly correlated with the extent of the infestation and the area of the infestation relative to the total area of each cover type. Therefore, infestations in certain cover types such as bottomland hardwood likely have a greater adverse effect on wildlife than those occurring in other cover types, because of the high percentage of the cover type infested, in addition to the extremely high value of riparian communities for a wide range of wildlife species. Plants that are most directly affected by weeds include native grasses and forbs, and to a lesser extent shrubs. The loss of these components from portions of natural plant communities would result in a decrease in numbers of ground-dwelling mammals, reptiles, amphibians, and invertebrates, as well as fewer ground- and low-canopy-nesting birds in infested areas. Weed infestations in riparian communities replace low- and mid-canopy native vegetation, degrading breeding and foraging sites for a wide range of species. Furthermore, weed infestations often result in increased fire frequency, further degrading native grass, forb, shrub, and even Forest communities, with resulting losses in wildlife habitat and diversity at a local scale.

All wildlife species, and especially those that use highly susceptible habitats and are suffering population declines, would be affected to varying degrees by weed expansion. As weeds expand they displace native plant communities and reduce productivity and food sources for wildlife. Because weed stand plant density and diversity are usually less than the density and diversity of the native plant stand it displaces, hiding cover structure, canopy cover, and height are reduced. This may cause smaller wildlife species to abandon an area, which can reduce the utility of habitats for predators through prey density reduction as native plant foods disappear.

Noxious weeds negatively impact the natural plant communities they invade by reducing plant diversity and species richness, thereby decreasing the quality and quantity of wildlife habitat. Without aggressive treatment, noxious weeds would continue to displace native vegetation and degrade wildlife habitat at the same or at higher rates than currently. This would result in continued declines in local wildlife populations, especially in the Overthrust Mountains, which includes large areas of highly susceptible habitats and is an area where current weed infestations are the most extensive and widespread.

Wildlife using habitats within the infested polygons and in highly susceptible habitats would be the most at risk from weed expansion in the future.

In addition to the direct and indirect effects of weed-caused habitat alteration on TES/MIS habitat and local populations, weed infestations also fragment larger blocks of suitable habitat. This can result in further decreases in wildlife diversity and abundance, because species that require large blocks of undisturbed habitat are displaced because of habitat fragmentation. Also, certain predators that would not otherwise be a factor are attracted to early successional openings that have been invaded and are being maintained by noxious weeds in otherwise intact habitat blocks, thereby gaining access to adjacent intact habitats. For example, sagebrush obligate song birds, which are suffering range-wide population declines, are very sensitive to habitat fragmentation. Similarly, early successional openings that have been invaded and are being maintained by noxious weeds in large forested areas allow nest predators and nest parasites to enter the edge of surrounding Forest stands, reducing the nesting success of many species of neotropical migratory birds.

The *Wasatch-Cache National Forest (W-CNF) Revised Forest Plan (RFP)* (Forest Service 2003a) identified species of concern from a viability perspective (at-risk species) and grouped these into habitat associations. Groupings were selected to facilitate an ecosystem sustainability or landscape scale approach. Tables B2-1 and B2-2 from the *W-CNF RFP* (Forest Service 2003a) are partially reproduced here as Table 4-6. They indicate habitats used by the species with the primary habitat shown with the letter “P.” Table 4-6 shows the 23 at-risk species identified by the W-CNF for habitats highly susceptible to weed infestations. W-CNF did not identify species-at-risk for Gambel oak and mahogany communities. Because these species are already at risk and they use highly susceptible habitats, the direct and indirect effects described in this section have a higher potential to adversely affect them and their habitat. Table 4-6 also includes the habitat preferences for threatened, endangered, and candidate species; MIS; W-CNF sensitive species; MIS; and neotropical migratory birds. The TES/MIS species that use cover types as their primary habitat (marked with “P” in Table 4-6) also happen to use cover types most susceptible to weed infestations, and are thus at the highest risk for additional local population declines because of expanding weed infestation.

The incidence of these direct and indirect adverse effects of weed infestations on TES/MIS may be relatively low in most cover types at the present time because of the relatively low rate of infestation compared to the total area of these cover types that are available. However, adverse effects on wildlife also occur at a lower level of intensity because of the size of actual infestation within the larger, infested polygon areas. The adverse effects of weed infestations on wildlife diversity and abundance within these larger infested polygons are likely much more subtle and difficult to detect, but all degradation of native habitat values has adverse effects on wildlife at some level. These more subtle effects would include lower reproductive success because of degraded food sources or foraging conditions, and increased predation rates because of degraded cover. While not immediately evident, lower reproductive success eventually would lead to reduced recruitment of young into breeding populations, smaller breeding populations, and, ultimately, reduced diversity and abundance. The area of infested polygons is

TABLE 4-6
Wildlife Occurrence by Plant Community/Weed Susceptibility and Sensitivity to Disturbance

		Species Occurrence by Habitat Type and Acres of High Susceptible Habitats at Risk								Moderately Susceptible Habitats	Low Susceptible Habitats
		Mountain Shrub	Tall Forb	Riparian	Ponderosa Pine	Sage/ Steppe	Pinyon/ Juniper	Gambel Oak	Mountain Mahogany	See Footnotes for Habitats	See Footnotes for Habitats
Species and Status	**W-CNF Status**	**22,200**	**3,200**	**3,500**	**540**	**190,700**	**79,000**	**91,300**	**13,900**	**482,400**	**348,100**
Threatened, Endangered, Candidate Species											
Bald eagle	T, SAR			X							
Western yellow-billed cuckoo	Ca, SAR			P							
Canada lynx	T									X	
Black-footed ferret	E, No Known Occurrence in W-CNF										
Gray wolf	Ex-N, No Known Breeding Pairs in W-CNF										
W-CNF Sensitive Species											
Spotted bat	S					X					
Townsend's big-eared bat	S, SAR			X							
Wolverine	S, SAR		X	X						X	X
Pygmy rabbit	S					X					
Boreal owl	S, SAR			X						X	X
Flammulated owl	S, SAR			X							

TABLE 4-6
Wildlife Occurrence by Plant Community/Weed Susceptibility and Sensitivity to Disturbance

		Species Occurrence by Habitat Type and Acres of High Susceptible Habitats at Risk								Moderately Susceptible Habitats	Low Susceptible Habitats
		Mountain Shrub	Tall Forb	Riparian	Ponderosa Pine	Sage/ Steppe	Pinyon/ Juniper	Gambel Oak	Mountain Mahogany	See Footnotes for Habitats	See Footnotes for Habitats
Species and Status	**W-CNF Status**	**22,200**	**3,200**	**3,500**	**540**	**190,700**	**79,000**	**91,300**	**13,900**	**482,400**	**348,100**
Great gray owl	S									X	X
Northern goshawk	MIS, S					X				X	X
Peregrine falcon	S, SAR			X							
Northern three-toed woodpecker	S									X	X
Columbian sharp-tailed grouse	S, SAR	X				P					
Greater sage-grouse	S, SAR			X		P					
Spotted frog	S			X							
W-CNF MIS											
Beaver	MIS			X							
Snowshoe hare	MIS									X	X
Northern goshawk	MIS			X						X	X
Migratory Birds		X	X	X	X	X	X	X	X	X	X

Status: T = ESA threatened, E = ESA endangered, Ca = ESA candidate, Ex-N = ESA Experimental/Non-essential, SAR = W-CNF Species-at-Risk, S=W-CNF Sensitive Species
Note: "P" refers to primary habitat
Moderately susceptible cover types include: Aspen / Conifer, Aspen, Conifer / Aspen, Douglas-fir, Mixed Conifer – Bear River and Wasatch Mountains, Mixed Conifer – Uinta Mountains, Bigtooth Maple, Willow, and Wet Meadow
Low susceptible cover types include: Alpine, Barren, Limber Pine, Lodgepole Pine, and Spruce-Fir
Source: Tables B2-1 and B2-2 from Forest Service 2003a

currently nearly 30,000 acres over the entire W-CNF. This represents a very large area over which subtle adverse effects on wildlife diversity and abundance are likely occurring.

All of the direct and indirect effects of weed infestation on wildlife habitat are especially problematic for TES species because these species generally occur at low densities and they have already suffered habitat loss, degradation, and fragmentation from a variety of other sources.

Temporary Disturbance and Displacement

Temporary disturbance and displacement would occur during actual treatment when people and animals are present in the same area at the same time. These impacts would typically include very short-term disturbance and displacement during treatment application, usually less than 1 day in duration at a given site. These disturbances are most likely to affect wildlife species that occupy the plant communities most susceptible to weed infestation, which, for the most part, are the communities with the largest current infestations. They include sagebrush-grassland, pinyon-juniper, mountain mahogany, Gambel oak, tall forbs, tall shrub-mountain brush, and bottomland hardwood (Table 4-6). The cover types that are rated as highly susceptible to weed infestation occur mostly in the Overthrust Mountains and Bonneville Basin. Habitats in the Uinta Mountains are rated mostly as low and moderately susceptible to weed infestation.

Wildlife species differ in their sensitivity to disturbance and their reactions to disturbance. Small mammals, amphibians, and reptiles are likely to move short distances and seek cover under rocks or logs or in underground burrows. Medium and larger mammals would be displaced from the treatment area and might even relocate a den site if the treatment-related disturbance is located very near the den site. Songbirds may leave the immediate treatment area for the duration of the treatment. Raptor responses would vary from temporary short distance displacement to possible nest abandonment if the treatment occurs during sensitive, early periods in the nesting cycle.

Dermal Exposure to and Ingestion of Herbicides

W-CNF TES/MIS species would be exposed to direct herbicide application or may consume vegetation following herbicide application. Dermal contact or eating contaminated food would be another type of potential impact to TES/MIS from herbicides. Other weed management program EISs prepared by the Forest Service in the West have examined the impact of herbicide application on wildlife. Findings in those EISs applicable to this DEIS are referenced herein. Herbicides examined in the following analysis that have been proposed for use in the treatment of noxious weeds on the W-CNF are 2,4-D, clopyralid, dicamba, glyphosate, and picloram. These herbicides also contain “inert” ingredients, including surfactants, which are not expected to have any significant effect.

The adjuvants used with these herbicides are expected to have no adverse effects on wildlife because of the very low concentrations at which they are used relative to their LD_{50} oral and dermal toxicity to wildlife (Table 4-7). Mitigation measures and BMPs (for

example, buffer zones) are expected to minimize adverse impacts, if any, of these other ingredients.

TABLE 4-7
Terrestrial Environment Information for Identified Adjuvants that May Be Used on the W-CNF

Adjuvant	Mix Rate per 100 gallons of Spray Solution	Toxicity		
		Species	Acute Oral LD_{50}	Acute Dermal LD_{50}
Activator 90	1 – 4 pt. (0.125 to 0.5 percent)	Rat	3870 – 5000 mg/kg	> 2000 mg/kg
Spread 90	0.5 to 3 pt. (0.0625 to 0.375 percent)	N/A	N/A	N/A
LI 700	1 – 4 pt. (0.125 to 0.5 percent)	Rat/rabbit	> 5000 mg/kg (rat)	>5000 mg/kg (rabbit)
Syl-Tac	1 – 3 pt. (0.125 to 0.375 percent)	N/A		
R11	1 – 3 pt. (0.125 to 0.375 percent)	Rat/rabbit	790 mg/kg (rat)	4200 mg/kg (rabbit)
MSO	N/A	N/A	5000 mg/kg	>4000 mg/kg

N/A = information not available

Reports exist that indicate many synthetic chemicals released into the environment may disrupt normal endocrine function in a variety of aquatic life and wildlife. Some of the effects observed in animals have been attributed to some persistent organic chemicals such as polychlorinated biphenyls, dichlorodiphenyltrichloroethane (DDT), dioxin, and some pesticides. Adverse effects include abnormal thyroid function and development in fish and birds; decreased fertility in shellfish, fish, birds, and mammals; decreased hatching success in fish, birds, and reptiles; demasculinization and feminization of fish, birds, reptiles, and mammals; defeminization and masculinization of gastropods, fish, and birds; decreased offspring survival; and alteration of immune and behavioral function in birds and mammals. Some argue that these adverse effects may be due to an endocrine-disrupting mechanism (EPA 1997); however, the causal link between exposure and endocrine disruption in wildlife is unclear (WHO 2002).

It is unknown whether herbicides have the same effect as DDT and other pesticide compounds. For example, 2,4-D mimics the growth hormone auxin, which in turn causes uncontrolled growth and eventually death in target plant species (Tu et al. 2001). This potential hormone disruption implicates 2,4-D as an endocrine disrupter. A recent study showed that 2,4-D does not influence male-to-female sex reversal in alligators (Guillette et al. 2000). However, little connection has been made between endocrine disruption in other wildlife or human health and herbicide use, primarily because information is not available (Safe et al. 2000). In addition, many other factors disturb wildlife growth, reproduction, and survival. Wildlife can be subject to a number of different stressors (such as habitat loss, competition, food availability, and disease) that may affect the same endocrine markers used to evaluate the effect of endocrine disrupters (Safe et al. 2002, WHO 2002); thus, the relationship between adverse hormonal effects in wildlife and endocrine disruption remains speculative (WHO 2002).

Effect of Herbicides on Amphibians

Among wildlife groups, amphibians are potentially the most sensitive to herbicides because of their permeable skin and complex life cycles. Most amphibian species require moisture or some form of water to complete their life cycle, and most are aquatic in their egg or larval stages. It is unknown if the safety standards (such as buffer zones and application rates) for other kinds of vertebrates are adequate for reptiles and amphibians (Hall and Henry 1992). Carey and Bryant (1995) reviewed the numerous pathways through which amphibians could be affected by chemicals in the environment. They suggest that adult and larval amphibians are not necessarily more sensitive to chemicals than other terrestrial or aquatic vertebrates. However, sublethal effects can manifest as increased susceptibility to disease, increased predation, altered growth rates, or disrupted development. They suggest "endocrine-disrupting toxicants can have effects at tissue levels well below detectable levels," and that "toxicants designated as safe should not be considered to be free of endocrine disrupting effects until proven otherwise." However, as noted in *Section 4.4.5*, *Human Health and Safety*, there is little available evidence that the herbicides proposed for use on the W-CNF are linked to endocrine disrupting activities in wildlife or humans.

Although amphibian populations have declined in pristine and polluted habitats worldwide, data are insufficient to show that endocrine-disrupting compounds caused the decline (WHO 2002). Risk assessments suggest that wildlife, including amphibians, would not be significantly affected by herbicides at the expected exposure levels. Also, there would be buffer zones around water and wetlands where herbicides will not be applied. This practice would minimize the potential for amphibians to be exposed to herbicides during sensitive developmental stages. Biological and mechanical methods of weed control should have no impact on amphibians. However, during terrestrial stages, amphibians could be trampled or run over, but such events would be rare.

Indirect Herbicide Ingestion by Wildlife

A variety of studies have investigated toxicity of herbicides on wildlife and domestic animals. The LC_{50}s (herbicide concentration lethal to 50 percent of the test organisms) for mallard ducks and quail exceed 10,000 parts per million (ppm) for picloram and dicamba; 4,640 ppm for clopyralid; and 5,000 ppm for 2,4-D (Forest Service 1984). Deer and cattle feeding studies showed that deer experienced no effects from ingesting 2,4-D-treated foliage with concentrations several times higher than would likely be applied on the W-CNF (Campbell et al. 1981). Cattle fed with picloram-treated hay at concentrations many times higher than those likely to be used on the W-CNF suffered no lethal effects (Monnig 1988). No effects were observed in heifers fed dicamba at 20,000 ppm in feed (Edson and Sanderson 1965). Monnig (1988) observed that picloram, 2,4-D, and glyphosate are excreted rather rapidly though the kidneys from test animals, and that warm-blooded test animals fed extremely high concentrations of these herbicides had either very low or undetectable concentrations of the test chemical in internal organs. Although not studied, clopyralid effects are likely to be similar to picloram, a close chemical analogue (Forest Service 2001a, 2001d). Other studies examining black-tailed deer and glyphosate have reported similar results (Forest Service 2000a).

According to Forest Service (1999a) data, 2,4-D herbicides have the worst-case LD_{50} (lethal dose at which 50 percent of test organisms perish) of any of the herbicides analyzed in this DEIS. The Forest Service further presented data showing that cattle (representative of wild ungulates) and dogs (representative of wild canids) were the most sensitive groups to 2,4-D. Their analysis (Forest Service 1999a) for elk and canine predators is replicated in the following text to show the probable effects of herbicides on these species on the W-CNF.

Immediately following a typical application rate of 1 pound of herbicide per acre, herbicide concentration on grass and forbs would be about 125 mg/kg or ppm (Monnig 1988). By comparison, concentration of picloram 90 days after application would be approximately 25 ppm (Watson et al. 1989), while concentrations of dicamba, clopyralid, 2,4-D, and glyphosate would be even lower as they break down quicker than picloram. If it is assumed that up to 2 pounds of herbicide (2,4-D) may be applied per acre (grass concentration would equal 250 mg/kg)—which is an application rate that could also be used on the W-CNF—and that the animals feed on the grass immediately after application and only eat contaminated vegetation, then the following is assumed:

Elk

Assuming that an elk (230 kg) eats 16.4 kg/day of forage then the dosage is 250 mg/kg x 16.4 kg/elk x elk/230 kg = 18 mg/kg. Assuming that elk have a LD_{50} similar to cattle, then the LD_{50} is 100 mg/kg and the dosage only represents 18 percent of the LD_{50}; therefore, 2,4-D is fairly non-toxic to elk.

Another herbicide concern is long-term accumulation. Chemicals proposed for use on the W-CNF do not bioaccumulate or biomagnify and because they are water soluble, they do not accumulate in fatty tissue and are excreted rapidly (Monnig 1988). According to Monnig (1988), the maximum muscle/organ concentration of the herbicides being analyzed is 0.1 mg/kg. Using this figure the following can be determined for canids.

Canids

If a coyote (23 kg) consumes 5.5 kg of road-kill elk in a day, the dosage is 0.1 mg/kg x 5.5 kg/coyote x coyote/23 kg = 0.02 mg/kg. The LD_{50} (2,4-D) for dogs is 100 mg/kg; therefore this dosage represents less than 1/400th of the LD_{50}. Herbicides would not be toxic to canids.

Additional examples follow in text that involve bald eagle (two scenarios) and sage grouse, which illustrate potential effects of 2,4-D on two avian species with different feeding habits.

Bald Eagle

In the first scenario, if a bald eagle (3.2 kg) consumes 0.5 kg of road-kill elk in a single day, the dosage is 0.1 mg/kg x 0.5 kg/bald eagle x bald eagle/3.2 kg = 0.02 mg/kg. In the second scenario, if a bald eagle (3.2 kg) consumes 0.5 kg of road-kill coyote in a single day that had previously fed on road-kill elk (as described in the above example), the dosage is 0.02 mg/kg x 0.5 kg/bald eagle x bald eagle/3.2 kg = 0.003 mg/kg. The LD_{50} value of 2,4-D for birds is 500 mg/kg (see *Appendix B, Characteristics of Herbicides*).

The contaminant values of 2,4-D for these two scenarios for bald eagle are both well below the LD_{50} value.

Sage Grouse

If a sage grouse (1.4 kg) consumes 10 percent of its body weight (0.14 kg) in grasses and forbs in a single day, then the dosage is 250 mg/kg x 0.14 kg/sage grouse x sage grouse/1.4 kg = 25 mg/kg. This value is well below (1/20th) the LD_{50} value of 2,4-D for birds of 500 mg/kg. Birds ingesting insects that were feeding on sprayed foliage would have similar or reduced levels of contaminants because of further dilution from insect body weights.

This analysis, and the fact that the herbicides do not bioaccumulate or biomagnify, and are also rapidly excreted, would indicate that there would be little or no effects to big game, predators, scavengers, or birds from herbicide application on the W-CNF. There would also be no long-term accumulation from repeated applications.

Dermal exposure test data for rabbits and rats (see *Appendix B, Characteristics of Herbicides*) indicate that LD_{50} values for chemicals that could potentially be used on the W-CNF vary from more than 2,000 mg/kg for 2,4-D and picloram to more than 5,000 mg/kg for glyphosate. These values greatly exceed chemical concentrations on vegetation when the chemical is applied at a rate of 2 pounds per acre (250 mg/kg for 2,4-D) and suggest that there would be limited risk to wildlife from dermal exposure to such vegetation. Analysis presented in *Section 4.4.5, Human Health and Safety,* similarly concludes that for people hiking through an area just sprayed with 2,4-D, the risk from dermal exposure and ingestion of 2,4-D through the skin would be 40 times lower than the EPA's Acceptable Daily Intake (ADI) value for 2,4-D. The ADI is the dose level determined by the EPA to be safe, even if received every day for a lifetime.

Herbicide spills would not present a hazard to wildlife, because any spill would be treated as a toxic release, the area would be small, and the presence of humans cleaning up the spill would displace any wildlife in the area before they could consume lethal doses of herbicides.

The implementation of BMPs and mitigation measures described in this DEIS supports the conclusion that impacts to migrating bird populations, as well as eggs and nestlings, would not be significant. Impacts would not be expected to result in violations of the Migratory Bird Treaty Act, which focuses on direct takings and not on impacting habitat. Furthermore, Executive Order 13186, which defines the responsibilities of Federal agencies to protect migratory birds under the four Migratory Bird treaties, requires Federal agencies, within the scope of their regular activities, to control the spread and establishment in the wild of exotic animals and plants that may harm migratory birds and their habitat. Controlling the establishment and spread of exotic plants, and thereby improving and protecting existing wildlife habitat, is the objective of this project.

Continuation of current weed management under the No Action Alternative would consist of limited treatment of noxious weeds primarily through ground-based spot treatment with herbicides on about 111 acres, plus other very minor efforts. This treatment level represents three percent of the known infested acres. Annual rates of weed

spread without treatment are estimated to be between 14 and 24 percent (see discussion in *Section 4.2.4.2.1, Native Plant Diversity)*. Therefore, by treating 3 percent annually, weed control efforts would lose ground each year and weed spread would continue. The direct and indirect effects on wildlife from noxious weed invasion would continue and would affect more acres each year. Direct treatment impacts on TES/MIS habitat and populations would be substantially greater than under the Proposed Action because of the continued expansion of weeds.

Furthermore, as seen in *Section 4.2.4.2.1, Native Plant Diversity*, and in Tables 4-8 and 4-9 (in *Section 4.2.4.2.3 Riparian Vegetation Loss and Aquatic Impacts*), possible rates of noxious weed spread over the next 20 years under the No Action Alternative could change this situation dramatically. Table 4-8 suggests that actual weed infestations (not the total infested polygon areas) could occupy between 50,000 and 269,000 acres of the W-CNF. Nearly 80 percent of the current known weed infestations occur in highly susceptible cover types. If this trend holds in the future, 40,000 to 215,000 of the approximately 400,000 acres of highly susceptible cover types on the W-CNF could become infested with weeds over the next 20 years with very severe impacts on TES/MIS.

TABLE 4-8
Estimates of Potential Acres Infested by Noxious Weed Spread on the W-CNF Under the No Action Alternative (at Different Rates of Spread and Time Intervals)

Acres of Weed Infestations					
Annual Weed Spread Rate (%)	**Current Year (2002)**	**Year 5**	**Year 10**	**Year 15**	**Year 20**
14	3,643	7,014	13,505	26,004	50,068
17	3,643	7,987	17,511	38,393	84,174
20	3,643	9,065	22,556	56,128	139,664
24	3,643	10,680	31,309	91,788	269,087

Cumulative Effects

Cumulative effects on noxious weeds resulting from treatments under the No Action Alternative are largely likely to be detrimental, particularly in the long term, to vegetation resources and native plant communities that provide habitat for a variety of wildlife TES/MIS. For example, implementation of the proposed Gourley Meadows Fuels Treatment Plan would remove live conifers and downed woody debris to create a firebreak for private landowners. This project would disturb the soil and open up the canopy for weed invasion, which has the potential to adversely affect wildlife resources if weeds establish. Additional examples of actions that could result in cumulative effects on wildlife and their habitat include grazing (various sheep and cattle allotments), building new roads for timber sales (e.g., the West Bear Vegetation Management project and Murdock Thinning project); trail construction and reconstruction (e.g., Richard Hollow Trail Construction and Little Bear Trail Reconstruction projects); and prescribed burns (e.g., the Hells Hollow and Stansbury Juniper Burn projects). All of these are typical

management decisions for the W-CNF, but under the No Action Alternative, which has such limited weed control efforts, they are expected to increase the potential for weed introduction, growth of weeds, and the need for weed control. This cumulative effect could potentially adversely affect wildlife and their habitat through the cumulative loss of native vegetation communities. Other ongoing W-CNF activities, such as recreation, especially in heavily roaded areas, may result in cumulative localized disturbances of wildlife.

4.2.3.2 Alternative 2: Proposed Action—Indicators 1, 2, and 3

Direct and Indirect Effects

Under the Proposed Action, a total of up to 1,586 acres of weeds on the W-CNF would be treated each year using a combination of mechanical, biological, controlled livestock grazing, and chemical methods. This represents 43 percent of the known weed infestations (3,643 acres) and would be a substantially greater area than the areas treated under the No Action Alternative (up to 126 acres annually) or Alternative 3 (up to 949 acres annually). This suggests that all weeds would be controlled within a few years under the Proposed Action. However, controls would not be 100 percent effective and new infestations would occur. At the Proposed Action rate of treatment, the W-CNF would substantially slow, and possibly reverse, the rates of weed spread and degradation of TES/MIS habitat. Some non-target plants would be affected, but compared to unchecked weed spread, these effects would be relatively minor and, given rehabilitation efforts, of a relatively short duration. The application of herbicides over larger areas than under the No Action Alternative would not be expected to have measurable effects related to disturbance on TES/MIS species. Benefits to wildlife TES/MIS species under the Proposed Action would be considerably greater than those discussed for the No Action Alternative. All of these species would benefit from the aggressive weed treatment and restoration of habitat (where appropriate) following treatment because of a reduction in the rate of loss of native plant community productivity from weed expansion. The above analysis of herbicide toxicity also applies to TES/MIS species and indicates no adverse effects would result from herbicide application other than possibly brief displacement during application.

Cumulative Effects

Cumulative effects on noxious weeds resulting from treatments under the Proposed Action are likely to be beneficial, particularly in the long term, to vegetation resources and native plant communities that provide habitat for a variety of wildlife TES/MIS. This benefit to wildlife resources should be a direct result of increased success at halting the spread of noxious weeds on the W-CNF through their wide-spread eradication, containment, and control, including halting spread from the W-CNF to adjacent lands. Under the Proposed Action, the spread of weeds on the W-CNF and, perhaps, on those non-National Forest lands immediately adjacent to the W-CNF would be expected to decline and benefit wildlife resources.

Other potential cumulative adverse effects on native plant communities and wildlife habitat that were described for the No Action Alternative also may occur under the

Proposed Action. These include the potential effects from increased grazing pressure on untreated use areas (various grazing allotments) and potential disturbance to native vegetation from heavy recreational use (various Forest-wide recreational activities); the construction, maintenance, and use of roads and trails such as the Richard Hollow Trail Construction and Little Bear Trail Reconstruction projects; prescribed burns (or wild fires) such as the Hells Hollow and Stansbury Juniper Burn projects; and logging for various purposes (harvest, fuel reduction, or post and pole products) such as the West Bear Vegetation Management project and Murdock Thinning project. These activities could disturb wildlife habitat and/or cause some wildlife species to abandon the area of disturbance. Resultant effects would probably be greater than under the No Action Alternative because of more intensive weed treatment activities under the Proposed Action. These effects, should they occur, would likely be short-term and minimal in scope.

Finally, there would be no cumulative effect on wildlife habitat due to Pacificorp's application of herbicides on the Forest, as discussed in *Section 4.2.1.2*.

4.2.3.3 Alternative 3: Weed Treatment Excluding Herbicide Use — Indicators 1, 2, and 3

Direct and Indirect Effects

Alternative 3 would attempt to control weeds annually through controlled livestock grazing on up to 689 acres, biological control on 233 acres, and mechanical control on 27 acres. Herbicides would not be used under this alternative. Livestock grazing can be effective to a point as long as it is continued, but if this treatment stops the weeds often return quickly because they have not been killed. Because the actual acres of weed infestations occur over a much larger area, non-target plants would certainly be eaten as well, degrading TES/MIS habitat values. Biological controls can be effective but require several years to become well established in an area. Overall, Alternative 3 is not likely to result in substantial weed control. Weed infestations are likely to continue to spread at a fairly rapid rate, degrading TES/MIS habitat values and further reducing populations of these species.

Cumulative Effects

Adverse cumulative effects on native plant communities and wildlife and their habitat associated with other ongoing activities or occurrences on the W-CNF (such as recreation, roads, trails, livestock, wild fires, and logging) and from weed treatment activities that were described for the No Action Alternative and Proposed Action (see examples given) also would occur under Alternative 3. Weed invasion impacts and, therefore, impacts on wildlife resources would not be expected to occur as rapidly as under the No Action Alternative because of the additional acres that would be treated under Alternative 3. However, impacts would be expected to occur more rapidly with fewer benefits to wildlife resources than under the Proposed Action because more acres of weeds would be treated each year and more treatment options are available with the Proposed Action than with Alternative 3. No potential for cumulative impacts on wildlife resources from herbicides would occur under Alternative 3 because chemicals would not be used to treat weeds.

4.2.3.4 No Action Alternative (Continuation of Current Management) — Indicator 4

Direct and Indirect Effects

Most big game winter range classified as critical (the only areas available during the most severe winters) occurs outside the W-CNF, though the reduction in availability because of land development has placed a higher value on the National Forest winter range (Forest Service 2004). The largest areas of big game winter range occur over large portions of the Overthrust Mountains; this is illustrated in Figure 4-1, Big Game Winter Range and Weed Infestations. Big game winter ranges on the W-CNF are primarily composed of mountain brush community types, including species such as Gambel oak, sagebrush, serviceberry, mountain mahogany, and bitterbrush (Forest Service 2004). These community types correspond with the sagebrush-grassland, mountain mahogany, Gambel oak, and tall shrub-mountain brush cover types that are most susceptible to weed infestation (Table 4-6) and which have many of the highest infestation rates as well as the most acres of current weed infestation. Most of the larger known weed infestations in the Overthrust Mountains occur on big game winter range (see Figure 4-1).

The Forest Service (2004) estimates indicate about 328,000 acres of mule deer winter range and 470,000 acres of elk winter range occur within the deer and elk herd units that overlap the W-CNF. The four cover types noted previously total 318,100 acres—of which 2,350 acres or 0.7 percent are currently infested with weeds. While this is not a large area at the present time, the potential for expansion in these highly susceptible habitats is great. Table 4-8 suggests that under the No Action Alternative, weeds could potentially spread to occupy between 50,000 and 270,000 acres of the W-CNF during the next 20 years. Much of this expansion would occur in these highly susceptible cover types that are vitally important as big game winter range. Even if weeds expanded at a substantially slower rate, large areas of winter range would likely degrade during the next 20 years.

Regardless of the rate of spread, winter ranges that are infested with noxious and other weeds are severely degraded for big game. As weeds expand, they displace native plant communities. Because the plant density and diversity within weed stands are usually less than the density and diversity of the native plant stand it displaces, forage and hiding and cover are reduced. Reduction of forage on big game winter range because of weed expansion would severely reduce the carrying capacity of the winter range. This would result in big game mortality, particularly during severe winters, when forage is not available in sufficient quantity to support winter herds. It would also place more stress on big game winter ranges that are not weed infested.

Forest Service (2004) indicates that big game winter range has been impacted through urban expansion along the Wasatch Front. Habitat has been lost through development and a reduction in the quality of habitat has occurred because of the introduction of non-native grasses, forbs, and noxious weeds. Forest Service (2004) indicates that these changes have altered normal fire cycles (increasing fire size, intensity, and frequency, and reducing the duration between fires) because of the larger composition of annual species that readily burn, and the high number of human-caused ignitions. Fires in these shrub-dominated communities, especially in the presence of annual weeds, often result in a loss of shrubs, thereby further reducing forage availability and hiding and thermal cover. Many of the shrubs do not readily sprout after fire and can be completely lost after one or two large fires.

Click her to view Figure 4-1 (2.9 MB)

Potential effects on big game resulting from herbicide dermal exposure or ingestion were determined to be insignificant.

Cumulative Effects

The kinds of cumulative effects on Wildlife Habitat Indicator 4 would be the same as those described under Wildlife Habitat Indicators 1, 2, and 3 for the No Action Alternative in *Section 4.2.3.1*.

4.2.3.5 Alternative 2: Proposed Action — Indicator 4

Direct and Indirect Effects

As noted previously, the Proposed Action would treat a substantially greater area than would the treatments under the No Action Alternative or Alternative 3. At this rate of treatment, the W-CNF would substantially slow and eventually reverse the rates of weed spread and degradation of big game winter range compared to the No Action Alternative. Potential effects on big game resulting from herbicide dermal exposure or ingestion were determined to be insignificant.

Cumulative Effects

The kinds of cumulative effects on Wildlife Habitat Indicator 1 would be the same as those described previously under Wildlife Habitat Indicators 2, 3, and 4 for the Proposed Action in *Section 4.2.3.2*.

4.2.3.6 Alternative 3: Weed Treatment Excluding Herbicide Use — Indicator 4

Direct and Indirect Effects

Alternative 3 would attempt to control weeds without chemicals, instead using controlled livestock grazing, biological controls, and mechanical methods. Livestock grazing can be effective to a point as long as it is continued, but if this treatment stops the weeds often return quickly because they have not been killed. Because the actual acres of weed infestations occur over a much larger area, non-target plants would certainly be eaten as well, substantially degrading big game winter range. Biological controls can be effective but require several years to become well established in an area. Overall, Alternative 3 is not likely to result in substantial weed control, and weed infestations are likely to continue to spread at a fairly rapid rate, further degrading big game winter range. Compared to the Proposed Action, this would result in increased big game mortality, particularly during severe winters, when forage is not available in sufficient quantity to support winter herds. It would also place more stress on big game winter ranges that are not weed infested. No potential effects on big game from herbicide dermal exposure or from ingestion would occur under this alternative.

Cumulative Effects

The kinds of cumulative effects on Wildlife Habitat Indicator 4 would be the same as those described previously under Wildlife Habitat Indicators 1, 2, and 3 for Alternative 3 in *Section 4.2.3.3*.

4.2.4 Ecosystem Function and Biodiversity

This section assesses potential project effects on two major subjects: ecosystem function (in *Section 4.2.4.1)* and biodiversity (in *Section 4.2.4.2*). Potential project effects on ecosystem function (hydrologic cycle, carbon and nutrient cycles, and ecosystem food webs) are addressed collectively, even though no issues were identified during public scoping for these particular ecosystem components.

Issue No. 1 identified during public scoping was directed at the loss of biodiversity, as follows:

- Loss of diversity of native vegetation and loss of wildlife habitat from noxious weed infestations

The following five indicators were used to evaluate the potential effects of Issue No. 1:

- Amount of at-risk plant species habitats infested by noxious weeds (addressed in *Section 4.2.1, Vegetation Resources and Noxious Weeds)*
- Amount of big game winter range lost to or modified by noxious weeds (addressed in *Section 4.2.3, Wildlife Resources*)
- Amount of native vegetation by cover type infested by noxious weeds (addressed in *Section 4.2.4.2.1, Native Plant Diversity*)
- Amount of habitat (and percent of total available) by wildlife/cover type groupings lost to or modified by noxious weeds (addressed in *Section 4.2.4.2.2, Wildlife/Cover Type*)
- Amount of habitat within 300 feet on each side of streams containing noxious weed infestations (addressed in *Section 4.2.4.2.4, Riparian Vegetation Loss and Aquatic Impacts*)

These indicators were used to evaluate the effects of noxious weed infestations on native plant diversity, at-risk plant species, wildlife habitat, and loss of riparian vegetation and its effect on aquatic resources. The biodiversity indicators are addressed individually in *Section 4.2.4.2, Biodiversity.*

4.2.4.1 Ecosystem Function

4.2.4.1.1 Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects

Continuance of existing weed management/control activities would not halt the spread of weeds across the W-CNF. Given the distribution and nature of the weed populations and their projected rate of spread compared to the acreage treated each year, weed

populations would continue to expand even with the weed treatments proposed under this alternative. Ecosystem function would experience little to no impact from treatment of noxious weeds, but ecosystem function would be adversely affected by weed population expansion.

As weed populations expand under the No Action Alternative, the hydrologic cycle would be disrupted, as discussed in this section. Runoff and erosion would increase under weed canopies, compared to native plant communities, which would decrease infiltration on these sites. A few weed species, such as leafy spurge, have dense canopies on favorable sites, but most weed species have sparse canopies. Transpiration from most weed-infested areas typically would be less than transpiration from native plant communities because most noxious weeds stands are lower in diversity and have sparser canopies than native plant communities (Olson 1999). Evaporation of soil moisture would increase in areas occupied by weeds, compared to native plant communities, because the weed stands generally have a poorly developed canopy and root structure that do not protect the soil from evaporation or promote water infiltration and storage.

Carbon and nutrient cycles are expected to cycle faster under this alternative, particularly for annual weeds. Noxious weeds are typically able to reduce soil nutrient availability by having higher nutrient uptake rates or by roots that decompose more slowly than roots of adjacent [native plants] or both (Olson 1999). In some cases, organic matter production and subsequent deposition onto soils would decrease over time, because of lower plant productivity compared to native plant communities. In other cases, particularly leafy spurge, litter can accumulate to depths of several inches and smother other plants (Fellows and Newton 1999). Lower plant productivity would also reduce the amount of other organic nutrients deposited onto the soil surface. This would reduce the amount of nutrients mineralized over time and further reduce nutrient cycling. This would lower the capability of the W-CNF to contribute to local and regional nutrient and carbon cycles and to continue to support a native, diverse plant community.

Weed expansion also has a detrimental effect on the food chain, which could impact the food web throughout the W-CNF. This impact can arise through disruption of plant communities (primary productivity) as discussed above or through reduced support for habitat of lower trophic-level prey species such as small mammals and birds. Food web stability, structure, and complexity can decline as a result of these effects (Brooks and Pyke 2002).

Cumulative Effects

Under the No Action Alternative, weed infestation on the W-CNF would be expected to continue to increase. This would reflect limitations on eradicating, controlling, or containing new weeds that have invaded the W-CNF from adjacent lands, or preventing or reducing the risk of invasion of adjacent lands by weeds presently occurring on the W-CNF. Cumulative effects from other projects such as the Uintah Highlands Mechanical Fuel Treatment, increased public access from proposed land exchanges, and proposed construction of fuel breaks for private landowners could potentially adversely affect ecosystem function through disruption of the hydrologic, carbon, and nutrient cycles, as well as through food webs, on a regional scale around the W-CNF. Ecosystem functions operate at broad landscape scales and can therefore be impacted from

cumulative actions. Adverse cumulative effects may be greatest in the west-central portion of the Overthrust Mountains and perhaps on adjacent non-National Forest lands because of extensive Dyer's woad infestations. Ecosystem function may be cumulatively affected by other ongoing and reasonably foreseeable W-CNF activities listed in Table 4-1, such as road and trail construction or reconstruction, livestock grazing, prescribed burns, and recreation activities that were described previously for other biological resources on the W-CNF. Weed treatment effects would result in some land disturbance and creation of bare surfaces, which would have short-term adverse effects on ecosystem function, but some long-term beneficial effects with the re-establishment of native plants.

4.2.4.1.2 Alternative 2: Proposed Action

Direct and Indirect Effects

Ecosystem function direct and indirect adverse impacts would be less under the Proposed Action than the No Action Alternative. Weeds would be aggressively eradicated, controlled, or contained using a variety of methods, and, where appropriate, treatment sites would be restored to native vegetation following treatment under the Proposed Action. Loss of native plant communities to weed infestations would decrease over time as weed populations are reduced and/or eliminated. As weed populations decline, the hydrologic cycle (where currently altered) would return to operating within normal parameters for the W-CNF. Hydrological modeling predicts increased precipitation runoff for weed invaded areas, even for high biomass weeds such as leafy spurge (Leitch *et al*. 1994). The Proposed Action is expected to result in decreased runoff, thereby encouraging infiltration of precipitation and subsequent plant transpiration and recharge of aquifers. Plant productivity decline would be less with the Proposed Action as native plant community establishment on eradicated weed sites would restore nutrient and carbon cycles over time. Food web support would be higher under the Proposed Action than with other alternatives because weed management is the most aggressive under the Proposed Action (Brooks and Pyke 2002).

Cumulative Effects

Compared to the No Action Alternative, cumulative effects of the Proposed Action combined with other projects listed in Table 4-1 would result in a net benefit to ecosystem function because of increased higher levels of weed control and eradication, slower weed population spread, and less total weed-infested acreage compared to existing conditions. This would result in an improved hydrologic cycle, nutrient and carbon cycles, and food web support on and off the W-CNF, because new weeds that have invaded the W-CNF from adjacent lands would be eradicated and invasion of adjacent lands by weeds presently occurring on the W-CNF would be curtailed as populations are controlled or eradicated. This cumulative effect would beneficially affect all ecosystem resources, such as aquatic organisms, wildlife, humans, and plant communities. For example, native plant communities would benefit because future rates of weed infestation would be lower and native communities would not be degraded by weeds. This would benefit wildlife because habitat values would not be degraded by weeds. Beneficial cumulative effects may be greatest in the west-central portion of the Overthrust Mountains and perhaps on adjacent non-National Forest lands because of eradication and

control of extensive Dyer's woad infestations. Other cumulative effects on ecosystem function would be similar to those described and the examples given for the No Action Alternative. They include the continuing effects on ecosystem function from other ongoing and reasonably foreseeable W-CNF activities or features that were described previously for other biological resources on the W-CNF(for example, roads, livestock grazing, prescribed burns, recreation), and from short-term disturbance but long-term revegetation—where appropriate—of treatment areas.

There would be no adverse cumulative effect on ecosystem function due to Pacificorp's application of herbicides on the Forest, as discussed in *Section 4.2.1.2*. Beneficial cumulative effects, as discussed above, would be enhanced by PacifiCorp's additional weed control activities.

4.2.4.1.3 Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects

Direct and indirect effects on ecosystem function would be similar to those described for the Proposed Action, but would occur at a much slower pace because of no herbicide application in Alternative 3. A combination of primarily controlled livestock grazing and biological treatments, and a lesser amount of mechanical treatment, would be applied to weed infestations on the W-CNF. Compared to the Proposed Action, this less aggressive approach would be less effective in treating weeds, take longer to achieve a reduced level of success, and be less successful in improving altered conditions in remote, difficult to access locations.

Cumulative Effects

Cumulative impacts of Alternative 3 combined with other ongoing and reasonably foreseeable activities on the W-CNF would be similar in nature, but would result in fewer beneficial effects and more adverse effects than anticipated under the Proposed Action, but more benefits and fewer adverse effects than under the No Action Alternative. Ecosystem function would be expected to gradually decline under Alternative 3. Implementation of Alternative 3 would not be expected to result in a successful long-term weed treatment program, or in healthy ecosystem functions on weed-infested areas of the W-CNF.

4.2.4.2 Biodiversity

4.2.4.2.1 Native Plant Diversity

The effects of weed treatment options on vegetation resources are extremely important. Concerns regarding vegetation resources are significant because the results of doing nothing to stem weed invasion are likely to be as bad or worse in the long term than the most aggressive weed treatment strategy. Biodiversity and plant species richness for native vegetation and plant communities, wildlife habitat values, and sensitive species populations are likely to be severely compromised by the unchecked invasion of weeds. Likewise, these same vegetation resources can be compromised by unconstrained weed

treatment efforts as well. The following discussion focuses on how these effects may differ among alternatives.

As noted previously, discussions of native at-risk plant species and the associated issues and indicators were presented separately in *Section 4.2.1, Vegetation Resources and Noxious Weeds*, in this chapter. However, some of the background information on plant communities present in the analysis area and the discussion of potential direct and indirect effects of each alternative on at-risk plant species presented in *Section 4.2.1* also is applicable to native plant diversity. This information is not duplicated in the following text and should be reviewed in *Section 4.2.1*. Similarly, some of the background information on potential direct and indirect effects of each alternative on native plant diversity presented in the following text informs the reader on broad effects to vegetation resources, including at-risk plant species. For these reasons, the reader is referred to *Section 4.2.1* for a companion discussion of potential treatment effects on vegetation resources and noxious weeds.

4.2.4.2.1.1 Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects

Under the No Action Alternative, the current levels of weed treatment would continue. Up to approximately 126 acres of weeds would be treated each year, with ground-based spot chemical treatments (approximately 111 acres annually) as the predominant treatment method. Direct and indirect effects from noxious weed invasion would be expected to occur at higher levels than current effects because of continued weed expansion. Under this alternative, direct treatment impacts are likely to be less than either of the other two alternatives because fewer acres would be treated under the No Action Alternative. However, indirect effects on native plant diversity caused by the continued expansion of weeds likely to occur under this alternative are expected to be substantially greater than under either of the other two action alternatives.

Noxious weeds negatively impact the natural plant communities they invade by reducing plant diversity and species richness, thereby decreasing the quality of wildlife habitat, and by overwhelming sensitive plant populations. Without aggressive treatment, noxious weeds would continue to displace native vegetation at the same or higher rates than currently exist. This would mean continued declines in plant diversity and species richness across native plant communities. Declines in natural vegetative communities would result in declines in the quality of wildlife habitats as well (http://www.mtweed.org/Impacts/Wildlife/wildlife.html). Populations of sensitive plant species in the path of weed expansion that could be expected to occur under less aggressive treatment would be impacted and possibly overwhelmed by noxious weeds. Sensitive plant populations that are within or along the perimeter of the currently infested areas and that occupy similar habitats would have the highest potential to be negatively impacted.

The Forest Service (1999a) calculated the manner and rate at which weed infestations can spread, noting this can be much like the compounding of interest on money. They have determined that certain vegetation types such as open sagebrush and grasslands, open river terraces, riparian benches, and pine grasslands are more susceptible to invasion by

spreading weeds than other vegetation types such as forested slopes, timbered riparian zones, and dense shrub communities. In 1999, the Forest Service (1999a) calculated the expansion of established noxious weed infestations into susceptible vegetation types on the Frank Church River of No Return Wilderness in Idaho using an average annual rate of weed spread of 17 percent, with variations between 14 and 24 percent annually depending on the species. Known spread rates for selected noxious weed species are: spotted knapweed, 24 percent; scotch thistle, 16 percent; common tansy, sulphur cinquefoil, Dyer's woad, leafy spurge, and common mullein, 14 percent; and rush skeletonweed, 14 to 50 percent (Forest Service 1999a).

There are presently 3,643 acres of inventoried, known noxious weed infestations on the W-CNF (see Table 1-2, in Chapter 1). Some of the same assumptions used to estimate weed spread on the Frank Church River of No Return Wilderness were used to estimate future noxious weed spread on the W-CNF under the No Action Alternative:

- Annual rates of weed spread are based on acres of existing infestations on the W-CNF, not on new starts or new invasions of weeds.
- Effects of major disturbances on the rate of noxious weed spread—such as fires, landslides, and timber blow down—are not included.
- Annual rates of weed spread under the No Action Alternative would average 17 percent, but could vary from 14 to 24 percent.

Continuation of current weed management under the No Action Alternative would consist of limited treatment of noxious weeds primarily through ground-based spot treatment with herbicides or hand pulling. Under this alternative, the treatment rate of up to approximately 126 acres of weeds per year would likely continue. This rate of treatment would address only a very small part of the 3,643 acres currently known to be infested with weeds and would likely have little effect on the current rate of spread.

Treatment of noxious weed infestations has the potential to impact native plant communities, sensitive species, and wildlife habitats in a similar manner to the weed infestations. The treatment method with the greatest potential to negatively affect native vegetation under the No Action Alternative is the use of herbicides. Most herbicides have only limited selectivity and could potentially result in the loss of desirable vegetation that is growing with or near the targeted weeds. Current BMPs under this alternative are in place to ensure that such losses to native vegetation would be minimal. Additional BMPs listed in *Chapter 2, Alternatives* would specifically reduce negative impacts and the risk of losses to sensitive plant populations from noxious weed treatment. Therefore, when these BMPs are followed, there should be little or no direct effects on rare plant species from the treatment of weeds under the No Action Alternative.

The greatest impact to diversity of native vegetation under the No Action Alternative would be expected to be the indirect effects of continued expansion of weed populations. These are expected to be most substantial adjacent to present weed populations, particularly after disturbance such as wild fire. Severe levels of deterioration of native vegetation and biodiversity are likely to continue under this alternative as desirable native grasses, forbs, and shrubs are replaced by weed species. Table 4-5 in *Section 4.2.3.1* shows all of the major cover types present on the W-CNF and their relative susceptibility

to weed infestation, the total area of each cover type, known area infested with weeds for each cover type, and the infested area as a percent of the total cover type area. Figure 4-2 depicts native vegetation and known weed infestations on the W-CNF.

Data presented in Table 4-8 indicate how quickly weeds could potentially spread within the W-CNF under the No Action Alternative. This table is based on several assumptions: 1) the current weed treatment prescription, which would continue under the No Action Alternative, has not been effective in controlling or eliminating weeds within the W-CNF; 2) this prescription would continue in the future under the No Action Alternative; and 3) reported rates of weed spread in the West. Five years from now, presently known weed infestations of approximately 3,643 acres would have doubled or tripled in size. Ten years from now, weeds would cover from approximately 13,505 acres (14 percent annual spread) to over 31,000 acres (24 percent annual spread) of the W-CNF. Twenty years from now, weeds would cover from just over 50,000 acres of the W-CNF at the most conservative spread rate (14 percent) to about 269,000 acres of the W-CNF at the least conservative spread rate (24 percent).

Cumulative Effects

Types of potential cumulative effects on native plant diversity would be similar to those described for at-risk plant species under the No Action Alternative in *Section 4.2.1, Vegetation Resources and Noxious Weeds*. Weed infestations are expected to continue under this alternative, which would result in declines in native plant biodiversity. These declines would be exacerbated by cumulative impacts from logging and grazing. In addition, there are likely to be cumulative impacts from projects designed to increase biodiversity, such as the Hell's Hollow Prescribed Burn, because of the lack of weed treatment options under this alternative after such disturbance.

4.2.4.2.1.2 Alternative 2: Proposed Action

Direct and Indirect Effects

Under the Proposed Action, a total of up to approximately 1,586 acres of weeds on the W-CNF would be treated each year using a combination of mechanical, biological, controlled grazing, and chemical methods. The number of acres treated annually would be greater than the existing or proposed No Action Alternative annual level of weed treatment (126 acres) on the W-CNF, where ground herbicide spot treatment is the predominant treatment method used. With implementation of BMPs, Integrated Weed Management (IWM) strategy, and a Decision Tree (Figure 1-3 in Chapter 1), it is unlikely that the combination of mechanical, biological, controlled grazing, and chemical treatments on 1,586 acres of weeds—where appropriate— would adversely affect native vegetation on the W-CNF to a great degree, although there is potentially more risk from direct effects of treatment under this alternative than Alternatives 1 or 3 simply because of the additional acres that would be treated and the number of acres treated by herbicide.

The potential for mature native shrub mortality is expected to be minimal where aerial applications are authorized because aerial applications would be targeted on specific application areas and because the label rates of application to treat shrubs are generally double that for perennial weedy forbs. In addition, label recommendations for target

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shrubs include thorough wetting of the entire plant, including the root crown. Such thorough wetting is not expected to occur under aerial applications. However, unprotected non-target seedlings and young plants could experience some mortality.

Cumulative Effects

Types of potential cumulative effects on native plant diversity would be similar to those described for at-risk plant species under the Proposed Action in *Section 4.2.1, Vegetation Resources and Noxious Weeds*.

4.2.4.2.1.3 Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects

Under Alternative 3, a total of up to approximately 949 acres of weeds on the W-CNF would be treated each year using a combination of mechanical, biological, and controlled grazing. Most of these acres (689 acres) would be treated using controlled grazing. This method of treatment can have detrimental impacts to plant biodiversity, especially if herders allow livestock to stray from dense infestations of weeds. Mechanical treatments also can disturb soil and affect biodiversity.

Indirect impacts on native plant diversity are likely to be greater under this alternative than the Proposed Action because weed expansion is more likely to occur without the use of herbicides and thereby impact diversity.

Cumulative Effects

Types of potential cumulative effects on native plant diversity would be similar to those described for at-risk plant species under Alternative 3 in *Section 4.2.1, Vegetation Resources and Noxious Weeds*.

4.2.4.2.2 Wildlife/Cover Type

The types of effects of weed infestation on wildlife biodiversity are essentially the same as those described for TES/MIS wildlife in *Section 4.2.3, Wildlife Resources*. However, the adverse and beneficial effects would apply to all wildlife species on the W-CNF rather than just to TES/MIS species. This section discusses the amount of habitat (and percent of total available) by wildlife/cover type grouping that would be lost to or modified by noxious weeds.

Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects. The acres and percent of wildlife/cover type groupings were described in *Section 4.2.3, Wildlife Resources*, *Section 4.2.4.2.1, Native Plant Diversity*, and in Tables 4-5 and 4-8. The effects of these habitat losses would be the same as those described for TES/MIS species in *Section 4.2.3, Wildlife Resources.* In terms of biodiversity, continued weed expansion that would occur under the No Action Alternative would degrade habitat, cover, and food sources for wildlife, especially those that prefer cover types that are highly susceptible to weed infestation (see Table 4-5). Species diversity would decline in areas that are infested with weeds.

As shown in Table 4-8, possible rates of noxious weed spread over the next 20 years under the No Action Alternative could change this situation dramatically. Table 4-8 suggests that actual weed infestations (not the total infested polygon areas) could occupy between 50,000 and 269,000 acres of the W-CNF. Nearly 80 percent of the current known weed infestations occur in highly susceptible cover types. If this trend holds in the future, 40,000 to 215,000 of the approximately 400,000 acres of highly susceptible cover types could become infested with weeds over the next 20 years with very severe impacts on wildlife diversity and abundance.

***Cumulative Effects*.** The kinds of cumulative effects on wildlife/cover type would be the same as those described for the No Action Alternative in *Section 4.2.3, Wildlife Resources*.

Alternative 2: Proposed Action

***Direct and Indirect Effects*.** The level of weed control anticipated under the Proposed Action would benefit a substantially greater area than the treatments under the No Action Alternative or Alternative 3. This suggests that all weeds would be controlled within a few years. However, controls would not be 100 percent effective and new infestations would occur. At the proposed rate of treatment, the W-CNF would substantially slow and eventually reverse the rates of weed spread and degradation of wildlife habitat and diversity. Some non-target plants would be affected, but compared to unchecked weed spread, these effects would be relatively minor and, given rehabilitation efforts, of a relatively short duration.

***Cumulative Effects*.** The kinds of cumulative effects on wildlife/cover type would be the same as those described for the Proposed Action in *Section 4.2.3, Wildlife Resources*.

Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects. Alternative 3 would attempt to control weeds annually using livestock grazing on 689 acres, biological control on 233 acres, and mechanical control on 27 acres. Herbicides would not be used under this alternative. Livestock grazing can be effective to a point as long as it is continued, but if treatment stops then the weeds often return quickly because they have not been killed. Because the actual acres of weed infestations occur over a much larger area, non-target plants would certainly be eaten as well, degrading wildlife habitat values, reducing wildlife diversity, and possibly increasing the competition for the remaining forage and browse species. Biological controls can be effective but require several years to become well established in an area. Overall, Alternative 3 is not likely to result in substantial weed control. Weed infestations are likely to continue to spread at a rapid rate, degrading wildlife habitat values and reducing wildlife diversity.

Cumulative Effects

The kinds of cumulative effects on wildlife/cover type would be the same as those described for Alternative 3 in *Section 4.2.3, Wildlife Resources*.

4.2.4.2.3 Riparian Vegetation Loss and Aquatic Impacts

Native vegetation is impacted by the occurrence and spread of weed invasions. Weeds, especially noxious weeds, have many mechanisms to out-compete native riparian species: allelopathy, abundant seed, fast growth rates, early growth, deep roots, no natural enemies, and avoidance by grazers that prefer native species (Sheley et al. 1999a). This competition by noxious weed invasions can cause a decline in the diversity and integrity of existing riparian plant communities. Altering the biophysical processes supported by riparian habitats through weed invasions can then affect aquatic environments (Quigley et al. 1996).

The analysis area for this indicator includes the riparian areas that surround water bodies across the W-CNF. The use of stream and lake-side (that is, riparian) management buffers as a means to ameliorate the direct effects, as well as minimize the indirect effects, of land management activities on riparian zones is well documented (Meehan 1991, Waters 1995). FEMAT (1993) provides rationale for the use of 300-foot distances, on either side of perennial streams and standing water bodies, as a means for defining the riparian reserve areas that protect terrestrial and aquatic habitats and species dependant on these habitats. The 300-foot distance was identified as an interim distance used in the absence of watershed analyses (FEMAT 1993). This interim distance also has been used in subsequent management documents as Forest-wide riparian and stream protective guidance (PACFISH 1995, INFISH 1995). For purposes of the aquatic analysis across the W-CNF, the identification of weed susceptible areas within 300 feet of water bodies (riparian zone) represents the area of analysis within W-CNF lands for the riparian area vegetation analysis issue.

Identification of disturbed areas with adequate light penetration within the riparian zones offers a means for predicting areas that are susceptible to invasion and infestation of weeds (Parendes and Jones 2000). Although some weed species have exhibited the ability to invade relatively undisturbed areas, disturbed sites on Forest lands are often colonized first by exotic species (Quigley et al. 1996). Roads and streams are well documented as pathways for exotic plant dispersal (Parendes and Jones 2000). Roads in particular are paths for weed dispersal because disturbances from traffic, construction, and maintenance, together with the open canopies, remove the biological barriers that once suppressed invasion opportunities. Stream flooding and erosion (both natural and anthropogenically derived) can also create disturbance patches that provide sites ripe for invading species (Waters 1995, Parendes and Jones 2000). Stream bank disturbances, however, appear to be less susceptible to weed species invasions than roads (Parendes and Jones 2000) and likely are driven more by natural disturbances across the W-CNF than through anthropogenic influences. For purposes of delineating areas that are highly susceptible to weed invasion, stream banks are not included across the W-CNF. Trails serve a similar function to roads on National Forests because they are pathways for Forest users, and are often the only access to primitive (undeveloped) and semi-primitive portions of the W-CNF (Quigley et al. 1996). Trails can also serve as a vector for weed transport and can provide areas for weed invasions similar to that of roads.

The road and trail system on the W-CNF provides access to a majority of the W-CNF for management and recreation purposes. These roads and trails may also serve as vectors for noxious weeds within riparian areas. Within riparian areas, approximately 540 miles of

roads and 490 miles of trails exist. As a means for estimating the approximate area of susceptibility that the roads and trails may provide within the riparian area, an estimated area was calculated across the W-CNF. An average road impact width of 40 feet and an average trail impact width of 8 feet were chosen. Across the W-CNF, approximately 2,630 acres of roads and 478 acres of trails may increase the susceptibility of riparian zones to weed infestations.

In addition, other Forest recreation and management sites within 300 feet of streams and lakes may provide a means for noxious weed introductions or expansions into riparian zones. These concentrated use areas include campgrounds, trailheads, dispersed camping areas, and other areas used for administrative and recreational purposes. As an estimate of the area that these sites provide for weed susceptibility, area estimates were assigned to the known activity areas. The total area estimated for other uses across the W-CNF totaled over 4,500 acres within 300 feet of streams and lakes that may increase weed susceptibility within the riparian area of the W-CNF.

Broad-scale cover types vary in their susceptibility to invasion by noxious weed species. Quigley et al. (1996) provide a thorough review of the susceptibilities of specific cover types found within the Interior Columbia River Basin from invasion by 25 exotic species, as well as the susceptibility of broad-scale cover types that may be found outside the basin. For the purposes of delineating susceptible riparian areas on the W-CNF, the broad-scale cover types described in Quigley et al. (1996) support the determination of susceptibility across the W-CNF. The riparian area within W-CNF-managed lands is estimated to total 242,017 acres and to include 23 cover types. Cover types that are highly susceptible to invasion within the W-CNF riparian zones are described by ecoregion in Table 4-9.

TABLE 4-9
Vegetation Types and Acres on the W-CNF Determined Highly Susceptible to Invasion by Noxious Weeds Within Riparian Zones (Forest Service 2005a)[a]

Vegetation Cover Type	Ecoregion			Total Acres
	Bonneville	Overthrust	Uinta	
Bottomland hardwood forests	216	2,316	259	2,791
Gamble oak	0	22,799	160	22,959
Ponderosa pine forests	0	0	70	70
Sagebrush/grasslands	4,196	25,706	9764	39,666
Tall forb lands	0[b]	593	0[b]	593
Tall shrub/mountain brush lands	1,808	3,242	116	5,166
Mahogany	19	2,686	172	2,877
Juniper/pinyon-juniper	11,548	10,073	98	21,719
Total Acres	17,787	67,415	10,639	95,841

[a]Acres estimated using GIS data

[b] While not mapped in the Stansbury Mountains, tall forb communities do occur at subalpine elevations in the range; In the Uinta mountains they occur in the western portion from the Whitney Reservoir area on the Evanston Ranger District to Hoyts Peak on the Kamas Ranger District.

Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects. Direct effects to riparian plant communities can occur when treatments to kill noxious weeds in a given area also inadvertently kill or suppress native vegetation, particularly forbs (see previous vegetative discussions in *Section 4.2.1* and *Section 4.2.4.2.1*). Indirect effects to native vegetation occur from weed mechanisms that support successful invasions and expansions into native and desired plant communities. Under the No Action Alternative, the direct effects from the current noxious weed invasions on aquatic habitat conditions would generally continue at the existing level. Table 2-2 (in Chapter 2) describes the current chemical, controlled livestock grazing, and mechanical treatments across the W-CNF. Up to approximately 126 acres of weeds (111 acres of ground-based spot treatments using herbicides) are treated annually. This would continue under the No Action Alternative.

The current highly susceptible cover types within riparian zones on the W-CNF total over 95,000 acres (Table 4-9). In addition, more than 7,600 acres of concentrated use areas, roads, and trails occur within riparian zones across the W-CNF. Direct and indirect impacts on these highly susceptible areas would be expected to continue under the No Action Alternative as described in *Section 4.2.1, Vegetation Resources and Noxious Weeds*, and in *Section 4.2.4.2.1, Native Plant Diversity* of this chapter. Vegetative cover types that are highly susceptible to weed invasions account for nearly 40 percent of the total riparian area on the W-CNF. These areas have an increased potential for short-term and long-term soil erosion and stream sedimentation at weed-infested sites (Quigley et al. 1996). Further, there are concentrated use areas, roads, and trails within the susceptible cover types that likely serve as a means for weed invasion, dispersal, and expansion. These particular areas have the potential for increasing weed-related impacts through erosion and sedimentation from riparian zones, which can directly and indirectly adversely affect aquatic habitat and associated fish and aquatic invertebrate populations.

Increased sediment delivery to drainages under the No Action Alternative because of increased weed spread can directly and indirectly affect aquatic resources through the sedimentation of habitat and increased levels of turbidity and suspended sediment in the water column. Increased sedimentation can cause a reduction or elimination of stream bottom habitat used by aquatic insects such as caddisflies, mayflies, and stoneflies that are important fish foods; a subsequent reduction in aquatic insect abundance and diversity; a reduction in the permeability among interstitial spaces within spawning gravels that inhibits the flow of well-oxygenated water and the removal of metabolic wastes; a subsequent reduction in spawning success, hatching success, and fish production; and a reduction in the interchange of surface and subsurface waters in the hyporheic zone beneath the stream channel (Nelson et al. 1991). Substantially increased sedimentation can eliminate or reduce the depths of pools that provide important year-round cover for juvenile, sub-adult, and adult fish, and may cause the premature siltation of beaver ponds, which often provide year-round habitat for trout and other cold water species. If severe enough, increased sediment loads can cause the erosion and migration of stream channels (Chamberlin et al. 1991), and the subsequent degradation of aquatic and riparian habitat. These conditions would likely result in further degradations to the Forest-wide geomorphic integrity, water quality, and biotic condition index, with an

increase in watershed vulnerability described in *Section 3.3.2.3.1* in *Chapter 3, Affected Environment.*

Elevated turbidity and suspended sediment levels caused by increased sediment delivery can have sublethal and acute effects on fish. Nelson et al. (1991) reported that suspended sediment concentrations of 1,200 milligrams per liter (mg/L) cause mortalities in underyearling salmonids, while suspended sediment concentrations as low as 100 mg/L up to 1,000 mg/L are sometimes associated with a general reduction in fish activity, impaired feeding, reduced growth, downstream displacement, and decreased resistance to other environmental stressors. (A concentration of 1 mg/L equals 1 part per million [ppm].) Fish and fish food production can be affected by the abrasive effects of very fine sediment on fish embryos and fry and on immature aquatic insects. In addition, very turbid waters can exhibit increased temperatures because of the water's capacity to retain more heat. This can affect those fish and invertebrate species that have the most restrictive cold-water or cool-water thermal requirements.

The potential degradation or loss of riparian habitat from weed infestation can be especially important in smaller drainages, because of the many direct and indirect influences riparian habitat has on the quality of aquatic habitat. Murphy and Meehan (1991) reported that riparian habitat can form a protective canopy that provides overhead cover for fish and moderates the extreme effects of air temperatures during summer (helps to cool streams) and winter (helps to insulate streams). Riparian habitat also helps reduce soil erosion and filters sediment before it enters streams, stabilizes streambanks, and allows for the formation of undercut banks that provide cover for fish. In addition, riparian habitat contributes litter (nutrients and food for invertebrates) and woody debris (instream cover) to drainages, and it provides habitat for insects that fall to the water's surface and are consumed by fish (Murphy and Meehan 1991).

It is difficult to predict how severely the invasion and spread of noxious weeds would alter or affect riparian-dependant species at a Forest-wide scale. However, given the 3,643 acres of known infested areas across the W-CNF, the 95,000 acres of highly susceptible habitats within riparian areas, and more than 7,600 acres of concentrated use areas, roads, and trails in riparian areas, it is apparent that the No Action Alternative (that is, continuation and expected worsening of the existing condition) would not keep pace with noxious weed infestations, spread, and associated impacts within riparian areas and on aquatic habitats in the future.

Aquatic resources potentially impacted by the direct and indirect effects of increasing weed infestations on the W-CNF include all of the at-risk species, MIS fish species, recreational fishes, and nongame species described in *Section 3.3.2, Aquatic Resources,* in Chapter 3. Potentially at-risk resources also include aquatic invertebrate species, such as pollution-intolerant mayfly and stonefly taxa. The greatest potential for impacts from increased sediment delivery and possibly riparian degradation may be to the native resident salmonids, especially protected, sensitive species such as the Colorado River and Bonneville Cutthroat Trout (see *Section 3.3.2, Aquatic Resources,* in Chapter 3). Sensitive amphibians such as the spotted frog, which is associated with aquatic and riparian habitat on the W-CNF, also may be affected by habitat degradation. Site-specific impacts from erosion and sediment delivery would depend on the slope, soil

characteristics, precipitation amount and pattern, distance to water, riparian buffer health and extent, and the species and life stages present.

The limited application of herbicides and other weed treatment methods on the W-CNF would continue under the No Action Alternative at the current treatment rate of up to approximately 126 acres per year (Table 2-2). It is likely that the treatments, under this alternative, would not keep pace with the spread of noxious weeds within the riparian areas.

Cumulative Effects. Types of potential cumulative effects on riparian vegetation and aquatic resources would be similar to those effects described for the No Action Alternative in *Section 4.2.2, Aquatic Resources*. Those projects and activities listed in Table 4-1 that were considered in the cumulative effects analysis and that would occur within or near riparian zones or that could otherwise lead to weed infestations in riparian zones would potentially have the greatest cumulative adverse effect on riparian vegetation loss and associated aquatic impacts. Examples include road and trail maintenance/construction/reconstruction; livestock grazing; recreational activities; and prescribed burns if they occur near or within riparian zones. The Snowbasin–Needles Connection Trail and Davenport Canyon Waterline Replacement projects are specific examples of projects that may result in these types of cumulative impacts.

Alternative 2: Proposed Action

Direct and Indirect Effects. The Proposed Action uses an IWM approach as a means to adapt, educate, prevent, treat, restore, and monitor desired Forest vegetation affected by noxious weeds across the W-CNF (see Proposed Action descriptions in Chapters 1 and 2). The combinations of possible weed treatments under the Proposed Action are designed to provide the greatest array of options to manage, eradicate, control, and contain the effects of noxious weeds on W-CNF resources. As described under the No Action Alternative, noxious weeds in riparian areas can displace vegetation that functions as a buffer to natural and anthropogenic erosion-related impacts on aquatic resources. Riparian areas have an increased potential for short-term and long-term soil erosion and stream sedimentation at weed-infested sites (Quigley et al. 1996). This can directly and indirectly adversely affect aquatic habitat and associated fish and aquatic invertebrate populations. Thus, an integrated approach to weed management provides the greatest variety and potential combination of means to eradicate, control, and contain weeds within Forest-managed lands while protecting the diversity and function of the desired vegetation.

The W-CNF contains an estimated 242,017 acres of riparian areas, with more than 95,000 acres of vegetation cover types considered highly susceptible to weed infestation (see Table 4-9). As described under the No Action Alternative, these susceptible habitats are intersected by roads, trails, and other concentrated use areas that further increase the likelihood of weed introductions and expansions within riparian areas on the W-CNF. The potential kinds of impacts that weed expansions can have on aquatic resources were described previously and include increases in sedimentation and turbidity.

Weed treatment practices that would be used under the Proposed Action include the ground-based and aerial (spot) application of herbicides, mechanical weed treatment,

biological controls, controlled livestock grazing, and/or combinations of these treatments. The likelihood of increased erosion, surface runoff, and sediment delivery to drainages, possibly resulting in water quality degradation and impacts on aquatic habitat and biota, would decline under the Proposed Action as weed-infested areas are treated and reclaimed by native and desired riparian vegetation.

The proposed treatment of weed infestations under the Proposed Action is based on selecting the highest priority infestations using the Priority and Objectives setting approach described in Chapter 1, applying the Decision Tree (Figure 1-3 in Chapter 1) to take into account sensitive resource factors, and then selecting the most ecologically sound method that would achieve the management objective for that weed species and/or infestation (using *Appendix C, Treatment Options Table*). Table 2-4 (in Chapter 2) summarizes the results of this analysis for the Proposed Action and indicates that up to approximately 1,433 acres of noxious weeds would be treated annually using herbicides (1,245 of these acres would be ground-based spot treatments); 6 acres would be treated using mechanical methods; 70 acres would be treated with controlled grazing; and 77 acres would be treated using biological controls.

The range of treatment options and other management measures associated with the Proposed Action should result in the most effective means for protecting and reclaiming riparian vegetation across the W-CNF and within riparian habitats. Implementation of the Proposed Action also should offer the most effective protection to aquatic habitats from the potential impacts of noxious weed infestations among the three alternatives being evaluated in this DEIS.

*Cumulative Effects***.** Types of potential cumulative effects on riparian vegetation and aquatic resources would be similar to those effects described for the Proposed Action in *Section 4.2.2, Aquatic Resources*. Those projects and activities listed in Table 4-1 that were considered in the cumulative effects analysis for the No Action Alternative also would apply to the Proposed Action. Examples include road and trail maintenance/ construction/reconstruction; livestock grazing; recreational activities; other herbicide application projects (PacifiCorp); and prescribed burns if they occur near or within riparian zones. However, because of an expected and much greater success in weed treatments under the Proposed Action, the potential for cumulative effects would be much less than anticipated under the No Action Alternative.

Alternative 3: Weed Treatment Excluding Herbicide Use

*Direct and Indirect Effects***.** Alternative 3 responds to concerns about the potential effects of herbicides by excluding chemical treatments from the options available for weed treatment. Consequently, there would be no potential risk of herbicides contaminating riparian, surface water, or groundwater resources of the W-CNF with this alternative. Instead, controlled livestock grazing, biological controls, and mechanical treatments or their combinations would be the only methods used to treat weeds on the W-CNF. Up to approximately 949 acres of weeds would be treated annually under this alternative, compared to 1,586 acres under the Proposed Action and 126 acres under the No Action Alternative.

Because fewer methods would be available for treating weeds, fewer acres would be treated annually, and because it is only realistic to control or contain rather than reduce the size of weed infestations under Alternative 3, it would take longer to achieve lesser levels of weed treatment success than anticipated under the Proposed Action. This is because of the effectiveness of chemicals at treating weeds on a larger scale and the means by which the chemical can kill individual plants and limit growth and reproduction. The effectiveness of grazing, biological, and mechanical treatment options in the eradication, control, or containment of invasive weeds can be delayed from several months to several years while the establishment and expansion of weeds continues to impact riparian habitats and possibly aquatic resources. As a result, it also would take longer to realize some benefits to aquatic and riparian resources resulting from reduced erosion and sediment delivery at weed-infested sites to drainages. Increased direct and indirect localized impacts on water quality and aquatic resources may be observed because of the increase in soil disturbance resulting from mechanical and grazing treatment activities. Alternative 3 would likely be less effective than the Proposed Action but more effective than the No Action Alternative (because many more acres would be treated annually) at protecting the biodiversity of riparian habitats and reducing potential impacts to aquatic and semi-aquatic species.

*Cumulative Effects***.** Types of potential cumulative effects on riparian vegetation and aquatic resources would be similar to those effects described for Alternative 3 in *Section 4.2.2, Aquatic Resources*. Those projects and activities listed in Table 4-1 that were considered in the cumulative effects analysis for the No Action Alternative and the Proposed Action also would apply to Alternative 3. Examples include road and trail maintenance/construction/reconstruction; livestock grazing; recreational activities; and prescribed burns if they occur near or within riparian zones. Because of the expected intermediate success in weed treatments under Alternative 3 compared to the other two alternatives, the potential for cumulative effects would be greater than anticipated under the Proposed Action, but less than anticipated under the No Action Alternative.

4.3 Physical Resources

4.3.1 Soils and Geology

There were no significant issues or specific issues of concern identified for soils or geology during scoping. However, soil properties can be affected by weed populations, and weed treatment can affect soil properties. Finally, soil type can affect the ability of chemicals to move through the soil into groundwater or over the soil into surface water via overland flow. Because the interaction between soil and hydrology is discussed in *Section 4.3.2, Surface Water and Groundwater Quality,* that particular aspect of soil impact assessment will not be discussed further in this section.

4.3.1.1 Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects

As described in *Section 4.2, Biological Resources,* weed populations on the W-CNF would continue to expand with the weed control treatments of the No Action Alternative. Soils, geology, and minerals would experience little to no impact from treatment of noxious weeds, but soils would be affected by weed population expansion. There is the potential for minimal impacts to soils from off-road chemical treatment activities. Cross-country travel during treatment activities could be a limited source of soil displacement.

As weed populations expand under the No Action Alternative, soil erosion would be expected to increase. Lacey et al. (1989) found that sediment yield from knapweed-infested sites can increase three times over that found on sites occupied by native vegetation. This could result in a significant increase in sediment yield to streams. The organic matter content of soils under weeds would decrease over time, because of lower plant productivity compared to native plant communities. This would reduce the capability of soil to support plant growth. As weeds expand under this alternative, progressively larger areas of the W-CNF would have lower soil productivity, which may require fertilization of areas being restored following weed treatment, and thereby increasing overall W-CNF weed management costs.

Soil type can influence which weed treatment is appropriate for an area, and soil properties associated with each soil type can lead to indirect effects on other resources from weed treatments. Soil properties that can indirectly affect other resources include those that control water runoff, regulate water infiltration, bind chemicals to the soil, and determine water-holding capacity of the soil. These soil properties would include soil particle size distribution, clay content, and organic matter content. As the percentage of large soil particles (e.g., gravel, cobble, rock) increases or soil textures become coarser, water infiltration increases and water runoff decreases. As clay content increases, the quantity of water able to infiltrate into the soil decreases and runoff increases. Organic matter and clay particles tend to adsorb herbicide molecules and the greater the percentage of organic matter and clay, the lower the possibility of leaching loss to the groundwater. The resources most likely to be indirectly affected by these soil properties are aquatic resources and water quality—in-depth discussions of which appear in *Section 4.3.2*, *Surface Water and Groundwater Quality*, and *Section 4.2.2*, *Aquatic Resources*.

Soil properties can also influence the type of treatment that may be appropriate on a given site. Soil properties are generally associated with the soil types derived from specific parent material sources. While this information is useful for early planning activities, it is no substitute for on-the-ground soil investigations prior to determining treatment options, but it can alert the planning team to potential constraints. Projects located on soils with high rock fragment percentages can have potential leaching problems, whereas projects located on soils with lower rock fragment percentages would have less leaching potential. Projects located on those soil types with high percentages of fine-grained soil particles may be susceptible to problems associated with runoff if the fine-textured soil horizons retard infiltration; however, on the positive side, fine-textured

soils tend to adsorb herbicide molecules and reduce leaching potential. Site investigations should be used to verify what soil textural conditions are present at the project location to determine whether herbicide leaching or runoff is a potential problem. These soil investigations should take into account the effects of coarse soil fragments and soil texture in determining leaching potential and whether or not a treatment site is likely runoff-dominated or infiltration-dominated. *Section 4.3.2, Surface Water and Groundwater Quality*, presents several scenarios where soils are an important component of determining fate and transport of herbicides.

Cumulative Effects

The No Action Alternative could cause adverse effects on soil through increased erosion from weed-infested sites and, possibly, from erosion of disturbed and/or barren weed treatment areas. Cumulative effects would occur when the No Action-related effects are combined with other ongoing W-CNF soil-disturbing activities, such as road and trail construction and maintenance, livestock grazing, vegetation management, oil and gas activities, prescribed burns, and recreation activities. Table 4-1 lists all projects considered in the cumulative effects analysis. Ground-disturbing projects such as the Little Bear Trail Reconstruction project are likely to result in additional negative cumulative impacts because of the limited weed treatment options available under this alternative. However, ongoing or proposed reasonably foreseeable W-CNF projects that reduce erosion would positively interact with effects from the No Action Alternative. These projects would include road decommissioning, Ponderosa Pine restoration, Murray Property seeding, and the Jones and Malmborg Mines reclamation.

4.3.1.2 Alternative 2: Proposed Action

Direct and Indirect Effects

Direct and indirect impacts on soils would be less under the Proposed Action than under the No Action Alternative. Under the Proposed Action, weeds would be aggressively eradicated, controlled, and/or contained using a variety of methods, and with treatment sites restored to native vegetation, where necessary, following treatment. Loss of native habitat to weed infestations would decrease over time as weed populations are reduced and eliminated. Soil erosion would decrease as native plant communities become restored through natural or artificial processes following weed treatment. Declines in soil productivity would diminish with the Proposed Action as native plant communities become established on eradicated weed sites and restore the nutrient and organic matter balance over time. The effects of eroded soils and sediment delivery on aquatic resources and surface water were discussed previously in this chapter. There is the potential for minimal impacts to soils from off-road chemical treatment activities. Cross-country travel during treatment activities could be a limited source of soil displacement. The Proposed Action would not affect geology or minerals.

Cumulative Effects

The Proposed Action would benefit soil resources because of increased levels of weed control and eradication, slower weed population spread, and less total weed-infested

acreage compared to existing conditions. This would result in improved soil protection in treated areas and reduced erosion both on and off the W-CNF. Cumulatively, Forest-wide erosion would decrease because of the positive project-related effects. The positive cumulative effect would be even greater when ongoing or proposed W-CNF activities such as other weed control projects (Pacificorp) or projects that curtail erosion are considered: road decommissioning, Ponderosa Pine restoration, Murray Property seeding, and the Jones and Malmborg Mines reclamation. This cumulative effect would benefit all resources affected by erosion, such as surface water quality and aquatic organisms.

4.3.1.3 Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects

Direct and indirect benefits to soils for Alternative 3 would be generally the same as those described for the Proposed Action, but would occur at a slower rate and be somewhat less widespread because there would be no herbicide application. A combination of primarily biological treatment, mechanical methods, and controlled livestock grazing would be used to treat weed infestations on the W-CNF under Alternative 3. This less aggressive approach would have a similar beneficial end result as the Proposed Action, but it would take longer to achieve. The lack of chemical options in remote, inaccessible areas would result in a less effective, less successful weed treatment program under this alternative than under the Proposed Action. There would be long-term benefits to soils from the reduction in size of weed populations and subsequent reduction in erosion compared to the No Action Alternative. Alternative 3 would not affect geology and minerals.

Cumulative Effects

Cumulative impacts on soils from Alternative 3 implementation, combined with the potential effects of other ongoing and reasonably foreseeable activities on the W-CNF, would be similar in nature to those described for the Proposed Action. However, there would be fewer beneficial effects and more adverse effects than anticipated under the Proposed Action, due to a slightly increased use of mechanical weed treatments and associated soil disturbance under Alternative 3. Positive erosion reduction effects would occur more slowly without the use of herbicides.

4.3.2 Surface Water and Groundwater Quality

Herbicide use requires caution because herbicides are chemical compounds which, if not used properly, can negatively affect water quality and, subsequently, aquatic species and human health. The risk to groundwater resources from herbicide application depends on the type, extent, and amount of herbicide that is used, local soil characteristics, and depth to the groundwater table. The risk to surface water resources from herbicide application also depends on the type, extent, and amount of herbicide used, as well as the site’s proximity to a stream or wetland, a stream’s ratio of surface area to volume, and whether transport from the site is runoff or infiltration controlled.

Issue No. 5, which was identified during scoping, concerns weed treatment effects on culinary water quality, as follows:

- Effects of weed treatment alternatives on water protected for domestic purposes

In response, the following indicator was identified to evaluate potential effects of Issue No. 5:

- Estimated concentration of herbicides in receiving waters (surface water and groundwater)

Environmental consequences are discussed in the following text for the identified indicator in relation to culinary water quality. In particular, Alternatives 1, 2, and 3 are assessed for their potential for chemical contamination of surface water and groundwaters and their effects on human health, as well as their ability to meet state water quality standards for culinary water. *Section 4.2.2, Aquatic Resources*, discusses the environmental consequences relative to aquatic and semi-aquatic species of concern. *Section 4.4.5, Human Health and Safety*, provides further discussion of weed treatment effects on human health.

4.3.2.1 Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects

Continuation of current management practices would consist of very limited treatment of noxious weeds in areas identified through past project activities. Future annual treatment levels and weed species treated under the No Action Alternative would be similar to those from 2004: primarily spot treatment with herbicides (111 acres), hand-pulling (3 acres), and controlled livestock grazing on approximately 12 acres containing weeds. Because there has been no systematic approach to weed treatment across the W-CNF, the treatment of noxious weeds has been associated with other activities and areas easily accessed while performing other work. All herbicide applications are in accordance with label instructions and are conducted or supervised by state-certified employees. The No Action Alternative does not include the Objectives and Prioritization from the Forest Weed Strategy nor does it include use of the Decision Tree (Figure 1-3 in Chapter 1). It does, however, include the non-treatment elements of an IWM as described in Chapter 2.

Because weed management practices under the No Action Alternative would not deviate from current practices, the estimated concentration of herbicides in receiving waters, the ability to meet state water quality standards, and the potential effects on human health would not be expected to change from current conditions. There have been no data or reported instances to indicate that any of the weed treatment activities on the W-CNF, including herbicide application, have impacted human health or water resources and, therefore, they would not be expected to under the No Action Alternative. However, even the very limited spot treatment of weeds using herbicides in Forest management as proposed under the No Action Alternative could inadvertently result in the chemical contamination of aquatic habitat through an accidental spill of an herbicide. For reader convenience, potential effects of this worst-case situation (accidental spill) are discussed together with three other examples of worst-case situations that could potentially occur

under the Proposed Action, but not the No Action Alternative, because of the difference in extent and type of chemical treatments between these two alternatives.

Certain indirect effects would occur under the No Action Alternative. For example, with the expected continued spread of noxious weeds under the No Action Alternative (as described in *Section 4.2.1, Vegetation Resources and Noxious Weeds*, and *Section 4.2.4., Ecosystem Function and Biodiversity*), there would be an increased potential for short-term and long-term soil erosion and stream sedimentation at weed-infested sites. This can directly and indirectly adversely affect surface water quality, aquatic habitat, and associated fish and aquatic invertebrate populations.

Weeds that form mono-typic stands and low above-ground biomass can encourage greater erosion and runoff. Citing studies by Lacey et al. (1989), who reported a three-fold increase in sediment yield and a 50 percent increase in runoff at a knapweed-infested site compared to a non-infested site, the Forest Service (1999a, 2001d) noted that the establishment of invasive weeds such as knapweed and sulphur cinquefoil within or adjacent to riparian habitats could increase overland runoff and sediment yield from such habitats. Studies on the Lolo National Forest in western Montana showed that a site with 80 percent knapweed cover yielded five times the amount of sediment as sites covered with bunchgrass (Hickenbottom 2000 *in* Forest Service 2001c). These same studies estimated that the effects of a 20-minute thunderstorm (100-year event intensity) occurring on 1,648 acres of big game winter range infested with spotted knapweed could produce an additional 160 tons of sediment compared to a weed-free site.

The potential degradation or loss of riparian habitat from weed infestation can be especially important in smaller drainages because of the many direct and indirect influences riparian habitat has on surface water quality and aquatic habitat. Murphy and Meehan (1991) reported that riparian habitat can form a protective canopy that provides overhead cover for fish and moderates the extreme effects of air temperatures during summer (helping to cool streams) and winter (helping to insulate streams). Riparian habitat also improves surface water quality by reducing soil erosion, filtering sediment before it enters the stream channel, and stabilizing the streambanks. Site-specific impacts to water quality from erosion and sediment delivery would depend on the slope, soil characteristics, precipitation amount and pattern, distance to water, and riparian buffer health and extent.

Cumulative Effects

Cumulative effects associated with the No Action Alternative and combined with weed treatments in areas adjacent to the W-CNF could potentially adversely affect water quality through increased erosion and sediment delivery to drainages. Specific examples include trail development and enhancement and bridge construction across Kays Creek. These adverse effects would result from expected increases in weed infestations, as well as the effects of treating, disturbing, and exposing soil surfaces. Cumulative effects on surface water quality from weed treatment activities potentially include short-term, localized increases in erosion and sediment delivery to drainages caused by mechanical treatments (soil disturbance) and chemical treatments (barren ground caused by weed removal). These areas would be subject to erosion until native vegetation becomes re-

established, after which time erosion and sediment delivery should be less than when weeds were present. This would represent an overall long-term cumulative benefit to surface water quality. Finally, there is the possibility of herbicide application in adjacent areas and possible cumulative effects on aquatic resources. However, there is close coordination across jurisdictional boundaries through cooperative partnerships. In addition, all such applications would be in accordance with EPA label guidelines, which are designed to protect aquatic organisms. Furthermore, application of the Decision Tree (Figure 1-3 in Chapter 1) early on in the planning process will ensure that consideration of past or concurrent biological and chemical use (for example, carbaryl for bark beetles, pisceticide such as rotenone for fish, magnesium chloride for roads, etc.) in the watershed is taken into account prior to proposing any additional chemical control of noxious weeds. In particular, the persistence of past chemical use and the potential for any adverse interactions among the proposed chemicals will be considered. The success of the Salt Lake City Watershed Ordinance is an example of how effective watershed management plans can be. That is, Salt Lake City allows a number of herbicides and pesticides (including 2,4-d-amine, Chlorsulfuron, Glyphosage, Metsulfuron, etc.) to be used within the municipal watersheds as long as certain protocols are followed—such as not allowing herbicide application within 24 hours of expected rainfall—and that chemicals be applied by licensed professionals only. Monitoring Big Cottonwood Creek upstream of the water treatment plant has not detected the presence of any of the allowable chemicals within the drinking water supply (per conversation with Florence Reynold [January 9, 2006]).

Additional potential cumulative effects may result from some of the other ongoing and reasonably foreseeable projects listed in Table 4-1. Examples include treatment of noxious weeds in utility corridors, prescribed burns and fire suppression activities, mine reclamation and gravel pit operations, livestock grazing and tree removal, and recreation uses near and on area drainages. These effects may be manifested as impacts to hydrologic function because of streambank disturbance, erosion, sediment delivery, and degradation of riparian and aquatic habitat—all of which can collectively act to degrade water quality.

4.3.2.2 Alternative 2: Proposed Action

Direct and Indirect Effects

The potential for adverse direct and indirect effects on water quality resulting from noxious weeds on the W-CNF would progressively decline under the Proposed Action compared to the No Action Alternative. Weed treatment practices that would be used under the Proposed Action include the ground-based and aerial application of herbicides, mechanical weed treatment, biological controls, controlled livestock grazing, and combinations of these treatments. The likelihood of increased erosion, surface runoff, and sediment delivery to drainages—possibly resulting in water quality degradation—would decline as weed-infested areas are treated and reclaimed.

The proposed treatment of known weed infestations is based on selecting the highest priority infestations using the Priority and Objectives setting approach described in Chapter 1, applying the Decision Tree (Figure 1-3 in Chapter 1) to take into account

sensitive resource factors, and then selecting the most ecologically sound method that would achieve the management objective for that weed species and/or infestation (using *Appendix C, Treatment Options Table*). Table 2-4 (in Chapter 2) summarizes the results of this analysis for the Proposed Action and indicates that, annually, approximately 1,433 acres containing noxious weeds would be treated using herbicides (119 acres of aerial application); 6 acres would be treated using mechanical methods; 70 acres would be treated with controlled grazing; and 77 acres would be treated using biological controls.

The mechanical treatment of weed sites could result in some localized soil disturbance and possibly increased sedimentation of nearby drainages. However, these effects would be expected to be minor and temporary in duration because of the comparatively few acres of soil disturbance followed by the reclamation and restoration (where appropriate) of treated areas. The release of biological controls on noxious weeds should have no adverse effect on water quality. Possible surface disturbance from controlled grazing on approximately 70 acres containing weeds under the Proposed Action would be very minor and localized. The effects of controlled grazing—which would be conducted according to stipulations in a project operation plan, followed by site restoration (where appropriate)—would not adversely affect water quality.

Herbicides can inadvertently enter surface water or groundwater resources through surface runoff, leaching through soils, accidental spills, and wind drift. Table 4-10 presents the state and federal culinary and aquatic water quality standards for three representative herbicides (2,4-D, glyphosate, picloram) proposed for use on the W-CNF that could potentially be used to treat nearly all of the established or potential species of noxious weed invaders on the W-CNF.

Appendix B, Characteristics of Herbicides, contains detailed information about the characteristics, application rates, and toxicity of herbicides proposed for use on the W-CNF.

The four worst-case situations presented in the following text evaluate the potential for chemical contamination of water resources and the potential risk to human health. The situations are: 1) the inadvertent entry of herbicides into surface water or groundwater through surface runoff (two scenarios are examined for large watersheds and two scenarios are examined for small watersheds); 2) leaching through soils (two scenarios are examined); 3) accidental spills; and 4) wind drift. These four situations are generally regarded as worst-case examples because of the extensive list of BMPs and mitigation measures (described in *Section 2.3.6, Management Practices and Mitigation Measures for All Alternatives* in Chapter 2) that would be implemented as integral parts of the Proposed Action to avoid or minimize the potential for worst-case adverse effects to occur. For example, BMPs and mitigation measures are included to avoid or minimize the likelihood of herbicide spraying in the immediate vicinity of water bodies by following buffer zone and wind velocity restrictions. In addition, use of the site-specific implementation process, Decision Tree (Figure 1-3 in Chapter 1), treatment option tables, and adaptive strategy described in *Chapter 2, Alternatives* would reduce the likelihood of the occurrence of the worst-case conditions described below. These site-specific processes are designed to avoid or minimize the potential for adversely affecting W-CNF

resources, especially sensitive resources such as culinary water quality, human health, and aquatic and/or semi-aquatic species.

Worst-Case Situations

Examples of the four situations are described in the following paragraphs.

Surface Runoff

To estimate the risk of possible herbicide concentration in streams, it is important to distinguish whether movement of rainfall on a weed treatment site is infiltration-dominated or runoff-dominated. Rainfall typically percolates into the soil on an infiltration-dominated site, but it is more likely to produce overland flow on a runoff-dominated site. Consequently, the potential for the inadvertent introduction of herbicides to streams would be expected to occur primarily via surface runoff. For example, the Forest Service (1999a) cited field studies of pesticide spray operations that showed pesticide input to streams varied from non-detectable levels to 6 percent of the amount applied. The Forest Service (2001d) also cited reviews by Rice (1990), which showed that a maximum of 10 percent of picloram applied on a runoff-dominated site could potentially enter a stream during a 6-hour precipitation event with a return period of 100 years. By comparison, only 1 percent of picloram applied on an infiltration-dominated site could potentially enter a stream via surface runoff in a 6-hour period in the event of rain. The Forest Service (2001a) reported that with picloram, the risk for contamination is generally greatest with the first storm following herbicide application that results in overland flows. The Forest Service (2001a) also reported that herbicide concentrations in streams generally peak in a 4- to 6-hour period following a runoff-generating event. Both types of runoff sites are included in the worst-case scenarios presented here.

TABLE 4-10
State and Federal Water Quality Standards for Three Representative Herbicides (2,4-D, glyphosate, and picloram) Proposed for Use in Weed Treatments on the W-CNF

Herbicide (Chemical Name)	Wyoming Human Health Value Fish and Drinking Water [a]	Utah Aquatic Wildlife [b]	Utah Coldwater Fisheries [b]	Drinking Water[a,b]	
				Utah Standards[b]	EPA Standards[c]
2,4 D (2,4-dichlorophenoxy acetic acid)	0.3 ug/L 790 ug/L (fish only)	290 ug/L	290 ug/L	77 ug/L	70 ug/L
Glyphosate (N-(phosphonomethyl) glycine)	700 ug/L				700 ug/L
Picloram (4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid)	500 ug/L				500 ug/L

[a]State of Wyoming Water Quality Rules and Regulations
[b]State of Utah Administrative Rules (R317-2), Standards of Quality for Waters of the State
[c]National Revised Primary Drinking Water Regulations 965 FR 76748, Dec. 7, 2000

There are, however, numerous examples of mitigation measures and BMPs, including buffer zones, that protect surface water quality during the aerial and ground-based

application of herbicides to safely and effectively treat noxious weeds in the western United States. For the Mormon Ridge Winter Range Restoration Project on the Lolo National Forest in western Montana, picloram (Tordon 22K) was applied aerially in 1997 on approximately 900 acres (TechLine 1998). Picloram was applied aerially at a rate of 1.5 pints per acre (approximately 0.37 pound per acre) using the same types of mitigation measures and BMPs that would be employed in aerial herbicide applications on the W-CNF, including a 300-foot, non-aerial treatment buffer to keep herbicides out of all fish-bearing water bodies (see Chapter 2). Water samples were collected from Mormon Creek prior to, during, 30 minutes after, and 60 minutes after aerial herbicide application (TechLine 1998). Water samples were tested for picloram at a detection level down to 0.01 parts per billion (ppb) (0.01 microgram per liter), which is far below any state water quality standards (see Table 4-10). Picloram was not detected in any of the water samples, indicating the stream protection measures were effective. One year following treatment of the Morman Ridge site, weed production had declined 98 percent from 1,075 pounds per acre to 25 pounds per acre, while grass production had increased 714 percent from 350 pounds per acre to 2,850 pounds per acre (TechLine 1998).

Results of water monitoring studies in association with herbicide applications on the Angeles, Eldorado, Lassen, Sierra, and Stanislaus National Forests in Region 5 of the Forest Service also illustrate the effectiveness of BMPs and buffers when properly implemented (Bakke 2001). More than 140 surface water samples were collected on these Forests during reforestation and noxious weed eradication projects using ground-based applications of glyphosate and triclopyr. Both of these herbicides are proposed for use on the W-CNF. There were no detections of glyphosate in any samples taken after reforestation projects that were not ascribed to contamination. The one project with a detection of glyphosate involved treatment of noxious weeds within the riparian zone. Even here, only one of twelve samples had a detection of glyphosate and that was at a low level of 15 micrograms per liter, which is below any level of concern for human health or state and EPA water quality standards (Bakke 2001) (Table 4-10). The few positive detections of triclopyr in non-accidental or erroneous applications in water monitoring were all at low levels; the highest was 2.4 micrograms per liter. These levels are below any aquatic levels of concern. The highest detected level of triclopyr (82 micrograms per liter) was the result of an absence of an untreated buffer on an ephemeral stream, but even this level does not represent a substantial risk of harm to humans or the environment (Bakke 2001).

Picloram—Salt Lake Ranger District/Mill Creek-Jordan River HUC 5. This worst-case analysis involves the ground-based application of picloram to treat 25 acres of common burdock in 1 day during summer. Picloram was selected for analysis because of its relatively high toxicity compared to other herbicides (see Table 4-10), and because of its persistence and mobility in the environment (see *Appendix B, Characteristics of Herbicides*). The ground-based herbicide treatment of 25 acres in a single day rather than over 1 week is regarded as an aggressive rate of weed treatment. Soil types vary throughout the Mill Creek-Jordan River HUC5 and include hydrologic groups “B,” “C,” and “D” (where “B” is defined as “moderately fine to moderately coarse-textured soil”; “C” as “moderately fine to fine-textured soil” and “D” as “clay soils” but with finer textures).

At an application rate of 0.50 pound per acre, a total of 12.5 pounds of picloram would be applied to the 25-acre treatment site. Assuming a worst-case scenario where 10 percent of the applied picloram inadvertently runs off into a nearby drainage over a 6-hour period, that drainage would receive 1.25 pounds of picloram. Mill Creek is a major drainage in the Mill Creek-Jordan River HUC5. Average monthly flows during late summer/fall when the herbicide could potentially enter Mill Creek because of a rainstorm vary from 11 cubic feet per second (cfs) in August to 7.5 cfs in October (USGS http://nwis.waterdata.usgs.gov, Gage No. 10170000). If 1.25 pounds of picloram enter Mill Creek over a 6-hour period in October, the resultant concentration would be 0.12 milligram of picloram per liter of river water (0.12 mg/L). This value is less then either the EPA or State of Wyoming drinking water quality standards for human health of 0.5 mg/L (see Table 4-10 [500 ug/L]). Resultant concentrations in tributaries to Mill Creek or any other drainage on the W-CNF that receive this same amount of picloram from a runoff-dominated site over a 6-hour period would not exceed the EPA or State of Wyoming drinking water quality standards if flows are at least 7.5 cfs.

Using these same assumptions and an application rate of 1 (rather than 0.50) pound of picloram per acre on a 25-acre runoff-dominated site, the resultant average concentration of picloram in Mill Creek in October during a 6-hour rainfall event would be approximately 0.24 mg/L. This value is slightly less than the applicable drinking water quality standards (see Table 4-10).

On infiltration-dominated sites where no more than 1 percent of the picloram applied could potentially enter a stream via surface runoff, the resultant average concentration in Mill Creek would be one-tenth what it would be for drainages receiving input from runoff-dominated sites. For the examples given above over a 25-acre treatment area, the resultant average concentration of picloram in Mill Creek in October would be 0.012 mg/L when applied at a rate of 0.5 pound per acre and 0.024 when applied at a rate of 1 pound per acre at an infiltration-dominated site. Both of these concentrations are considerably less than the EPA or State of Wyoming drinking water quality standards listed in Table 4-10.

Soil types, as well as other site-specific characteristics such as slope, type and abundance of vegetative cover, and degree of soil compaction, also determine whether a treatment site is infiltration-dominated or runoff-dominated. The differences in potential risk to receiving surface waters between runoff- and infiltration-dominated sites discussed previously illustrate the importance of using the site-specific implementation process, Decision Tree (Figure 1-3 in Chapter 1), treatment options table, and an adaptive strategy for the Proposed Action when selecting the most appropriate treatment option for a particular weed infestation site to minimize the potential for adverse effects.

2,4-D amine—Ogden Ranger District/Outlet Ogden River HUC 5. This worst-case analysis involves the 1-day aerial application of 2,4-D to treat 500 acres of Dyer's woad during summer. This analysis is believed to represent a worst-case scenario because of the very large acreage that would be treated in a single day. At an application rate of 1 pound of 2,4-D per acre, a total of 500 pounds of 2,4-D would be applied to the 500-acre treatment site in 1 day. This analysis assumes that 10 percent (50 pounds) of the applied 2,4-D runs off and enters the Ogden River over a 6-hour period in October when

the average flow is 70 cfs (USGS http://nwis.waterdata.usgs.gov, Gage No. 10139500). The resultant average concentration of 2,4-D in the Ogden River would be 0.53 mg/L. This value is above the State of Utah's drinking water standard of 0.077 mg/L (see Table 4-10). Wyoming's water quality standard of 0.3 micrograms/L (0.0003 mg/L) is based on taste rather than toxicity; consequently, this analysis focuses on the State of Utah's drinking water quality standard. Resultant concentrations in tributaries to the Ogden River or any other drainage on the W-CNF that receive this same amount of 2,4-D from a runoff-dominated site over a 6-hour period would exceed the State of Utah's drinking water standard if flows are at least 70 cfs.

Using these same assumptions and an application rate of 2 pounds (rather than 1 pound) of 2,4-D per acre on runoff-dominated sites, the resultant average concentration of 2,4-D in the Ogden River in October during a 6-hour rainfall event would be approximately 1.1 mg/L. This value exceeds the State of Utah's drinking water standard (Table 4-10).

On infiltration-dominated sites where no more than 1 percent of the 2,4-D applied could potentially enter a stream via surface runoff, the resultant average concentration in the Ogden River in October would be approximately one-tenth what it would be if herbicide input was from runoff-dominated sites. Resultant concentrations of 2,4-D on infiltration-dominated sites would be 0.053 mg/L when applied at a rate of 1 pound per acre and 0.11 mg/L when applied at a rate of 2 pounds per acre. These values are similar to the State of Utah's drinking water standard of 0.077 mg/L.

Low Flow Watersheds

The W-CNF examples given previously provide applicable scenarios for the potential impacts of a picloram and 2,4-D runoff within larger streams of the W-CNF. However, under extreme low-flow conditions, smaller streams within the W-CNF can have a flow of only 1 cfs. This stream size and streamflow are used in the following examples.

Ogden Ranger District, Headwaters Ogden River HUC 5, Beaver Creek (HUC 160201020204). Beaver Creek drains 21,708 acres and Dyer's woad is by far the dominant weed species (approximately 2,000 acres). Using the same assumptions for runoff- and infiltration-dominated sites during a rainfall event as in the previous analyses, applying 2,4-D at rates of 0.50 and 1 pound per acre to treat Dyer's woad, and assuming an extreme low-flow scenario of 1 cfs flowing in Beaver Creek, the maximum number of acres that could be treated in 1 day without exceeding the State of Utah's drinking water standard for 2,4-D (0.077 mg/L [77 ug/L], see Table 4-10) was calculated. These calculations show that on a runoff-dominated site in the Beaver Creek watershed, the maximum number of acres that could be treated in 1 day with 2,4-D at application rates of 0.50 and 1 pound per acre without exceeding the State of Utah's drinking water standard value would be approximately 2.07 acres and 1.04 acres, respectively. On an infiltration-dominated site, the maximum number of acres that could be treated in 1 day with 2,4-D at application rates of 0.50 and 1 pound per acre without exceeding the State of Utah's drinking water standard would be approximately 20.7 acres and 10.4 acres, respectively.

Logan Ranger District, Blacksmith Fork HUC 5, Left Hand Fork, Blacksmith Fork Canyon (HUC 160102030207). Left Hand Fork drains 35,640 acres. A total of 150 acres

of Dyer's woad, 25 acres of Canadian thistle, 5 acres of poison hemlock, and <1 acre of scotch thistle have been inventoried in this HUC 5. The same type of analysis for the application of picloram as described above for Beaver Creek was conducted for Left Hand Fork, again assuming an extreme low flow of 1 cfs. Calculations for picloram show that on a runoff-dominated site in the Left Hand Fork watershed, the maximum number of acres that could be treated in 1 day with picloram at application rates of 0.50 and 1 pound per acre without exceeding the State of Wyoming's drinking water standard value of 0.5 mg/L would be approximately 13.5 acres and 6.7 acres, respectively. On an infiltration-dominated site, the maximum number of acres that could be treated in 1 day with picloram at application rates of 0.50 and 1 pound per acre without exceeding the State of Wyoming's drinking water standard would be approximately 135 acres and 67 acres, respectively.

Leaching

Herbicides can potentially move through soils with rainfall, depending on soil permeability and water-holding capacity. They can subsequently enter groundwater and surface water and potentially adversely affect water quality and human health if the concentrations are high enough. If a soil is coarse and permeable, water can pass through the soil rapidly and carry some of the herbicide with it. If soils retain water in their upper horizons for later use by plants, there will be less opportunity for the water and herbicide to move through the soil and impact water quality (Forest Service 1999a). The Forest Service (2001a) noted that a reduced potential for leaching is largely facilitated by plant uptake of the herbicide, natural decomposition, volatilization of active ingredients in the herbicide, and adsorption of the herbicide by soil particles.

In a review of Forest chemicals, Norris et al. (1991) stated that the "leaching of chemicals through the soil profile is a process of major public concern, but it is the least likely to occur in forest environments." Norris et al. (1991) also noted that most chemicals are relatively immobile in soil and that intense leaching can move chemicals a few centimeters to 1 meter in depth, but these distances are small in comparison to distances between proposed treated areas and streams.

The Forest Service (1999) cited studies by Watson et al. (1989) on the occurrence of picloram in coarse soils in western Montana following its application at a rate of 1 pound per acre. Picloram is a relatively mobile, persistent, and toxic herbicide that can be used to treat spotted knapweed and other weed species present on the W-CNF. Picloram concentrations in the upper 5 inches of soil in the western Montana studies ranged from 205 to 366 parts per billion; the maximum concentration measured at soil depths between 30 and 40 inches was 24 ppb. No picloram was measured in shallow groundwater wells (detection level = 0.5 ppb) (Forest Service 1999a). A detection level of 0.5 ppb is equivalent to a concentration of 0.0005 mg/L, which is substantially less than applicable state and EPA drinking water quality standards.

The Forest Service (1999) cited other studies that measured and compared soil concentrations of herbicides less persistent in the environment than picloram. Specific data regarding soil permeability characteristics was not cited by the Forest Service (1999). In those studies, Rice et al. (1992 *in* Forest Service 1999a) found that clopyralid was never detected at soil depths greater than 10 inches, and after 30 days 2,4-D was

never detected at soil depths greater than 2 inches. In those same studies, picloram was detected at soil depths between 10 and 20 inches within 30 days following spraying, but it was not detected (detection level = 10 ppb or 0.01 mg/L) at a soil depth greater than 10 inches 1 or 2 years after spraying (Rice et al. 1992 *in* Forest Service 1999a). The Forest Service (1999) concluded that there is relatively little risk of the deep leaching of picloram, clopyralid, or 2,4-D; they assumed results would be similar for the herbicide dicamba, even though it was not tested, because its persistence and mobility are similar to those of 2,4-D and clopyralid. The Forest Service cited other studies showing there is little probability of carryover of 2,4-D or dicamba in soils from one summer to the following spring because of their short half-lives, and thus limited opportunity for these herbicides to accumulate in the soil and migrate into groundwater. The Forest Service (1999) stated that even if small amounts of any of these herbicides entered streams or larger rivers on the Frank Church River of No Return Wilderness in Idaho, then the “dilution factor would render the herbicide concentrations to infinitesimal levels.” These conditions may be equally applicable to the W-CNF, especially given the BMPs and mitigation measures proposed during implementation.

To further examine the potential for herbicides leaching through the soil profile and reaching the groundwater table in concentrations likely to adversely affect human health or drinking water quality standards, herbicide concentration with depth and time was estimated using the CHEMFLO-2000 model (EPA 2003). CHEMFLO-2000 was developed for the EPA by D.L. Nofziger and Jinquan Wu at Oklahoma State University. In general, CHEMFLO-2000 is an interactive program for simulating water and chemical movement in unsaturated soils. The van Genuchten (1980) equations assuming a sandy loam were used to estimate both the conductivity and water characteristic functions for both scenarios described below. Complete details regarding CHEMFLO-2000 are included in the user’s manual (EPA 2003).

Two worst-case scenarios were considered (the Ogden River and East Fork Blacks Fork River). For both scenarios, the relatively mobile, persistent, and toxic herbicide picloram was applied at the maximum suggested use rate for forested sites (2 quarts/acre or an acid equivalent of 1 lb per acre). The EPA and the State of Wyoming have set drinking water standards for picloram at a concentration of 500 ug/L (i.e., 0.5 g/m^3 or 0.5 mg/L) (see Table 4-10).

For the Odgen River scenario, a semi-arid climate, a highly permeable soil type (Phoebe soil type), and a depth to groundwater of 6 feet were assumed. For the East Fork Blacks Fork River scenario, a mesic climate, a highly permeable soil type (Fourmile soil type), and a depth to groundwater of 6 feet were assumed. Additional soil and chemical properties for each scenario are shown in Tables 4-11 and 4-12.

The 1-hour-duration storm with average return frequencies of between 2 years and 500 years was modeled for each scenario. For the Ogden River scenario, the 1 hour precipitation amounts ranged between 0.62 inch (for the 2-year storm) and 3.01 inches (for the 500-year storm) (values provided by W-CNF personnel). For the East Fork Blacks Fork River scenario, the 1-hour precipitation amounts ranged between 0.55 inch (for the 2-year storm) and 2.55 inches (for the 500-year storm) (values provided by

TABLE 4-11
CHEMFLO-2000 Soil Parameters

			Upper Soil Horizon					Lower Soil Horizon				
Scenario	**Bulk Density [mg/m^3]**	**Depth to Ground-water**	**Depth [cm]**	**Organic Content [g/g]**	**Saturated Hydraulic Conductivity [cm/hour]**	**Saturated Water Content [v/v]**	**Residual Water Content [v/v]**	**Depth [cm]**	**Organic Content [g/g]**	**Saturated Hydraulic Conductivity [cm/hour]**	**Saturated Water Content [v/v]**	**Residual Water Content [v/v]**
Ogden River	1.56	6 ft (183 cm)	76	0.014	15	0.41	0.065	124	0.014	5	0.43	0.049
East Fork Blacks Fork River	1.56	6 ft (183 cm)	50	0.014	50	0.41	0.065	150	0.014	50	0.43	0.049

W-CNF personnel). Each storm was modeled in CHEMFLO-2000 for up to 400 hours to estimate maximum concentrations with time and depth, assuming these very conservative and unlikely precipitation amounts. The maximum level of herbicide concentration entering the groundwater for the Ogden River scenario was approximately 0.13 mg/L or g/m^3 and occurred after the 500-year storm had been modeled for 18 hours. The resultant concentration is less than the EPA and the State of Wyoming drinking water standards for picloram (Table 4-10). Similarly, the maximum level of herbicide concentration entering the groundwater for the East Fork Blacks Fork River scenario was approximately 0.13 mg/L or g/m^3, and occurred after the 500-year storm had been modeled for 24 hours. The resultant concentration is less than the EPA and the State of Wyoming drinking water standards for picloram (Table 4-10).

TABLE 4-12
CHEMFLO-2000 Herbicide Parameters

Transport Property	Value
Diffusion Coefficient of Chemical in Water[a] (cm^2/hr)	0.036
Dispersivity[b] (cm)	2
Estimate Partition Coefficient using Koc[a] (m^3/mg OC)	6.93
Uniform 1st Order Degradation Constant in Liquid[a] (1/hr)	0.014
Uniform 1st Order Degradation Constant on Solids[a] (1/hr)	0.0005
Uniform Zero Order Production Constant[c] ($g/m^3/hr$)	0.0

[a] See Appendix B, Characteristics of Herbicides
[b] Values are generally less than 1 cm for laboratory soil columns and less than 10 cm for field soils (Seyfried and Rao1987). A value of 2 cm was assumed.
[c] A conservative value of zero was assumed, that is, additional picloram is not being produced nor is there any zero-order decay of the existing picloram.

Accidental Spills

The Forest Service (2001b) reports that most groundwater contamination by herbicides derives from point source discharges, such as accidental spills; leaks; storage and handling facilities; improperly discarded containers; or rinsing equipment in loading and handling areas. These discharges can result in localized high concentrations of herbicides. The Forest Service (1999) discussed results of two studies where picloram was intentionally introduced to streams. In the first study, 2.8 pounds of picloram were introduced to a stream flowing 190 cfs. By comparison, USGS data show that in June the Ogden River near Ogden averages about 500 cfs, Little Cottonwood Creek near Salt Lake City averages about 300 cfs, and Big Cottonwood Creek near Salt Lake City averages about 220 cfs. Maximum picloram concentration 100 yards downstream from the introduction point 6 minutes later was 14 mg/L. About 3.5 miles downstream, the maximum picloram concentration was 0.005 mg/L, which is less than the EPA and State of Wyoming drinking water quality standard (0.5 mg/L) for picloram. In a second study, a picloram concentrate of 6.26 mg/L was metered into a stream for 50 minutes. No picloram was detected (detection level = 0.001 mg/L) beyond about 4 miles downstream. The maximum picloram concentration upstream of this point (2.362 mg/L, measured about 1/4 mile downstream of the introduction point) lasted approximately 1 hour. Based on these studies, the Forest Service (1999) observed that: 1) herbicide concentrations tend

to drop rapidly within a short distance of the spill site; and 2) at any given point in the stream, the elapsed time of exposure to the spilled herbicide should be short.

In the event of an herbicide spill under the Proposed Action (or the No Action Alternative as discussed previously), the potential for adversely affecting water quality would depend on numerous factors, including the spill amount, herbicide toxicity, exposure duration, and receiving water flow. To reduce the risk of this potential occurrence, a number of BMPs and mitigation measures were identified previously for both the ground-based and aerial application of herbicides and are described further in *Section 2.3.6, Management Practices and Mitigation Measures for All Alternatives.* Examples include defined procedures for mixing, loading, and disposing of herbicides; only mixing herbicides at sites where spills into streams could not occur; properly calibrating, rinsing, and cleaning equipment; having an approved herbicide emergency spill plan and spill containment equipment available during herbicide application; and maintaining various-sized, no-treatment/no-spray buffer zones around water and aquatic resources, depending on the nature of the resource and method of herbicide application.

Wind Drift

Aerial spraying near aquatic and riparian zones may represent the greatest risk to water quality either through the inadvertent direct application or wind drift of herbicides. Risk of contamination during the ground-based application of herbicides is less than during aerial application because application occurs more slowly and applicators are able to recognize potential problems and adjust their application techniques (Forest Service 2001b). To reduce the potential risk for such impacts to occur, a number of BMPs and mitigation measures were identified previously for both the ground-based and aerial application of herbicides and are described further in *Section 2.3.6, Management Practices and Mitigation Measures for All Alternatives*. Examples of these include obtaining a weather forecast prior to spraying to ensure no extreme weather events would occur during or soon after spraying that would allow drift or runoff into streams; not spraying when wind velocity exceeds fixed standards and is in a direction that could impact federally listed and Forest Service sensitive species and resources; maintaining various-sized, no-treatment/no-spray buffer zones around aquatic and riparian resources, depending on the nature of the resource and method of herbicide application; using appropriate air speed and aircraft height to reduce wind drift potential; and using onsite wind-monitoring devices to determine wind direction and speed.

Rashin and Graber (1993) examined both the effectiveness and ineffectiveness of BMPs associated with aerial spraying of herbicides within the State of Washington. They concluded that the most important factors that influence the effectiveness of the BMPs are as follows:

- Proximity of spray swaths to the streams (that is, buffer widths)
- Streamflow regimes as they relate to the dilution of the chemicals
- Equipment configuration and operation and the resultant droplet size
- Ability of the operator to identify surface flow in streams
- Weather conditions that include wind speed, direction, and precipitation
- Pesticide toxicity and environmental characteristics

- Topographic features affecting flight pattern and release height, and
- Presence of riparian vegetation and slash.

The BMPs and mitigation measures for the Proposed Action provide specific standards to ensure proper application of herbicides. As shown by Rashin and Graber (1993), these BMPs and mitigation measures should minimize the potential for adverse effects on water quality.

Worst-Case Scenario Summary

The direct and indirect effects of chemical treatments under the Proposed Action would be expected to result in long-term improved streambank, riparian habitat conditions, and water quality. However, short-term disturbances may occur from vegetation removal and may have a slight negative effect on either water quality or aquatic resources in specific areas.

Disturbances may also arise from the inadvertent chemical contamination of water resources through surface runoff, leaching through soils, accidental spills, or wind drift. However, it is unlikely that any of the worst-case situations examined here would occur because of the implementation of BMPs, or use of a site-specific implementation process, decision tree, the treatment options table, or an adaptive strategy. If worst-case conditions did occur, several scenarios described previously involving herbicide runoff and possibly leaching of herbicides would result in exceedances of State and EPA water quality standards. Herbicide-specific buffers should reduce the moderate level of concern regarding the chance of a product entering the aquatic habitat.

Potential short-term impacts to water resources could occur if there were an accidental spill of a relatively toxic herbicide in or near a stream, or if application rates greater than those recommended given the worst-case scenarios presented above were to occur. Resultant effects may be localized depending on various factors, including the volume of spill, dilution by the receiving water, soil type and precipitation events, etc. Adherence to BMPs and mitigation measures would reduce the likelihood of such a spill occurring, plus they would minimize or avoid the potential occurrence of wind-drift-related impacts on water quality.

Cumulative Effects

Cumulative effects of the Proposed Action and weed treatment in areas adjacent to the W-CNF would result in increased levels of weed treatment success and the progressive decline of weed infestations. This would potentially benefit surface water quality through reduced erosion and sediment delivery to drainages. Under the Proposed Action, the cumulative effects on hydrologic function, within and immediately downstream of the analysis area, would be beneficial compared to the cumulative effects of the No Action Alternative.

No adverse downstream cumulative effects on water quality or human health would be expected from the Proposed Action, as no adverse effects are predicted for this alternative and no adverse impacts have been observed from existing chemical use on the W-CNF. No adverse downstream cumulative effects are expected from worst-case situations

involving herbicide runoff or leaching because of the extremely low chemical concentrations and mixing effect of tributary inflow, and the implementation of weed management BMPs and other mitigation measures described previously in Chapter 2. Implementation of BMPs for the PacifiCorp Vegetation Maintenance program would avoid cumulative impacts from that program. The potential exists for downstream adverse effects on surface water quality if an herbicide spill or wind-drift-related impact were to occur close to Forest Service boundaries, or if application rates greater than those described previously and under conditions similar to the worst case scenarios occurred. However, increased flows proceeding downstream would further dilute the herbicide. Furthermore, weed management BMPs and mitigation measures described previously are designed to prevent or reduce the risk of these types of impacts. In particular, herbicide application within the Salt Lake City watershed would comply with City Ordinance 17.04.375 described in Chapter 2; consequently, picloram would not be used in the Salt Lake City watershed. As discussed above, application of the Decision Tree (Figure 1-3 in Chapter 1) will ensure that the potential for adverse interactions or cumulative impacts from previous or concurrent applications of biological or chemical agents within the watershed will be considered prior to the application of any additional chemical agents.

Other cumulative effects would generally be similar to those described for the No Action Alternative. Long-term benefits through sediment reduction would result from the re-establishment of native vegetation in previously treated, weed-infested areas.

4.3.2.3 Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects

There would be no risk of herbicides contaminating the surface or groundwater resources of the W-CNF with this alternative. Instead, mechanical, controlled livestock grazing, and biological treatments or their combinations would be the only methods used to treat weeds on the W-CNF. Approximately 949 acres of weeds would be treated annually under this alternative, compared to 1,586 acres under the Proposed Action.

Because fewer treatment methods are available for treating weeds under Alternative 3, fewer acres would be treated annually, and because it is only realistic to control or contain rather than reduce the size of weed infestations under Alternative 3, it would take longer to achieve lesser levels of weed treatment success than anticipated under the Proposed Action. The effectiveness of mechanical, grazing, and biological treatment options in the eradication, control, or containment of invasive weeds can be delayed from several months to several years while the establishment and expansion of weeds continues. As a result, it also would take longer to realize some benefits to aquatic and riparian resources resulting from reduced erosion and sediment delivery at weed-infested sites to drainages. Increased direct and indirect localized impacts on water quality and aquatic resources would likely occur because of the slight increase in soil disturbance resulting from mechanical treatment activities. However, because Alternative 3 does not include the use of herbicides, there would be no potential for the occurrence of any of the worst-case situations involving herbicide application described for the Proposed Action.

Cumulative Effects

Beneficial cumulative effects of Alternative 3, combined with weed treatment effects in areas adjacent to the W-CNF, would be fewer than under the Proposed Action but greater than under the No Action Alternative. Overall, weed treatment success would be hampered under Alternative 3 compared to the Proposed Action. It would take longer to achieve a lesser level of success because of the absence of the application of herbicides. In some instances, these long-term results may include an expected gradual decline in noxious weeds and some resultant gradual benefits to surface water quality within the W-CNF.

Adverse cumulative effects on surface water quality under Alternative 3 would be greater than those described for the Proposed Action, but less than those for the No Action Alternative regarding sediment delivery from other ongoing W-CNF activities. There would be no potential under Alternative 3 for adverse cumulative effects or adverse interaction with past or concurrent use of additional chemical and/or biological agents within the W-CNF from herbicide application.

4.3.3 Air Quality

No significant issues or indicators associated with air quality were identified during public scoping. There is the potential, however, for several types of effects on air quality resulting from weed treatment activities. These are discussed in the following text.

4.3.3.1 Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects

Under the No Action Alternative, existing weed treatment techniques would continue, including current levels of ground-based herbicide application. One effect on air quality would be potential drift from herbicide spraying onto non-target areas. Spot spraying would result in little drift because applications are made close to the ground’s surface. A chemical odor may persist at spray sites for several hours following ground-based application. Other direct effects on air quality would include dust from spray vehicles and mechanical weed control efforts.

Indirect effects on air quality from successful weed treatment would include localized reductions in airborne pollen from weeds and allergens at certain times of the year. However, because the No Action Alternative would continue weed eradication and control efforts at their present level, it is anticipated that pollen levels across the W-CNF would gradually increase with the steady spread of weeds under this alternative. None of the herbicides approved for use in wildland weed control produce significant airborne by-products. Indirect effects from these activities would be minimal because of the application of BMPs and mitigation measures described in the following text.

Cumulative Effects

Potential cumulative effects on air quality under the No Action Alternative include possible localized increases in dust from herbicide spot treatment and spray vehicles' activities, mechanical weed treatment, and from other, nearby, ongoing W-CNF activities such as road and trail use and maintenance. Cumulative effects on air quality also may result if prescribed burns (e.g., the Hells Hollow and Stansbury Juniper Burn projects) and smoke occur in the vicinity—and at the same time—as weed treatments. Similar cumulative effects may result from nearby weed treatments on lands adjacent to the W-CNF. Also, some localized odors from herbicide use may persist for several hours if W-CNF and adjacent herbicide treatments occur at the same time and in proximity to one another. Because the effects of herbicide application are short term, they would not have cumulative carry-over effects from year to year on air quality.

4.3.3.2 Alternative 2: Proposed Action

Direct and Indirect Effects

A potential short-term direct effect on air quality under the Proposed Action is herbicide drift to non-target areas during aerial spraying. Ground-based herbicide application would result in little drift because applications are made close to the ground's surface. In either case, the odor of chemicals may persist at spray sites for several hours following ground-based or aerial application. Other direct effects would include increased dust and pollen from vehicles or mechanical treatments.

Short-term mechanical treatments could also include burning weeds with a propane torch. This may lead to a small increase in smoke or haze in the immediate vicinity of the treatment area. None of the herbicides currently registered for wildland weed control are known to produce airborne by-products from burning treated vegetation in amounts that affect air quality. However, spot burning of vegetation treated with chemicals would not be planned within the same season that chemicals are applied. Mechanical treatment of this kind would only be used on small, isolated infestations of weeds, while chemicals would generally be applied on larger, more mature, infestations.

Because the Proposed Action would provide the greatest level of weed control compared to the other alternatives, it would result in the greatest reduction in airborne weed pollen and allergens in the affected area in the long term.

Cumulative Effects

Cumulative effects on air quality under the Proposed Action from other ongoing W-CNF activities (for example, road and trail use and maintenance such as the Richard Hollow Trail Construction and Little Bear Trail reconstruction, or prescribed burns such as the Hells Hollow and Stansbury Juniper Burn projects, and from treatment activities on lands adjacent to the W-CNF, would be similar to those described for the No Action Alternative. The potential application of chemical herbicides on adjacent ownerships, or from other projects on the W-CNF (PacifiCorp) combined with W-CNF applications from this program, would result in the same, short-term effects on air quality caused by chemical odor. This effect may combine to cover a more extensive area if application

occurs on adjacent lands at similar times. Because these effects are short term, they would not have carry-over effects relative to air quality from year to year.

4.3.3.3 Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects

Short-term effects on air quality from herbicide application would not occur under this alternative because no chemicals would be used. However, the slightly more extensive use of mechanical treatments under Alternative 3 may result in localized increases in dust levels and temporary, but repeated, instances of air quality degradation. Because it would take longer to achieve a lesser level of weed control or containment under Alternative 3 than the Proposed Action, temporarily increased dust levels from mechanical treatments, at least in localized areas, may extend over a long period of time. Beneficial effects of reduced weed pollen and allergens on any particular site would occur if weeds are reduced on that site. Individually, these effects may be too small to substantially benefit local air quality.

Cumulative Effects

Cumulative effects under this alternative would be similar to those described for the Proposed Action, with two exceptions: 1) there would be a greater potential for cumulative, localized, air quality impacts because of increased dust levels resulting from more extensive mechanical treatments; 2) there would, however, be no potential for cumulative herbicide effects because chemicals would not be used under Alternative 3.

4.3.4 Fire/Fuels Management

The presence of weeds can influence fire behavior and the ability of the W-CNF to manage lands using prescribed or wildland fire. Issue No. 7 identified during public scoping regarding fire and fuels is as follows:

- Effects of noxious weed infestations and treatments on fire and fuels management

This issue is of particular concern in wildland/urban interface areas where the risk of fire and potential threat to the public may be exacerbated by the presence of noxious weeds and increased fuel loadings. Indicators used to evaluate the effects from alternative implementation on Issue No. 7, as discussed in the following text, include:

- Acres of noxious weed treatments resulting in a change in fuel loading
- Acres not available for wildland fire use and prescribed fire because of weed infestations

4.3.4.1 Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects

Acres of Noxious Weed Treatments Resulting in Change in Fuel Loading

Under Alternative 1, weed infestations would be treated using primarily spot herbicide applications, with very small amounts of controlled livestock grazing and hand pulling/digging. Up to approximately 111 weed-infested acres would be treated each year using herbicides, 12 acres would be treated through grazing, and 3 acres would be treated by hand pulling/digging.

Fuel load is a significant fuel property in determining whether a fire will ignite, how fast it will spread, and what its intensity will be (Anderson 1982). In general, the smaller the fuel diameter, the easier it will ignite and burn. Weeds, which are included in the grass fuel group, can increase fuel loading as they establish and expand, particularly when found in monotypic stands. Fire ignition is easiest in the grass fuel group, because of the predominance of small diameter fuel. The rate of spread is also expected to be faster through this small diameter fuel. Even though weeds are included in this fuel group, non-noxious, invasive grasses such as cheatgrass and bulbous bluegrass tend to dominate the fuel category and drive the rate of fire spread. However, in some localized instances, noxious weeds such as Dyer's woad may greatly contribute to the fuel load.

The area treated annually under Alternative 1 (up to 126 acres) would not be expected to reduce the infested acres, and hence fuel loading, on the W-CNF. This is particularly true where Dyer's woad infestations are severe. If approximately 3,643 acres are currently infested with weeds and a 14 percent average rate of spread is assumed, then approximately 510 new acres would be infested the first year. The next year, approximately 564 new acres would be infested and the pattern would be repeated, with weeds spreading across the W-CNF over time. Therefore, Alternative 1 would not be able to treat all of the currently infested acreage or keep pace with the projected new infestation acreage This also assumes that all infested acres can be accessed and treated effectively under the No Action Alternative, which is probably not a valid assumption because aerial application would not be used under this alternative. An additional consideration regarding the effectiveness of Alternative 1 is that on about 12 percent of the treated acres, methods other than herbicides would be applied. The non-herbicide methods, while effective over the long-term, are much slower than chemical treatment methods in achieving treatment success. This could allow additional weed spread and increased fuel loading.

Acres Not Available for Wildland Fire Use and Prescribed Fire Because of Weed Infestations

Weed-infested areas on the W-CNF are not typically prescribed burned or treated with wildland fire, because these areas tend to have a high risk of rapid increases in noxious weed infestations after fire unless weeds can be treated. The inability to use fire as a treatment is especially true at lower elevations near the wildland/urban interface, where weeds are more common and vectors are potentially more numerous. It is difficult to justify treating an area with fire without having the tools to treat post-fire infestations,

knowing the weeds will increase. Currently, low-elevation cover types (oak brush, oak/grass) in the wildland/urban interface area on the W-CNF are not included in the Wildland Fire Use Plan as areas in which to allow natural fires to burn, because these cover types are highly susceptible to weed invasion and the suitability for weed invasion would increase even more post-fire. The area of noxious weed establishment and spread is expected to increase steadily over time under the No Action Alternative. As the infested acres steadily increase, the area available for prescribed or wildland fire use would steadily decrease.

Cumulative Effects

The ability to fully implement the Forest's Five-Year Vegetation Management Plan and Wildland Fire Use Plan is compromised as long as weed infestations occur on the W-CNF. The opportunity to treat the wildland/urban interface is particularly impacted at low elevations where many weed infestations are found. This condition is expected to worsen over time under the No Action Alternative as weed infestations spread and fuel loadings increase in wildland/urban interface areas. In addition, some of the other ongoing and reasonably foreseeable actions on the W-CNF (listed in Table 4-1) could contribute to the invasion and spread of noxious weeds, could increase fuel loads and fire risks, and could further limit the opportunity to treat the wildland/urban interface using prescribed burns under the No Action Alternative. Examples of actions that could result in cumulative effects include grazing (cattle and sheep allotments); building new roads for timber sales (e.g., West Bear Vegetation Management and Murdock Thinning projects); trail construction and reconstruction (e.g., Richard Hollow Trail and Little Bear Trail projects); a broad range of Forest-wide recreation activities and Forest uses; and prescribed burns (e.g., Hells Hollow and Stansbury Juniper Burn projects)—all of which create opportunities for weed invasion through surface disturbance. Implementation of the proposed Gourley Meadows Fuels Treatment Plan, for example, would remove live conifers and downed woody debris to create a firebreak for private landowners. This project would disturb the soil and open up the canopy for potential weed invasion. All of these actions are typical management decisions for the W-CNF; however, under the No Action Alternative, which has such limited weed control efforts, they are expected to increase the potential for weed introduction, growth of weeds, and the need for weed control. The end result under the No Action Alternative would be additional weed infestations that further limit the ability to implement the Wildland Fire Use Plan near urban areas, and an increase in catastrophic fire risks to public safety. In the event of fire, assigning a local weed specialist resource advisor to the Incident Command Team (ICT) when the fire occurs near a noxious weed infestation area is one measure to minimize the potential for adverse cumulative effects.

4.3.4.2 Alternative 2: Proposed Action

Direct and Indirect Effects

Acres of Noxious Weed Treatments Resulting in Change in Fuel Loading

The Proposed Action provides the greatest range of treatment options and flexibility to treat high priority weed-infested areas. The focus on chemical treatment would provide

for effective and rapid treatment of large areas. The ability to use aerial application methods results in the Proposed Action being the only alternative that would extend treatment into areas inaccessible by land-based equipment. Reduction in the extent of infested areas would result in the reduction of fine fuel loading within the treatment areas.

Each year under the Proposed Action, up to 1,433 acres of weeds would be treated with herbicides; up to 6 acres by hand; up to 70 acres by controlled livestock grazing; and up to 77 acres using biological controls. Reduction in fuel loading on these 1,586 acres of weeds would help to reduce the potential for rapid fire spread on these lands. The emphasis on chemicals also would help prevent re-growth of weeds in treated areas, ensuring that the fuel load reduction is sustained.

Acres Not Available for Wildland Fire Use and Prescribed Fire Because of Weed Infestations

The area of noxious weed establishment and spread is likely to be reduced, by eradicating, containing, and controlling weeds, over time under the Proposed Action—at the fastest rate of all alternatives. As weed-infested acreage declines, post-fire weed establishment potential also declines and opens up more areas for fire treatment. If weeds do invade a post-fire area, tools are available under the Proposed Action to aggressively treat those areas. This is particularly true for wildland and prescribed fire use in remote areas because herbicides can be applied by air. These remote areas are not likely to be available for fire use in Alternatives 1 and 3 that do not use herbicides or aerial application methods. Concentrating herbicide-based controls in the wildland/urban interface would accelerate weed acreage reduction in these areas and allow the W-CNF to use fire to reduce the risks to public safety and dwellings.

Cumulative Effects

Cumulative effects on noxious weeds resulting from treatments under the Proposed Action are expected to be beneficial to the Forest’s Five-Year Vegetation Management Plan and Wildland Fire Use Plan, particularly in the long term. This benefit should be a direct result of increased success at halting the introduction and spread of noxious weeds on the W-CNF through their widespread eradication, containment, and control. Under the Proposed Action, the same kinds of ongoing and reasonably foreseeable actions and examples of projects described under the No Action Alternative would occur and represent threats for weed introduction and spread. The Proposed Action, however, contains a range of weed treatment options to be implemented annually over a relatively large number of acres that are expected to result in weed declines on the W-CNF. This benefit would be especially important in those low-elevation wildland/urban interface areas where implementation of prescribed burns is limited because of post-fire weed invasion risks. Assigning a local weed specialist resource advisor to the ICT when the burn occurs near a noxious weed infestation area is one measure to minimize the potential for adverse cumulative effects.

4.3.4.3 Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects

Acres of Noxious Weed Treatments Resulting in Change in Fuel Loading

Alternative 3 responds to concerns about potential adverse effects of herbicides by excluding chemicals from the options available for weed treatment. Each year under Alternative 3, up to 27 acres of weeds would be treated by hand pulling/digging; up to 689 acres by controlled livestock grazing; and up to 233 acres using biological controls. This alternative would treat up to 949 acres of weeds annually, or about 823 acres more than the No Action Alternative and 637 acres less than the Proposed Action.

Infested acres are not likely to decline quickly, as only slow-acting treatments (biological) or treatments with species-specific limitations (grazing and biological) would be used. Weed eradication and subsequent reduction of fuel loads would take more time under this alternative, compared to the Proposed Action and some weed species not affected by grazing or biological controls would continue to spread. Fine fuels in areas not having successful or delayed weed control would increase, followed by an increase in the danger of fire ignition and rapid fire spread.

Acres Not Available for Wildland Fire Use and Prescribed Fire Because of Weed Infestations

Acres available for prescribed fire and wildland fire following eradication of weeds would be less than for the Proposed Action and would increase more slowly under Alternative 3. Hazard reduction in remote areas and along the wildland/urban interface would proceed slowly and hazards in some areas would not be reduced because weeds would not be removed, leaving areas susceptible to post-fire noxious weed invasion.

Cumulative Effects

Cumulative effects related to noxious weeds and fire/fuels management under Alternative 3 would be intermediate to those described for the Proposed Action and No Action Alternative. Weed infestations may slowly decline in treated wildland/urban interface areas and allow some use of prescribed burns to reduce fire risks to the public in treated areas. However, because fewer acres would be treated annually using fewer weed treatment options compared to the Proposed Action, the potential to reduce weeds and associated post-fire weed invasion near urban areas would be less under Alternative 3. The likelihood of other ongoing and future actions described previously to cumulatively contribute to additional weed infestations and fuel loadings on the W-CNF also would be greater under Alternative 3 than with the Proposed Action. Threats to public safety and dwellings from potential catastrophic fires at the wildland/urban interface may slowly decline in some areas on the W-CNF, but increase in other areas that cannot be effectively or quickly treated using the treatment options and acreages proposed under Alternative 3.

4.4 Economic and Social Resources

4.4.1 Economic Resources

No significant issues or specific issues of concern were identified during scoping for economic resources. However, an important aspect of the proposed project is the cost compared to the benefits of the different treatment methods. Therefore, this section addresses the following economics indicator:

- Cost of a particular combination of treatments in an alternative relative to the benefit that would be derived from the alternative

The costs of a treatment method and the method's associated effectiveness provide a good measure for determining and comparing the estimated benefits of noxious weed treatments across the W-CNF. This is because the cost is an easily measurable value (per-acre-per-year basis) that can be compared among alternatives, whereas the economic quantification of the environmental and societal benefits provided by weed treatment is not easily measurable. The potential effectiveness of a treatment method, therefore, can provide a surrogate for the monetary benefit to be derived and compared against the quantifiable costs. The methods selected for weed control will have both direct and indirect economic effects on the W-CNF and surrounding areas. The indicator, as shown above, is the focus of this economic assessment.

The ability to treat established weed infestations is affected by the size of, and accessibility to, the infestation, treatment flexibility, and treatment restrictions associated with an area. Treatment flexibility refers to the structured approach of IWM and a management methodology that is based on the understanding of the ecology, uses, and interactions of the plants and animals within the system (Griffith 1999). For example, small patches of weeds may be permanently eliminated with persistent herbicides or other cultural management treatments, whereas large infestations can be best approached using the variety of approaches identified in an IWM strategy. The size and accessibility of a treatment area will influence treatment costs and the logistics of treatment. As a result, the number of acres treated annually and the timing of treatments will be influenced.

Noxious weeds appear to be spreading across Federal lands at a rate of over 4,600 acres per day and at an annual cost of more than $20 billion (UWCA 2005). However, the ability to finance treatments on W-CNF lands may be limited, because of annual changes in budgets. While recent years have seen an increase in the budget for the management of noxious weeds, the consistency of this funding is uncertain at best. Without consistent control or eradication efforts over a long duration, noxious weed expansion into susceptible habitats is a certainty (Forest Service 2003a). The IWM approach proposed across the W-CNF provides the financial and technical flexibility to employ various treatment methods that are dependent on the cost and effectiveness (benefit) of the treatment (Table 4-13 compares estimated costs). Alternatives for the proposed project are compared by the treatment method costs and their effectiveness for treating weed infestations on the W-CNF.

TABLE 4-13
Alternatives Annual Cost Comparison for Noxious Weed Treatment on the W-CNF
Following are estimated costs per year of implementing noxious weed management for the various alternatives. Estimated costs do not reflect overhead or inflation but are included as ranges to reflect the variability associated with weed treatment options. No attempt was made to estimate the costs of failure to control noxious weeds or aggressively quantify the beneficial effect of weed control on biodiversity or commercial activities associated with ecosystem health.

	Possible Treatment Options						
	IWM Non-Treatment Elements	**Chemical Ground-Based (spot and block)**	**Chemical Aerial**	**Manual and Mechanical (cutting and hand pulling/digging)**	**Grazing**	**Biological**	**Total Acres Treated, Total Cost, and Average Cost per Acre per Year***
Alternative 1 (No Action) Maximum number of acres treated per year	NA	110.94	0	2.54	12	0	125.48
Total cost of treatment option per year*		$33,282	0	$5,080	$6,000	0	$44,362
Cost per acre per year*		$300	$300	$2,000	$500	$500	$354
Alternative 2 (Proposed Action) Maximum number of acres treated per year	NA	1,314	119	6	70	77	1,586
Total cost of treatment option per year*		$394,200	$35,700	$12,000	$35,000	$38,500	$515,400
Cost per acre per year*		$300	$300	$2,000	$500	$500	$325
Alternative 3 (No Herbicide) Maximum number of acres treated per year	NA	0	0	27	689	233	949
Total cost of treatment option per year*		0	0	$54,000	$344,500	$116,500	$515,000
Cost per acre per year*		$300	$300	$2,000	$500	$500	$543

W-CNF estimates (7-12-05). This dollar amount was used as a “cap” (highest projected budget available) for action alternatives.

Non-treatment practices for noxious weeds are common to all of the alternatives and are centered on proactive weed prevention and educational programs. They are a cornerstone of IWM programs and are essential to successfully managing weeds. These practices include the following elements:

- Weed prevention
- Weed inventory and early detection
- Information and education programs
- Cooperative partnerships and coordination
- Compliance with laws, orders, policies, and the RFP

No direct effect to economic indicators would result from the implementation of non-treatment practices because these are proactive methods, and expenses are expected to be similar across all alternatives. However, this treatment method would be expected to indirectly improve economic conditions within the W-CNF through proactive weed prevention and education. Given that these methods are proposed for all alternatives, and that the associated costs and benefits are assumed to be equal across the alternatives as well, the costs for non-treatment practices will not be used in the economic comparison.

4.4.1.1 Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects

The spread of existing noxious weed species and the establishment and spread of new species would likely continue under the No Action Alternative. Hirsch and Leitch (1996) estimated the value of the direct economic impact of weed-infested wildlands (multiple-use lands such as rangelands and Forest lands) in Montana at $3.95 per infested acre and more than $3 million annually. These values (based on 1996 values) represent a combination of treatment costs and land and land-use revenues (lost benefits) that negatively impact Montana’s economy. In Utah, the Duchesne County Weed Department estimates that it spends $120,000 per year controlling weeds on county lands and roads (DCG 2005). This estimate represents an economic loss (lost benefit) to just one of Utah’s counties, and statewide estimates would be higher. It is unlikely that the spread of noxious weeds across the W-CNF would be controlled under the No Action Alternative, and it is most likely that this alternative would result in the greatest percentage of susceptible acres becoming infested with noxious weeds because of the limited number of treated acres annually. In other words, if all susceptible acres became infested with noxious weeds, as may eventually occur under this alternative (see estimated weed spread rates in Table 4-8), a conservative estimate of the impact to the local economy would be at least the $3.95 per infested acre times the highly susceptible acres, or 404,300 acres (see Table 4-5). This loss to the local economies—both urban and rural—may total more than $1,597,000 annually, a conservative estimate given the use of 1996 values ($3.95 per infested acre). This annual estimate represents the estimated cost of treatment and the lost values of the W-CNF lands.

The Forest Service-managed lands and adjacent communities would share the economic impact of these losses since these communities rely, to varying degrees, on the resources available on the W-CNF. Direct and indirect effects of the expansion of noxious weeds

on vegetation, fisheries, wildlife, ecosystem function, and, ultimately, recreational opportunities would also influence the economic well being of communities adjacent to the W-CNF. The economic sectors most affected by this alternative are the land owners and managers; county, state and federal agencies providing cooperative treatment support; permittees leasing impacted lands; and the local and regional recreational suppliers and users whose activities are on affected lands (Svejcar 1999).

Cost-Benefit Ratio

The cost-benefit ratio of the No Action Alternative is considered moderate to low because it treats the fewest acres (up to 126 acres per year); provides little flexibility in treatment methods (limited chemical, manual and mechanical, and controlled livestock grazing); would be the second least costly treatment per acre at $354 per acre per year (see Table 4-13); and would cost the least annually at $44,362 (see Table 4-13). Under the No Action Alternative (Table 4-13) the cost per acre is moderate while the benefit of the treatment method is low because of the limited numbers of acres treated per year compared to the potential for Forest-wide weed expansion. In other words, the lost benefits from expanding noxious weeds within the W-CNF would outweigh the low annual cost of this treatment method because the method would not keep pace with infestations. In addition, the No Action Alternative would not meet the Forest Management goal of providing sustainable and predictable levels of goods and services (Forest Service 2003a).

4.4.1.2 Alternative 2: Proposed Action

Direct and Indirect Effects

The Proposed Action offers the most aggressive approach to treating current and future infestations of noxious weeds within the W-CNF by offering the widest range of treatment methods and acres treated annually across the W-CNF (Table 4-13). A conservative estimate of the impact to the local economy would be the savings of currently infested, highly susceptible, wildland acreage (less than 2,800 acres; Table 4-5), which amounts to approximately $11,000 (that is, $3.95 x 2,800 acres). In addition, the highly susceptible acres (404,300; Table 4-5) that could potentially be treated to control or prevent future infestations amounts to a savings of more than $515,400 annually (that is, 1,586 acres multiplied by $325; Table 4-13), and represents the acres protected (that is, benefits gained) by the Proposed Action. An estimate of the annual cost of the Proposed Action would depend on the acres treated and the specific type of treatment within a treatment category (Table 4-13) that is chosen, according to the site-specific implementation process use of the Decision Tree (Figure 1-3 in Chapter 1); a minimum tool approach in wilderness: and an adaptive strategy—all of which were described in previous chapters of this DEIS.

New jobs from the weed treatment activities proposed under the Proposed Action would directly benefit surrounding communities that participate in cooperative weed management treatments. Other economic impacts would occur where noxious plants begin to die off and native plant populations have not yet recovered. Soil conditions may require some additional, short-term expenditure to prevent or reduce the risk of erosion-

related impacts and to hasten the restoration of treatment sites, where appropriate. These impacts should decrease as native plant populations recover.

Cost-Benefit Ratio

The cost-benefit ratio of the Proposed Action is the highest among the three alternatives because it would treat the most acres (up to 1,586 per year), provide the greatest flexibility in treatment methods (aerial and ground-based herbicide application, manual and mechanical, grazing, and biological, and combinations of these treatments), and be the least costly per acre treated ($325 per acre per year; Table 4-13). The total annual expenditures of the Proposed Action would be approximately the same as Alternative 3 but the Proposed Action would treat more acres (Table 4-13). Of all of the alternatives, the cost per acre is lowest under the Proposed Action (because of efficiencies gained by treating more total acres and because of the cost per acre of herbicide treatment compared to other treatments), while the benefits of the treatment methods are highest because of the array of methods available, if needed, to treat (or prevent) broad-scale infestations that could occur across the W-CNF. In other words, the benefit of preventing weed expansions across the W-CNF is in line with the low cost per acre and the alternative would be expected to stay ahead of the pace of weed expansions. In addition, the alternative would meet the Forest Management goal of providing sustainable and predictable levels of goods and services (Forest Service 2003a).

4.4.1.3 Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects

Alternative 3 offers the second most aggressive approach to treating current and future infestations of noxious weeds within the W-CNF by treating the second highest number of acres (949) annually, but by limiting the treatment flexibility to non-chemical treatment methods (Table 4-13). A conservative estimate of the impact to the local economy would be the savings of currently infested, highly susceptible, wildland acreage (less than 2,800 acres), which amounts to approximately $11,000. In addition, the highly susceptible acres (404,300 acres; Table 4-5) that could potentially be treated to prevent future infestations would amount to less savings than the Proposed Action (that is, fewer benefits gained and increased losses). The decreased savings, compared to the Proposed Action, would result from the less effective methods proposed under this alternative for treating large-scale infestations (that is, only non-chemical methods) and the exclusion of the least expensive per-acre treatment methods (chemical applications). Other economic effects would be similar to the Proposed Action.

Cost-Benefit Ratio

The cost-benefit ratio of Alternative 3 is second best among the three alternatives because it would treat the second highest number of acres (up to 949 acres per year), even though it provides less flexibility than other alternatives that include chemical treatment. This alternative would be the most costly per acre treated ($543 per acre per year; Table 4-13). Further, the total annual cost under Alternative 3 would approximate the Proposed Action cost but treat approximately 40 percent fewer acres (Table 4-13). Under Alternative 3, the cost per acre would be high, while the benefits of the treatment methods would be

moderate because the array of alternatives available to treat (or prevent) broad scale weed infestations across the W-CNF do not include chemicals. However, even though chemical treatment is not included, Alternative 3 does provide a more focused approach for treating weeds than the No Action Alternative—which *does* include chemical treatment—and would treat a larger area. In the absence of chemical methods, it is uncertain if Alternative 3 would stay ahead of the pace of weed expansions and meet the Forest Management goal of providing sustainable and predictable levels of goods and services (Forest Service 2003c).

4.4.2 Recreational and Visual Resources

This section addresses potential project effects on recreational and visual resources. No issues related to these subjects were identified as significant during public scoping. However, an important recreation issue of concern was identified, as follows:

- The effects of weed infestations and treatment on recreation activities and scenic quality

The following indicators were used to evaluate the potential risk of effects on recreation and scenic resource values, as follows:

- Loss of recreation opportunity because of recreation area closure or warnings for treatment according to chemical label directions from treatment activities
- Loss of recreation opportunity because of weed infestations that create physical barriers (such as yellow starthistle, musk thistle, scotch thistle, and puncture vine on trails)
- Loss of scenic quality because of weed infestations and weed treatments

The above indicators were used to assess the effects of weed treatments and weed infestations on recreation activities (access to areas and ability to participate and enjoy the activity). Although not identified as a specific issue, consideration of scenic resources also is an important component in assessing potential project effects on W-CNF features; this is addressed in the following text. Weed infestation and weed treatment effects associated with the use of Wilderness areas and roads and roadless areas are addressed separately in *Section 4.4.3, Wilderness Resources*, and *Section 4.4.4, Roads and Roadless Areas*.

4.4.2.1 Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects

Loss of Recreation Opportunities from Weed Treatment Activities

Weed treatments can adversely impact recreation opportunities during summer when treatment would occur. If visitors are recreating in the W-CNF where and when weed management activities are occurring, some visitors may have their access to certain areas temporarily limited, and their ability to participate in and enjoy their desired recreation activity may be restricted. This may occur to a limited extent as a result of chemical,

ground-based spot treatments on up to 111 acres per year. However, this occurs now, and would be a continuation of existing conditions under the No Action Alternative. These effects would be very localized and temporary (occurring on up to 111 acres per year [approximately 0.009 percent of the W-CNF]). They are expected to affect a very small number of recreationists compared to the number of recreationists that would be adversely affected by expanding weed infestations under this alternative. Weed prevention, control, and revegetation activities do not occur during the fall, winter, and spring recreation seasons and, therefore, would not impact recreation activities during these times.

Loss of Recreation Opportunities from Presence of Weeds

This alternative is a continuation of existing weed management practices on the W-CNF, and would treat few acres annually using limited methods. Because of this, noxious weeds are expected to continue to grow and spread at a rate faster than they are removed. Under the No Action Alternative, potential rates of weed spread and estimated future acres of weed infestations on the W-CNF (see Table 4-8) would substantially and adversely impact W-CNF resources. Depending on the rate of spread, approximately 50,000 to 270,000 acres or 4 to 22 percent of the W-CNF could potentially be covered with weeds 20 years from now. This would likely result in noxious weeds spreading into various recreation areas on the W-CNF, and reducing or possibly eliminating access to those areas by creating physical barriers (extensive areas of Dyer’s woad, for example). By affecting access to areas used for recreation, noxious weeds also would affect recreationists’ abilities to participate in and enjoy recreation activities on the W-CNF. This is considered an adverse effect on those recreationists and recreation opportunities. This is an ongoing (continuing) effect of implementation of the No Action Alternative. In the specific localized areas where recreation activities occur and where noxious weeds are treated and/or eradicated, a benefit to recreationists and recreation opportunities would result.

Figure 4-3 depicts locations of all recreation areas on the W-CNF, together with the susceptibility to weed infestations (high, medium, or low) of native vegetation cover types and known weed infestations. Sizes of some of the recreation areas shown on Figure 4-3 have been enlarged slightly to better illustrate the distribution of recreation sites among cover type susceptibilities on the W-CNF. Approximately 4,700, 4,200, and 5,100 acres of recreation areas occur in high, medium, and low weed susceptibility cover types, respectively. Recreation areas in or near high susceptibility cover types are particularly vulnerable to weed infestations. Regardless of cover type, recreation areas by themselves are especially vulnerable to new weed infestations because of the presence of recreationists, their equipment, and their pets—all of which can serve as vectors for the introduction and spread of weed seeds.

Loss of Scenic Quality Because of Weed Infestations and Weed Treatments

From a scenic resources perspective, the continued spread of weeds under the No Action Alternative would primarily affect recreationists’ views in the immediate foreground (within 100 feet of the viewer), where weeds are out of scale (size and shape of weeds contrast sharply with the nearby vegetation) or visually out of place (forms, lines, colors, or textures of the weeds are not harmonious with the surrounding environment). To the

viewers who are unaware that they are looking at noxious weeds, weeds that have interesting color combinations, textures, forms, or flowers may be appealing and add visual interest to the landscape. Other viewers who recognize and appreciate the native vegetation may have views that are adversely affected by the continuing loss of native wildland acres. As native plant populations decrease, opportunities for viewing wildlife that rely on these native plants also could diminish.

Cumulative Effects

Ongoing or reasonably foreseeable activities besides recreation that occur on the W-CNF may introduce weed seeds or contribute to weed spread into recreation areas. Weed vectors and/or ground disturbance associated with road and trail construction, maintenance, and reconstruction (e.g., Richard Hollow Trail construction and Little Bear Trail reconstruction), livestock grazing on various sheep and cattle allotments, prescribed burns (e.g., the Hells Hollow and Stansbury Juniper Burn projects), and tree removal (e.g., the West Bear Vegetation Management project and Murdock Thinning project) could provide starting points for the spread of weeds into recreation areas. Activities on lands adjacent to W-CNF managed lands also could result in the introduction of weeds to recreation areas on the W-CNF. Table 4-1 lists past and present types of projects and future projects (with examples given previously) that could result in cumulative effects when combined with the effects of one of the alternatives of the proposed project. Because of the limited scope of the No Action Alternative, cumulative effects on recreation and scenic resources on the W-CNF would be adverse rather than beneficial.

4.4.2.2 Alternative 2: Proposed Action

Direct and Indirect Effects

Loss of Recreation Opportunities from Weed Treatment Activities

Recreation areas (both those that have developed facilities and those that are undeveloped) on the W-CNF would continue to be vulnerable to the introduction and spread of noxious weeds from activities occurring within and adjacent to these areas—the same types of effects as described for the No Action Alternative. However, the range of weed treatment options available and treatment of up to 1,586 acres of weeds each year under the Proposed Action is expected to be adequate for successfully managing existing and potential future weed introductions to W-CNF recreation areas. The Proposed Action would provide the flexibility to prioritize the need for weed treatments in recreation areas according to the vegetation cover type weed susceptibility (depicted in Figure 4-3). Successful management of existing and potential future weed infestations adjacent to and within W-CNF recreation areas would help reduce the likelihood of further weed spread in recreation areas on the W-CNF.

Aerial and ground-based herbicide applications or manual, mechanical, or biological control methods would likely result in access temporarily being precluded to areas being treated, which would also preclude recreation activities from occurring there. Personnel, vehicles, and equipment would generate noise and possibly fumes and dust in the area

Click here to view Figure 4-3 (2.9 MB)

being treated, which are expected to result in short-term effects on the quality of the recreational experience. Aerial applications would also generate noise, which is expected to result in short-term, adverse effects on the quality of the recreational experience.

Offsetting these potential impacts is that treatments would be localized and last a short time (several days to several weeks) in any given location. There would be no long-term effects on access to areas or on the ability to participate in recreation activities on the W-CNF as a result of up to 1,433 acres (up to approximately 0.11 percent of the W-CNF) of chemical weed treatment each year and treating up to a total of 1,586 acres of weeds per year using all treatment methods available under the Proposed Action. An exception to this would occur if an area is currently inaccessible for recreation pursuits because of noxious weeds, and removal of the noxious weeds and restoration/revegetation would open up the area. This would be considered a benefit to recreationists.

The Proposed Action weed management program would only occur during the summer recreation season and, therefore, existing recreation opportunities and scenic values would not be affected during the fall, winter, and spring. In summer, if visitors are recreating on the W-CNF where and when either aerial or ground-based weed management activities are occurring, some visitors may have their recreational experience interrupted and feel affected. Other viewers, however, may be interested in the activities that are going on around them (they require less privacy and are more accepting of human activities and human-altered settings). Because of the small percentage of total acres on the W-CNF that would be treated in any given year (up to approximately 0.13 percent or 1,586 acres total under the Proposed Action), the effect on recreation opportunities would be very localized, and would be expected to affect only a small number of recreationists.

Loss of Recreation Opportunities from Presence of Weeds

Aggressive weed treatment of the Proposed Action would likely result in halting or reducing the spread of noxious weeds into various recreation areas on the W-CNF. This would reverse or remove the barriers to access to those areas currently affected by the physical barriers presented by weeds (extensive areas of Dyer’s woad, for example). By improving access to areas used for recreation that are currently blocked by noxious weeds, recreationists’ abilities to participate in and enjoy recreation activities on the W-CNF would improve. This is considered a beneficial effect on those recreationists and recreation opportunities in the specific areas where recreation activities occur, and where noxious weeds are treated and/or eradicated.

Loss of Scenic Quality From Weed Infestations and Weed Treatments

Potential impacts on scenic resources during weed management activities would be short-term in any given location and would include dust from some weed treatment activities (for example, some mechanical treatments) and the presence and activities of personnel, vehicles, and equipment. For aerial applications, short-term views of airplanes would occur. Some recreationists viewing the area may see the presence and activities of personnel, vehicles, and airplanes as detracting from the scenic values of the area. These people would experience a temporary impact. For other people, the presence of these

activities would be interesting, add visual variety to the landscape, and not represent an impact.

Changes in the appearance of the setting would occur following treatment activities, including dead/wilted vegetation from herbicide spraying and/or bare ground/disturbed soil where the weeds were removed. This is not likely to persist over the long term, because of the beneficial effects of weed treatment, site restoration, and revegetation—if appropriate—that would re-establish native plant communities. There is, however, the potential for multiple treatments of weeds over several years, particularly of severe infestations, to ensure long-term success and re-establishment of native plant communities. Once weed management activities have ceased, it is expected that wildlife viewing opportunities would resume, and possibly improve, as native habitat is re-established and habitat conditions improve over the long term.

Scenic resources would be affected as discussed previously for the No Action Alternative. Viewers who are unaware that they are looking at noxious weeds and find them interesting because of their color combinations, textures, forms, or flowers, would be adversely affected following their removal. Other viewers who recognize and appreciate the native vegetation would have their views positively affected by the aggressive removal of weeds and restoration of native wildland acres. As native plant populations increase, opportunities for viewing wildlife that rely on these native plants would also increase.

Cumulative Effects

Cumulative effects on recreation and scenic resources resulting from treatments under the Proposed Action are likely to be beneficial to recreation areas, particularly in the long term. This benefit should be a direct result of increased success at halting the spread of noxious weeds on the W-CNF through their wide-spread eradication, containment, and control. Under the Proposed Action, the spread of weeds in W-CNF recreation areas would be expected to decline. Those types and examples of projects and activities that would increase weed invasion potential, and which were discussed under the Cumulative Effects section of the No Action Alternative (*Section 4.4.2.1*), would add to the burden of weed control for the W-CNF. However, under the Proposed Action, they are more likely to result in less invasion potential because of the expanded weed treatment options and acreages treated compared to the No Action Alternative or Alternative 3.

4.4.2.3 Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects

Loss of Recreation Opportunities from Weed Treatment Activities

Compared to the Proposed Action, this alternative includes fewer types of weed treatments (no herbicide application), would only treat up to 949 acres of weeds per year (approximately 0.08 percent of the W-CNF), and would require a greater use of controlled livestock grazing, biological treatments, and mechanical treatment. Similar to the summer months' effects described for the Proposed Action, access to areas for recreation pursuits and the ability to participate in and enjoy recreation activities on the

W-CNF may be disrupted by ground-based weed treatment activities under Alternative 3. Treatment-related effects on recreation and visual resources would generally be the same as discussed for the Proposed Action, but at a lesser degree with fewer acres being treated and no aerial or ground-based spray equipment being used. No long-term adverse effects on access to areas or the ability to participate in and enjoy recreation activities on the W-CNF would result from treating up to 949 acres of weeds annually under Alternative 3.

Loss of Recreation Opportunities from Presence of Weeds

A long-term benefit to recreationists would result from the treatment and reduction or elimination of noxious weeds, but it would be a lesser benefit than with the Proposed Action because Alternative 3 would treat fewer acres of weeds. In addition, weed treatments associated with Alternative 3 would be somewhat less effective than under the Proposed Action, potentially resulting in more weed-infested areas in the future under Alternative 3. Recreation areas with existing weed infestations and in or near native vegetation cover types with high susceptibility to weed infestations (depicted in Figure 4-3) likely would be at risk under Alternative 3.

Loss of Scenic Quality Because of Weed Infestations and Weed Treatments

Treatment-related effects on scenic resources would generally be the same as discussed for the Proposed Action, but at a lesser degree with fewer acres being treated and no aerial or ground-based spray equipment being used.

As discussed previously, a long-term benefit to recreationists would result from the treatment and reduction or elimination of noxious weeds. The extent of weed populations would slowly decrease, improving scenic resources. However, scenic value improvements would accrue at a slower pace with Alternative 3 and would be a lesser benefit than with the Proposed Action, because Alternative 3 would treat fewer acres of weeds.

Cumulative Effects

Adverse cumulative effects associated with other ongoing activities or occurrences on the W-CNF that would contribute to weed invasion or spread and from weed treatment activities that were described for the No Action Alternative and Proposed Action also would occur under Alternative 3. Weed invasion impacts would not be expected to occur as rapidly as under the No Action Alternative because of the additional acres that would be treated under Alternative 3, but they would be expected to occur more rapidly than under the Proposed Action because more acres of weeds would be treated each year and more treatment options are available with the Proposed Action than with Alternative 3.

4.4.3 Wilderness Resources

This section addresses potential project effects on Wilderness resources. No issues related to this subject were identified as significant during public scoping. However, an important Wilderness resources issue of concern was identified, as follows:

- The effects of weed infestations and treatments on Wilderness values

The following indicators were used to evaluate the potential risk of effects to Wilderness values:

- Areas infested within designated and recommended Wilderness areas (RFP Management Prescriptions 1.1, 1.2, 1.3, and 1.5)
- Location, timing, and duration of treatment activity within Wilderness

These indicators were used to assess the effects of weed infestations and weed treatments on Wilderness values (solitude, remoteness, primitive recreation opportunities, and natural appearance) as discussed in the following text. The effects on biodiversity on the W-CNF were discussed in *Section 4.2.4.2, Biodiversity,* and would be the same in Wilderness areas.

4.4.3.1 Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects

Areas Infested within Designated and Recommended Wilderness Areas

Figure 4-4 depicts designated (existing) and recommended Wilderness areas, known weed infestations, and areas categorized as having high, medium, or low susceptibility to weed invasion on the W-CNF. Most of the known noxious weed infestations on the W-CNF occur outside of Wilderness areas. Approximately 46 acres of known weed infestations exist in designated Wilderness, and less than 1 acre exists in recommended Wilderness. However, as discussed in *Section 3.5.3, Wilderness Resources,* existing weed infestations in Wilderness areas including Dyer's woad, leafy spurge, and Canada thistle are an increasing problem and starting to spread to new areas. The Mount Naomi Wilderness area in the Overthrust Mountains, especially, has had noxious weed invasions. Occurrences of noxious weeds are also becoming more common in wilderness areas near the Wasatch Front because of the high recreation use.

The potential for noxious weed introduction and spread would be highest in those portions of W-CNF Wilderness areas that have been categorized as having a high susceptibility to weed invasion. These are depicted in Figure 4-4 and include designated Wilderness areas in the northern and southern portions of the Overthrust Mountains; the west-central portion of the Bonneville Basin; and a recommended Wilderness area in the western portion of the Uinta Mountains. Weed susceptibility in most of the designated High Uintas Wilderness is rated as low.

There is the potential for noxious weeds to gradually spread into designated and recommended Wilderness areas because of the No Action Alternative's inability to keep pace with the anticipated spread of weeds on the W-CNF. No more than 126 acres of weed infestations would be treated annually under the No Action Alternative, consisting primarily of chemical spot treatments (up to 111 acres, but none in Wilderness) followed by controlled livestock grazing (12 acres), and handpulling or digging weeds (3 acres). This level of treatment would be far less than is needed to successfully manage existing and potential future weed infestations that could occur on the more than 300,000 acres of Wilderness areas on the W-CNF.

Click here to view Figure 4-4 (0.8 MB)

Because the No Action Alternative is a continuation of existing weed management practices, noxious weeds are expected to continue to grow and spread at a rate faster than they are removed. This may result in noxious weeds spreading into wilderness areas, possibly reducing or eliminating access to those areas, altering the natural appearance, impacting natural ecosystem values of Wilderness areas, and degrading solitude and remoteness values typically associated with Wilderness experiences. All of these are considered adverse effects on Wilderness values that would result from the continued spread of noxious weeds under the No Action Alternative.

Location, Timing, and Duration of Treatment Activity within Wilderness

The effects of weed treatment on solitude, remoteness, natural appearance, and primitive recreation opportunities in Wilderness areas would be very localized and limited, because of the very small number of acres that would be actively treated in any year (up to 126 acres on the entire W-CNF; and no chemical treatment is currently authorized in Wilderness). If visitors are recreating in Wilderness areas where and when weed treatment is occurring, their solitude and sense of remoteness may be interrupted. Some visitors may have their access to certain areas limited, and their ability to participate in their desired recreation activity may be restricted. These effects would be temporary and localized, and are expected to affect only a small number of recreationists. Weed prevention, control, and revegetation activities do not occur during the fall, winter, and spring recreation seasons and, therefore, would not impact Wilderness recreation activities during these times.

Cumulative Effects

Non-motorized vectors of noxious weed seed spread—such as the boots and clothing of backpackers, campers, hunters, and anglers and/or their horses and/or dogs—could directly result in the establishment of new weed infestations in Wilderness areas. These areas would then be subject to weed spread for the same reasons as given in the discussion of direct and indirect effects. Other ongoing or reasonably foreseeable activities that occur adjacent to Wilderness areas on the W-CNF may introduce weed seeds or contribute to weed spread into Wilderness areas. Weed vectors and/or ground disturbance associated with road and trail use, construction, and reconstruction, livestock grazing, prescribed burns, recreation activities at various types of sites, and tree removal, for example, could provide starting points for the spread of weeds into Wilderness areas. Table 4-1 lists past and present types of projects and future projects that could result in cumulative effects when combined with the effects of one of the alternatives of the proposed project. Examples of these types of projects include road and trail construction, maintenance, and reconstruction (e.g., Richard Hollow Trail construction and Little Bear Trail reconstruction); livestock grazing on various sheep and cattle allotments; prescribed burns (e.g., the Hells Hollow and Stansbury Juniper Burn projects); and tree removal (e.g., the West Bear Vegetation Management project and Murdock Thinning project). Because of the limited scope of the No Action Alternative, cumulative effects would be adverse rather than beneficial.

4.4.3.2 Alternative 2: Proposed Action

Direct and Indirect Effects

Areas Infested within Designated and Recommended Wilderness Areas

Wilderness areas on the W-CNF would continue to be vulnerable to the introduction and spread of noxious weeds from activities occurring within and on adjacent areas, the same as those described for the No Action Alternative. However, the range of weed treatment options available and treatment of up to 1,586 acres of weeds each year under the Proposed Action is expected to be adequate for successfully managing existing and potential future weed introductions to W-CNF Wilderness areas. The Proposed Action would provide the flexibility to prioritize the need for weed treatments in Wilderness areas according to their weed susceptibility. Successful management of existing and potential future weed infestations adjacent to and within W-CNF Wilderness areas would help reduce the likelihood of further weed spread in Wilderness areas on the W-CNF.

Location, Timing, and Duration of Treatment Activity within Wilderness

Impacts on Wilderness area values (solitude, remoteness, natural appearance, primitive recreation opportunities) anticipated under the No Action Alternative because of increased weed infestations would be more limited than under the Proposed Action. In addition, the proposed weed management program would only occur during the summer recreation season and, therefore, the existing Wilderness values would not be affected by weed treatment activities during the fall, winter, and spring months.

During the summer, access to areas for recreation pursuits, the ability to participate in recreation activities, and solitude and remoteness values of Wilderness areas may be disrupted by weed treatment activities. Depending on the treatment, weed species being treated, and size and location of the area to be treated, treatment duration in any given location could last several days to several weeks, with follow-up monitoring to determine how successful the treatment was. If visitors are recreating in the Wilderness area where and when ground-based weed treatment is occurring, some visitors may have their solitude and sense of remoteness interrupted and feel affected. Because of the relatively small total acres that would be treated on the entire W-CNF in any given year (up to 1,586 acres) under the Proposed Action, the effect on solitude/remoteness values on the more than 300,000 acres of Wilderness areas on the W-CNF would be very localized, and would be expected to affect only a small number of recreationists.

There would be changes in the natural appearance of the setting following weed treatment activities, including dead/wilted vegetation from herbicide spraying and/or bare ground/disturbed soil where the weeds were removed. This is not likely to persist over the long term, because of the beneficial effects of weed treatment, site restoration, and revegetation that would re-establish native plant communities. There is, however, the potential for multiple treatments of weeds over several years, particularly of severe infestations, to ensure long-term success and re-establishment of native plant communities.

Ground-based herbicide applications or manual, mechanical, or biological control methods would likely result in access being precluded to areas being treated, which would also preclude primitive recreation activities from occurring there. Personnel and equipment would generate noise and possibly fumes and dust in the area being treated, which are expected to result in short-term effects on the solitude and remoteness values of the area.

Offsetting these potential impacts is that treatment would be localized and last a short time (several days to several weeks) in any given location. There would be no long-term effects on access to Wilderness areas or on the ability to participate in primitive recreation activities under the Proposed Action. An exception to this would occur if an area is currently inaccessible for recreation pursuits because of noxious weeds and removal of the noxious weeds and restoration/revegetation would open up the area. This would be considered a benefit to recreationists.

Cumulative Effects

Cumulative effects on Wilderness values resulting from treatments under the Proposed Action are likely to be beneficial to Wilderness areas, particularly in the long term. This benefit should be a direct result of increased success at halting the spread of noxious weeds on the W-CNF through their wide-spread eradication, containment, and control. Under the Proposed Action, the spread of weeds in W-CNF Wilderness areas would be expected to decline. Examples of the those projects and activities that would increase weed invasion potential, and which were discussed under the Cumulative Effects section of the No Action Alternative (*Section 4.4.3.1*), would add to the burden of weed control for the W-CNF. However, under the Proposed Action, they are more likely to result in less invasion potential because of the expanded weed treatment options and acreages treated compared to the No Action Alternative or Alternative 3.

4.4.3.3 Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects

Areas Infested within Designated and Recommended Wilderness Areas

Direct and indirect effects related to weed treatments in Wilderness areas would be similar to those described for the Proposed Action, but would occur at a much slower pace because of no herbicide application in Alternative 3. A combination of primarily controlled livestock grazing and biological treatments, and a lesser amount of mechanical treatment, would be applied on up to 949 acres annually of weed infestations on the W-CNF under Alternative 3. Compared to the Proposed Action, where herbicide application would be the primary treatment method, Alternative 3 would be less effective in treating weeds; take longer to achieve a reduced level of success; and be less successful in improving altered conditions in remote, difficult to access locations that are generally representative of Wilderness areas on the W-CNF. Wilderness areas with existing weed infestations and with high susceptibility to weed infestations described under the No Action Alternative likely would be at risk under Alternative 3 as well.

Location, Timing, and Duration of Treatment Activity within Wilderness

Potential impacts to Wilderness values (solitude, remoteness, natural appearance, and primitive recreation opportunities) from weed infestations would be greater than under the Proposed Action, but potential adverse weed treatment effects on these Wilderness values would probably be slightly less than under the Proposed Action. Similar to the summer months' effects described for the Proposed Action, access to areas for primitive recreation pursuits, the ability to participate in primitive recreation activities, and solitude and remoteness values of the Wilderness areas may be disrupted by ground-based weed treatment activities under Alternative 3. Effects would generally be the same as discussed for the Proposed Action, but to a lesser degree with fewer acres being treated.

Cumulative Effects

Adverse cumulative effects associated with other ongoing activities or occurrences on the W-CNF that would contribute to weed invasion or spread and from weed treatment activities that were described for the No Action Alternative and Proposed Action also would occur under Alternative 3. Weed invasion impacts would not be expected to occur as rapidly as under the No Action Alternative because of the additional acres that would be treated under Alternative 3, but they would be expected to occur more rapidly than under the Proposed Action because more acres of weeds would be treated each year and more treatment options are available with the Proposed Action than with Alternative 3.

4.4.4 Roads and Roadless Areas

This section addresses potential project effects related to roads and roadless areas on the W-CNF. No significant issues or specific issues of concern associated with these Forest resources were identified during scoping. However, consideration of roads and roadless areas is an important component in assessing potential project effects on W-CNF features.

4.4.4.1 Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects

The distribution of roads and known weed infestations on the W-CNF was depicted in Figure 3-9 in Chapter 3. Data indicate an association between travel corridors and known weed infestations on at least some portions of the W-CNF. This same association would be expected to continue and probably strengthen under the No Action Alternative because of this alternative's inability to keep pace with the anticipated spread of weeds on the W-CNF. No more than 126 acres of weed infestations would be treated under the No Action Alternative each year. This level of treatment would likely be far less than is needed to successfully manage existing and potential future weed infestations along the more than 1,000 miles of roads present on W-CNF management areas.

As discussed in *Section 3.5.4, Roads and Roadless Areas* (in Chapter 3), roads and trails can provide a pathway for the introduction and spread of noxious weeds. Because of the W-CNF's adjacent relationship to urban communities, it is highly influenced by the rapid

population increases occurring in the area. As road use has increased, so have potential vectors and seed sources for the spread of noxious weeds within and adjacent to the W-CNF. Expected increases in weed infestations under the No Action Alternative would likely not prohibit the use of roads, but the use, maintenance, and construction of roads would contribute to increased weed infestations on the W-CNF.

Weed infestations associated with W-CNF roads and other parts of the Forest provide starting points for the potential spread of weeds into roadless areas. Figure 4-5 depicts roadless areas, known weed infestations, and areas categorized as having high, medium, or low susceptibility to weed invasion on the W-CNF. The occurrence of inventoried roadless areas near large infestations of noxious weeds is most apparent in the west-central portion of the Overthrust Mountains of the W-CNF, where large infestations of Dyer's woad are found. Inventoried roadless areas that allow for road construction and reconstruction and motorized use may be related to the abundance of noxious weeds in the vicinity, given that roads can serve as vectors for weed seed introduction and spread. The intermingled ownership pattern may also contribute to weed abundance.

The continued spread of noxious weeds in this and eventually in other roadless areas would be expected under the No Action Alternative because of the limited treatment options and relatively few acres of weeds that would be treated annually under this alternative. The potential for noxious weed introduction and spread also would be high in those portions of W-CNF roadless areas that have been categorized as having a high susceptibility to weed invasion. These are depicted in Figure 4-5 and are prominent in the northern and west-central portions of the Overthrust Mountains and much of the Bonneville Basin. Weed susceptibility in most portions of the Uinta Mountains is rated as moderate or low. The No Action Alternative would likely not be able to eradicate, control, or contain weed infestations if they occur in any of the W-CNF roadless areas. This could result in a negative impact to important roadless area characteristics such as diverse plant communities and reference landscapes.

Cumulative Effects

Inventoried roadless areas of the W-CNF that allow for the construction and reconstruction of roads would have a greater potential for noxious weed introduction and spread. The potential for the introduction and spread of noxious weeds in inventoried roadless areas where road construction and reconstruction or motorized use are not allowed would be comparatively less than in roaded areas. However, non-motorized vectors of noxious weed seed spread—such as from the boots and clothing of backpackers, campers, hunters, and anglers and/or their horses and/or dogs—could result in the establishment of weeds in backcountry roadless areas. These areas would be subject to weed spread for the same reasons as given in the discussion of direct and indirect effects.

Other ongoing or reasonably foreseeable activities on the W-CNF that may introduce weed seeds or contribute to weed spread through ground disturbance also could provide starting points for the spread of weeds into roadless areas. Table 4-1 lists past and present types of projects and future projects that could result in cumulative effects when combined with the effects of one of the alternatives of the proposed project. Examples of

these types of projects include road and trail construction, maintenance, and reconstruction (e.g., Richard Hollow Trail construction and Little Bear Trail reconstruction); livestock grazing on various sheep and cattle allotments; prescribed burns (e.g., the Hells Hollow and Stansbury Juniper Burn projects); tree removal (e.g., the West Bear Vegetation Management project and Murdock Thinning project); and Forest-wide recreational activities. Because of the limited scope of the No Action Alternative, cumulative effects would be adverse rather than beneficial.

4.4.4.2 Alternative 2: Proposed Action

Direct and Indirect Effects

Roads on the W-CNF would continue to provide a pathway for the introduction and spread of noxious weeds in adjacent areas, the same as described for the No Action Alternative. However, the range of weed treatment options available and treatment of up to 1,586 acres of weeds each year under the Proposed Action is expected to be adequate for eradicating, controlling, and/or containing existing and potential future weed introductions along W-CNF roads. This also would contribute to the successful management of existing weed infestations and prevention of new weed infestations in roadless areas on the W-CNF. The Proposed Action would provide the flexibility to prioritize the need for weed treatments in areas according to their weed susceptibility. Successful management of existing and potential future weed infestations along W-CNF roads and in roadless areas would help reduce the likelihood of further weed spread on the W-CNF.

Cumulative Effects

Cumulative effects on roads and roadless areas resulting from treatments under the Proposed Action are likely to be beneficial to road corridors and roadless areas, particularly in the long term. This benefit should be a direct result of increased success at halting the spread of noxious weeds on the W-CNF through their wide-spread eradication, containment, and control. Under the Proposed Action, the spread of weeds along roads and trails and in roadless areas on the W-CNF would be expected to decline. Those projects and activities that would increase weed invasion potential and which were discussed under the Cumulative Effects section of the No Action Alternative would add to the burden of weed control for the W-CNF. However, under the Proposed Action, they are more likely to result in less invasion potential because of the expanded weed treatment options and acreages treated compared to the No Action Alternative or Alternative 3.

Click here to view Figure 4-5 (0.8 MB)

4.4.4.3 Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects

Direct and indirect effects related to weed treatments along roads and in roadless areas would be similar to those described for the Proposed Action, but would occur at a much slower pace because there would be no herbicide application in Alternative 3. A combination of primarily controlled livestock grazing and biological treatments, and a lesser amount of mechanical treatment, would be applied on up to 949 acres annually of weed infestations on the W-CNF under Alternative 3. Compared to the Proposed Action, where herbicide application would be the primary treatment method, Alternative 3 would be less effective in treating weeds, take longer to achieve a reduced level of success, and be less successful in improving native plant diversity. Areas of existing weed infestations and areas with high susceptibility to weed infestations described under the No Action Alternative likely would be at risk under Alternative 3 as well.

Cumulative Effects

Adverse cumulative effects associated with other ongoing activities or occurrences on the W-CNF that would contribute to weed invasion or spread, and from weed treatment activities that were described for the No Action Alternative and Proposed Action, also would occur under Alternative 3. Weed invasion impacts would not be expected to occur as rapidly as under the No Action Alternative because of the additional acres that would be treated under Alternative 3; however, they would be expected to occur more rapidly than under the Proposed Action because more acres of weeds would be treated each year and more treatment options are available with the Proposed Action than with Alternative 3.

4.4.5 Human Health and Safety

Issue No. 6 identified during public scoping was as follows:

- Treatment effects on human health

The following indicators were listed in Chapter 2 to evaluate the potential effects for Issue No. 6:

- Potential for health effects to workers from acute herbicide exposures during ground and aerial applications
- Potential for health effects to visitors on the W-CNF from chronic and/or acute herbicide exposure to herbicide residuals

Chemical (herbicide) treatment is an important method when the management objective is weed eradication or control. It involves the application of herbicides (chemical compounds) at certain stages of plant growth to kill weed species. Herbicides are extensively screened and tested before they are approved and registered for use by the EPA. Such registrations typically require at least 120 tests over a 7- to 10-year period, and can cost approximately $30 million to $50 million (Forest Service 2001d). Further, herbicide labels carry the force

of laws governed by federal and state agencies. Labels contain information about the proper administration of each herbicide, including the following:

- List of the ingredients
- EPA registration number
- Precautionary statements (hazards to humans and domestic animals, personal protective equipment, user safety recommendations, first aid, and environmental hazards)
- Directions for use, storage, and disposal
- Mixing and application rates
- Approved uses and inherent risks of use
- Limitations of remedies
- General information

Numerous factors are used to determine the likelihood of a herbicide eliciting an adverse effect on an individual. The most obvious are the concentration and toxicity of the chemical encountered, although there are many other factors that affect the risk posed to those working on or visiting Forest Service lands.

This analysis begins with a section titled *Toxicity/Hazard Assessment of Herbicides,* which provides detailed information about the herbicides that would potentially be used in the analysis area, as well as their relative potency to humans. This is followed by a discussion of the potential effects from herbicide use associated with each alternative on forest workers and visitors/residents.

4.4.5.1 Toxicity/Hazard Assessment of Herbicides

A wide variety of opinions exist within the general population concerning the value and safety of pesticides, including the herbicides proposed for use on the W-CNF. Many people, especially in rural and agricultural areas, regard pesticides as a necessary part of their business or living, and as a relatively safe tool—if used properly (Forest Service 2001f). The U.S. Forest Service's Northern Region (Region 1) has analyzed the risk of using a number of the herbicides proposed for use on the W-CNF, including 2,4-D, picloram, clopyralid, dicamba, glyphosate, imazapic, and metsulfuron methyl. This analysis is presented in the following two risk assessment documents: *Risk Assessment for Herbicide Use in Forest Service Regions 1, 2, 3, 4, and 10 and on Bonneville Power Administration Sites* (Forest Service 1992); and *Human Health Risk Assessment for Herbicide Application to Control Noxious Weeds and Poisonous Plants in the Northern Region* (Monnig 1988). Additional studies or research referenced include *EPA Science Advisory Board Report: Assessment of Potential 2,4-D Carcinogenicity-3/91* (EPA 1994) and *EPA RdD/Peer Report of Picloram-9/93* (EPA 1993). These documents are incorporated into this document by reference and are included in Region 4 Forest Service files.

The Forest Service (2001f) discussed the considerable body of laboratory test data that are available on herbicides. Under the Federal Insecticide, Fungicide, and Rodenticide

Act (FIFRA), herbicide manufacturers are required to register each herbicide and its label with EPA before it can be manufactured for commercial use—the process of which comprises submitting a number of items to EPA:

- a registration application
- a proposed label
- a statement of all claims to be made for the herbicide
- directions for its use
- a confidential statement of the formula
- a description of the tests that provide the basis for the manufacturer's claims

Most of the laboratory tests have been conducted to meet requirements for EPA registration of these chemicals for use in the United States. Current federal regulations allow for conditional registration of herbicides pending the completion of all tests required for final registration as long as no unreasonable adverse effects are found in the interim. The Forest Service (2001f) also noted that this allowance for "continued use before all testing of a herbicide is completed" concerns some members of the public and has led to charges that "untested" herbicides are allowed on the market. To the contrary, all of the herbicides proposed for use on the W-CNF are EPA-approved for use according to their label instructions, are conditionally registered, and have been assigned EPA registration numbers.

Appendix B, Characteristics of Herbicides, provides information about the characteristics and properties of the herbicides proposed for use on the W-CNF. Information about toxicity levels and toxicity categories comes from results of tests the EPA requires under FIFRA for herbicide registration that must evaluate acute (short-term) and chronic (longer term) exposures of laboratory animals to chemicals. All of these herbicides have been subjected to long-term feeding studies that test for general systemic effects (for example, kidney and liver damage). Additionally, tests on the effects on reproductive systems, mutagenicity (birth defects), carcinogenicity (cancer), and teratogenicity (malformations) have been conducted (Forest Service 1999a, 2001f).

Table 4-14 lists EPA toxicity categories (EPA 2004c, Forest Service 2001d)—I, II, III, or IV—for various types of harmful acute exposure routes or reactions (oral, dermal, inhalation, eye irritation, and skin irritation). Herbicides are linked to a specific toxicity category by the potency of the product for a given exposure route. Each toxicity category is accompanied by a "Signal Word": danger/poison, warning, caution, or none. Details of the concentration ranges for each toxicity category and exposure route are provided in Table 4-14. As an example, a herbicide with an oral LD_{50} of 600 mg/kg would be considered a toxicity Category III for acute oral toxicity and might be labeled as such by the following statement: *"Caution—harmful if swallowed. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco."*

TABLE 4-14
EPA Toxicity Categories for Various Types of Harmful, Acute Reactions

Toxicity Category	Signal Word	Oral LD_{50} (mg/kg)	Dermal LD_{50} (mg/kg)	Inhalation LC_{50} (mg/L)	Eye Irritation	Skin Irritation
I	DANGER Poison	0 – 50	0 – 200	0 – 0.2	Corrosive; corneal opacity not reversible within 7 days	Corrosive
II	WARNING	>50 – 500	>200 – 2,000	>0.2 – 2.0	Corneal opacity reversible within 7 days; irritation persisting for 7 days	Severe irritation at 72 hours
III	CAUTION	>500 – 5,000	> 2,000 – 20,000	>2.0 – 20	No corneal opacity; irritation reversible within 7 days	Moderate irritation at 72 hours
IV	NONE	>5,000	>20,000	>20	No irritation	Mild or slight irritation at 72 hours

Sources: Forest Service 2001d, EPA 2004a

Table 4-15 compares human hazards based on these EPA acute toxicity categories for the herbicides proposed for use on the W-CNF. EPA toxicity categories for acute oral, acute dermal, acute inhalation, and primary skin irritation are rated as “caution” or “none” for all of the herbicides, except picloram (“danger/poison” for inhalation). Table 4-15 indicates acute effects associated with primary eye irritation exceed “caution” levels for five of the herbicides.

TABLE 4-15
Human Hazards Based on Acute Toxicity Categories for Weed Control Herbicides on the W-CNF

Herbicide	Acute Oral Toxicity	Acute Dermal Toxicity	Acute Inhalation	Primary Eye Irritation	Primary Skin Irritation
2,4-D amine	Caution	Caution	Caution	Danger-Poison	Caution
Clopyralid	Caution	Caution	Caution	Warning	None
Dicamba	Caution	None	None	Danger-Poison	None
Glyphosate	None	None	Caution	Warning	None
Imazapic	None	None	None	Caution	Caution
Metsulfuron Methyl	None	Caution	Caution	Warning	Caution
Picloram	Caution	Caution	Danger-Poison	Caution	None

Sources: EXTOXNET 2004, EPA 2004a, Bio-Weed® 2002, Forest Service 2001a, and U.S. Department of Energy 2002

Table 4-16 compares the potential for harmful human carcinogenic, teratogenic, reproductive, and mutagenic chronic effects for the herbicides proposed for use on the W-CNF. Data presented in Table 4-16 show that for each of the four human health categories evaluated, the herbicides would either have “no effects” (no effects have been shown in laboratory tests and it is not considered a significant hazard to humans) or “unlikely effects” (inconsistent or isolated effects have been shown in laboratory tests and it is not considered a significant hazard to humans at expected exposure levels), with

two exceptions: the “unknown effects” regarding the carcinogenicity of 2,4-D and picloram, which indicate that laboratory tests are inconclusive or further testing is required.

TABLE 4-16
Comparison of Harmful Chronic Effects of Herbicides Proposed for Controlling Weeds on the W-CNF

Herbicide	Potential Chronic Effects			
	Carcinogenic	Teratogenic	Reproductive	Mutagenic
2,4-D amine	Unknown	Unlikely	Unlikely	Unlikely
Clopyralid	No effects	No effects	No effects	No effects
Dicamba	No effects	No effects	Unlikely	No effects
Glyphosate	No effects	No effects	Unlikely	No effects
Imazapic	No effects	No effects	No effects	No effects
Metsulfuron Methyl	No effects	No effects	No effects	No effects
Picloram	Unknown	No effects	No effects	Unlikely

No Effects = No effects have been shown in laboratory tests and it is not considered a significant hazard to humans
Unlikely = Inconsistent or isolated effects have been shown in laboratory tests and it is not considered a significant hazard to humans at expected exposure levels
Unknown = Laboratory tests are inconclusive or further testing is required
Sources: EXTOXNET 2004, EPA 2004a, Bio-Weed® 2002, Forest Service 2001a, and U.S. Department of Energy 2002

The herbicides identified in these tables also contain “inert” constituents, including surfactants, which are not expected to have any significant human health effect at relevant exposure levels. However, implementation of Forest Management Standards and Guidelines, BMPs, and mitigation measures (described in Chapter 2) would be expected to minimize the potential for adverse impacts (if any) of these inactive constituents as well as of the herbicides themselves to the potentially affected human user groups described previously. This minimization is accomplished by reducing the potential for human exposure to active and inactive ingredients or by reducing the exposure to elevated levels of these ingredients.

Table 4-16 indicates that none of the herbicides considered for use on the W-CNF are known carcinogens, although the Forest Service (1999, 2000b, 2001f) has stated that the evidence on the carcinogenicity of 2,4-D and picloram is widely debated. Thus, a summary of evidence related to the carcinogenic potential of these two herbicides is provided in the following section.

Effects of 2,4-D and Picloram

The EPA developed a carcinogen classification system (EPA 1986) that represents a weight-of-evidence approach to classifying the likelihood that a constituent is a human carcinogen. Information considered in developing the classification includes human studies of the association between cancer incidence and exposure, as well as long-term animal studies under controlled laboratory conditions. Other supporting evidence considered includes short-term tests for genotoxicity, metabolic and pharmacokinetic properties, toxicological effects other than cancer, structure-activity relationships, and

physical and chemical properties of the constituent. EPA's weight-of-evidence classification system is shown in Table 4-17.

TABLE 4-17
EPA Weight-of-Evidence Classification System for Carcinogenicity

Group	Description
A	Human carcinogen, based on evidence from epidemiological studies
B1 or B2	Probable human carcinogen B1 indicates that limited human data are available B2 indicates sufficient evidence in animals and inadequate or no evidence in humans
C	Possible human carcinogen, based on limited evidence in animals
D	Not classifiable as to human carcinogenicity
E	Evidence of noncarcinogenicity for humans

Source: EPA 1986

According to the EPA's Integrated Risk Information System (IRIS), both 2,4-D and picloram have not undergone a complete evaluation and determination under its program for evidence of human carcinogenic potential (EPA 2004b). The Forest Service Project File on the risk assessments cited previously (Monnig 1988, Forest Service 1992) contains a letter from Dr. John Graham of the Harvard University School of Public Health stating that the weight of evidence for 2,4-D as a carcinogen is "not strong," and even if it is ultimately shown to be carcinogenic, it is "unlikely to be [a] very potent" one. In addition, the Science Advisory Board (EPA 1994), at the request of the EPA, reviewed 2,4-D and concluded as follows (*in* Forest Service 1999a):

> *Epidemiologic cohort studies have generally shown no increased risk of cancer, albeit that all of the populations for which specific exposure to 2,4-D have been identified were small, and the follow up period short. . .The committee concluded that current studies cannot distinguish whether observed risks reported are due to the use of 2,4-D. . .The Committee concludes that the data are not sufficient to find that there is a cause and effect relationship between the exposure to 2,4-D and Non-Hodgkin's Lymphoma.*

Regarding picloram, the *EPA Peer Report* (EPA 1993) review of this chemical classified it into Group E. A Group E chemical (see Table 4-17) is part of a group "that shows no evidence for carcinogenicity in at least two adequate animal tests in different species or in both adequate epidemiologic and animal studies" (*in* Forest Service 1999a). Considering the available studies on 2,4-D and picloram, the current evidence is mixed suggesting that these compounds are, at most, weakly carcinogenic.

Additionally, an increasing scientific concern and public debate has occurred in the last decade regarding endocrine disrupting chemicals (EDCs) and their effects on human and wildlife endocrine systems. Ecologists, epidemiologists, endocrinologists, and toxicologists have called attention to the potential hazardous effects that estrogen-like and anti-androgenic chemicals and certain other environmental chemicals may have on human health and ecological well-being. They assert that certain chemicals may disrupt the endocrine system. Because EDCs mimic the effects of some hormonal or

reproductive responses, they are often blamed for decreases in fertility, altered sexual characteristics in wildlife, or increases in certain cancers.

As discuss previously in *Section 4.2.3, Wildlife Resources*, and in regard to the effects of herbicides on wildlife, it is unknown whether herbicides have the same effect as DDT and other pesticide compounds. For example, 2,4-D mimics the growth hormone auxin, which in turn causes uncontrolled growth and eventual death in target plant species (Tu *et al.* 2001). This potential hormone disruption implicates 2,4-D as an endocrine disrupter. A recent study showed that 2,4-D does not influence male-to-female sex reversal in alligators (Guillette *et al.* 2000). However, little connection has been made between endocrine disruption in other wildlife or human health and herbicide use, primarily because information is not available (Safe et al. 2000).

No observed effect levels (NOELs) are available for most types of laboratory toxicity tests, and they indicate the highest dose in a particular test that did not result in adverse health effects to the animal being tested (Forest Service 2001f, 1999). Extrapolating a NOEL from an animal study to humans is an uncertain process. The EPA compensates for this uncertainty by dividing NOELs from animal tests by a safety factor (typically 100) when deciding how much herbicide will be allowed on various foods. As noted previously in *Section 4.2.3.1*, this adjusted dose level is referred to as the acceptable daily intake (ADI) and is determined by the EPA to be a dose of a particular chemical that is believed to be safe, even if received every day for a lifetime. The ADI value is usually expressed as milligrams of herbicide allowed per kilogram of body weight per day. ADI values are inversely proportional to the toxicity of the herbicide. Table 4-18 lists the ADIs for herbicides proposed for use on the W-CNF. The lowest ADI value among the herbicides listed in Table 4-18 is for 2,4-D.

TABLE 4-18
Acceptable Daily Intake (mg/kg-day)

Herbicide	ADI[a]
Picloram	0.07
2,4-D amine	0.01 (0.3)[b]
Glyphosate	0.1
Imazapic	No data
Dicamba	0.03
Clopyralid	0.5
Metsulfuron methyl	0.25

[a] From Forest Service 1992 *in* Forest Service 2001d
[b] For 2,4-D the World Health Organization has established an ADI of 0.3

In the risk assessments cited in Table 4-18, the Forest Service (Forest Service 2001f) has calculated that the 1-day (ADI) dose for workers applying 2,4-D with a backpack sprayer could potentially exceed the EPA's recommended daily dose. However, these risks were determined to be very small because the spraying would only take place a few weeks each year, as compared to the EPA's ADI values, which assume a lifetime of daily doses.

In addition, BMPs and mitigation measures (listed in Chapter 2) to be implemented during weed treatment are intended to minimize the incidence of worker exposure to herbicides. They include protective measures that would reduce the potential for worker exposure to active and inactive herbicide ingredients or to elevated levels of these ingredients.

The Forest Service (1999, 2001f) also acknowledged the possibility of idiosyncratic responses such as hypersensitivity in a small percentage of the population. Such individuals are usually aware of their sensitivities because various natural and synthetic compounds typically trigger them. These persons would not be permitted to work on herbicide spray crews.

4.4.5.2 Alternative 1: No Action (Continuation of Current Management)

Direct and Indirect Effects

The continuation of current management practices would consist of very limited chemical, mechanical, and, to a lesser extent, controlled livestock grazing treatment of noxious weeds. Only the chemical treatment is examined here. Future treatment levels and weed species treated under the No Action Alternative would be similar to those treated in 2004 (Table 2-2 in Chapter 2). Because there has been no systematic approach to weed treatment across the W-CNF, the treatments have been associated with other activities and generally limited to areas easily accessed while performing other work. At present, only the Overthrust Mountains and Uinta Mountains are treated using chemicals (spot treatment of weeds).

Potential for Health Effects to Workers from Acute Herbicide Exposures during Application

The application of herbicides is very spatially limited and represents the only areas potentially at risk of affecting workers under the No Action Alternative. At present, only up to 111 acres are treated annually using ground-based applications. This same practice would continue under the No Action Alternative. Although Forest Management Standards and Guidelines, BMPs, and mitigation measures for handling and applying herbicides would be followed, acute worker exposures through inhalation, incidental ingestion, and dermal contact is possible under this alternative. The potential for effects to workers is low, and is examined above in *Section 4.4.5.1, Toxicity/Hazard Assessment of Herbicides*.

Forest worker health and safety could potentially be indirectly impacted in the event of an accidental herbicide spill. The Forest Service (1999a) reported that an examination of various accident records for a 10-year period revealed no major accidents involving herbicide application projects. The Forest Service Northern Region Health Risk Assessment (Monnig 1988 *in* Forest Service 1999) states that spills of herbicide concentrate directly onto people could cause acute effects such as nausea, trembling, and headaches, depending on the degree of exposure, cleanup time, and individual factors. The calculated probability of truck spills involving herbicides, assuming 1,220 weed treatment projects per year, ranged from five every 1,000 years to one accident in 2,400 years. The probability of such an accident involving a drinking water reservoir was

conservatively calculated at one accident every 34,000 years (Monnig 1988 *in* Forest Service 1999).

To prevent and reduce the risk of the occurrence of accidental herbicide spills, a number of management practices and mitigation measures are identified in Chapter 2 for both the ground-based and aerial application of herbicides. Specifically, the following measures will help ensure human safety:

- defined procedures for mixing, loading, and disposing of herbicides
- only mixing herbicides at sites where spills into streams could not occur
- properly calibrating, rinsing, and cleaning equipment
- having an approved herbicide emergency spill plan and spill containment equipment available during herbicide application in the unlikely event a spill did occur
- maintaining various-sized, no-treatment/no-spray buffer zones around waterbodies, depending on the method of herbicide application

Other measures specifically directed at protecting human health and safety from herbicide use in the W-CNF are listed under *Section 2.3.7.4 Chemical Application Protective Measures* in Chapter 2.

Potential for Health Effects to Visitors on the W-CNF from Herbicide Residuals Following Application

The application of herbicides is ground based, very spatially limited, and represents the only areas potentially at risk to W-CNF visitors under the No Action Alternative. At present, only up to 111 acres are treated annually using ground-based applications. This same practice would continue under the No Action Alternative. Although Forest Management Standards and Guidelines, BMPs, and mitigation measures for applying herbicides would be followed, individuals could be exposed to residual herbicides through the inhalation of dust or through dermal contact with sprayed vegetation. No problems have been reported because of existing treatment practices and none would be expected with implementation of the No Action Alternative. The potential for effects to W-CNF visitors is examined above in *Section 4.4.5.1, Toxicity/Hazard Assessment of Herbicides*.

Indirect exposure could occur to visitors through accidental herbicide spills or hiking. Accidental spill indirect effects were discussed in the preceding section. The Forest Service (2000f) cited results of risk assessments (Forest Service 1992, Monnig 1988) on the risk of indirect exposure to people hiking through a recently sprayed area. In this setting, the primary ingestion route for the herbicide would be through the skin. If a hiker walked through an area just sprayed with 2,4-D, the dose of 2,4-D received would be 40 times lower than the EPA's ADI for 2,4-D. In the case of picloram, the dose received in 1 hour by people picking berries in an area recently sprayed with this chemical would be 37 times lower than the EPA's ADI (Forest Service 2001f). Because a hiker walking directly under an aerial application could experience higher exposure levels, protective measures are required before and during aerial herbicide applications (see *Section 2.3.7.4, Chemical Application Protective Measures, Items 2a-2e* in Chapter 2). In particular,

adjacent land owners and affected permit holders will be notified in advance. Before spraying, an aerial or on-the-ground inspection will be made to ensure no one is in the area.

Cumulative Effects

Potential cumulative effects to human health from using herbicides to treat weeds would apply to workers and to the public who may be repeatedly exposed to herbicides over an extended period of time. As mentioned previously, the No Action Alternative offers limited treatments using herbicides on the W-CNF. However, there is still a possibility for cumulative impacts to W-CNF workers and visitors under this alternative.

Potential cumulative effects to human health from using herbicides to treat weeds would apply to workers and to the public, who may be repeatedly exposed to herbicides over an extended period of time. The ADIs listed in Table 4-18 are based on the level of herbicide that would be acceptable each day for a lifetime. As noted in other assessments of herbicide toxicity (Forest Service 2001f), a person may be exposed to some quantity of herbicide over time; however, because spraying would occur for only a few weeks each year, the daily intake would not approach the EPA's ADI standards. The risk assessments cited previously (Monnig 1988, Forest Service 1992) assume that 2,4-D and picloram are carcinogenic, although, as discussed previously, current evidence is inconclusive. The risk assessments projected that cancer rates would be highest for workers rather than the general public because their doses would be expected to be the highest. Cancer probabilities of workers would increase by about 1 in 1 million after spraying 2,4-D for 193 days or picloram for 17,000 days (Monnig 1988 *in* Forest Service 2001f). These estimates were based on a worst-case exposure scenario: a high dose of herbicide with a low amount of worker protection.

Table 4-19 provides some perspective on the estimated cancer risks projected for spraying 2,4-D and picloram versus other common activities or exposures. For example, one round-trip transcontinental air trip represents an increased risk of cancer from cosmic rays of approximately 1 in 1 million. The same level of increased risk is associated with living in Denver, Colorado, for 1.5 months rather than at sea level, because of increased cosmic rays, as well as from smoking two cigarettes, or receiving 20 days of natural background radiation.

TABLE 4-19
1 In 1 Million Risks of Cancer Death

Source of Risk	Type and Amount of Exposure
Herbicide Worker [a]	• 2,4-D 193 days of spraying • Picloram 17,000 days
Cosmic Rays [b]	• One transcontinental round trip by air • Living 1.5 months in Colorado compared to New York • Camping at 15,000 feet over 6 days compared to sea level

TABLE 4-19
1 In 1 Million Risks of Cancer Death

Source of Risk	Type and Amount of Exposure
Eating and Drinking [b]	• 40 diet sodas (saccharin) • 6 pounds of peanut butter (aflatoxin) • 180 pints of milk (aflatoxin) • 200 gallons of drinking water from Miami or New Orleans • 90 pounds of broiled steak (cancer risk only)
Smoking [b]	• 2 cigarettes
Other—20 days of sea level natural background radiation [b]	• 2.5 months in masonry rather than wood building • 1/7 of a chest x-ray using modern equipment

[a] From Monnig (1988 *in* Forest Service 2001f)
[b] From Crouch and Wilson (1982 *in* Forest Service 1999a)

The Forest Service (1999) reported that cancer risks to members of the general public are 100 to 1,000 times less than the risk to workers when considering exposure to the same herbicide. They concluded that risks on this order could not be detected by epidemiology studies as conducted by the National Cancer Institute. Because the average American has about a 1 in 4 chance of developing cancer in his or her lifetime, the cumulative impact from spraying at the rates proposed would not be expected to be significant.

Individuals who work in agricultural or the lawn and garden industries may have additional exposure to herbicides over and above those that may be encountered on the W-CNF. However, given the protective measures directed at human health, the cumulative impacts from herbicide spraying on the W-CNF, while complying with all EPA label directions, are not expected to be significant.

The Forest Service (2001f) summarized previous reports on the possible synergistic effects of herbicides. Synergism is when the combined cumulative impact of two or more chemicals exceeds the impacts that would result from adding their individual effects. The previously referenced risk assessments considered various possible synergistic effects, including interactions of active and inert ingredients in a herbicide formulation; interactions of herbicides and other chemicals in the environment; and the cumulative effects of herbicide treatments on the W-CNF and other herbicide use to which the public might be exposed, such as on adjacent non-National Forest lands. The Forest Service (2001f) concluded that for a number of reasons, synergistic or other unusual cumulative interactions would be expected to be rare. They cited work by Mullison (1985), Monnig (1988), Forest Service Risk Assessment for Herbicide Use (1992), and EPA (1994) on the low teratogenic, mutagenic, and carcinogenic properties of herbicides compared to naturally occurring chemicals in food. They also noted that the low and short-lived doses that would result from spraying these herbicides would be very small compared to many other chemicals in the environment. Finally, they cited the EPA's *Guidelines for the Health Risk Assessment of Chemicals* that appeared in the Federal Register on September 24, 1986, that a synergistic effect is not expected for these relatively small doses of herbicides. The Forest Service (2001f) cites recent research by Arnold et al. (1996) and a review of this work by Kaiser (1996) on the synergistic effects of four

herbicides (three of these have been banned in the United States), but concludes that there is not yet sufficient scientific research that the chemicals proposed for use would exhibit synergistic effects.

Table 4-1 lists ongoing and reasonably foreseeable projects, including those related to noxious weed management, within the W-CNF that were considered in the cumulative impact analysis. The Forest Service cannot absolutely guarantee the absence of a synergistic reaction between the herbicides proposed for use on the W-CNF and other chemicals to which workers or the public might be exposed. However, based on the best scientific information available (see *Section 4.4.5.1, Toxicity/Hazard Assessment of Herbicides*) and assuming the full implementation of all protective measures for the aerial and ground-based application of herbicides across the W-CNF, it would be reasonable to expect that cumulative human health risk from herbicide applications and immediately adjacent areas would be very low to nonexistent. Additionally, there would likely be no adverse cumulative effects on the public or workers from potential exposures occurring from other ongoing or future activities on the W-CNF that are unrelated to weed treatments.

4.4.5.3 Alternative 2: Proposed Action

Direct and Indirect Effects

Potential for Health Effects to Workers from Acute Herbicide Exposures During Application

The Proposed Action includes both aerial and ground-based herbicide applications. The Proposed Action would be the most aggressive treatment using herbicides across the W-CNF, and although Forest Management Standards and Guidelines, BMPs, and mitigation measures for handling and applying herbicides would be followed, acute worker exposures through inhalation, incidental ingestion, and dermal contact is possible under this alternative. The potential for effects from herbicide exposure to workers is examined above in *Section 4.4.5.1, Toxicity/Hazard Assessment of Herbicides*. Direct and indirect effects as discussed in *Section 4.4.5.2* also apply to this alternative, but would have a greater probability of occurring given the larger area to which herbicides would be applied.

Potential for Health Effects to Visitors on the W-CNF from Herbicide Residuals Following Application

The Proposed Action includes both aerial and ground-based herbicide applications. Individuals visiting the W-CNF could be exposed to residual herbicides through the inhalation of dust or through dermal contact with sprayed vegetation. Aerial application of herbicides would likely occur in the most remote areas where access is limited and away from private land owners and most recreationists. The potential for herbicide exposure to W-CNF visitors is examined above in *Section 4.4.5.1,Toxicity/Hazard Assessment of Herbicides*. Direct and indirect effects as discussed in *Section 4.4.5.2, Alternative 1: No Action,* also apply to this alternative, but would have a greater probability of occurring given the larger area to which herbicides would be applied.

Cumulative Effects

Cumulative effects would be the same as discussed in *Section 4.4.5.2, Alternative 1: No Action*.

4.4.5.4 Alternative 3: Weed Treatment Excluding Herbicide Use

Direct and Indirect Effects

Potential for Health Effects to Workers from Acute Herbicide Exposures During Application

Under Alternative 3, no herbicides would be used, and only grazing or manual and mechanical, biological, and IWM non-treatment elements would be implemented. Under this scenario, there are no exposure pathways where workers could be exposed to herbicides.

Potential for Health Effects to Visitors on the W-CNF from Herbicide Residuals Following Application

Under Alternative 3, no herbicides would be used, and there would be no exposure pathways where W-CNF visitors could be exposed to herbicides.

Cumulative Effects

Alternative 3 proposes no chemical treatments so there is no risk of cumulative effects to members of the public or workers from herbicide exposure.

4.4.6 Cultural Resources

This section addresses potential project effects on cultural resources. No issues related to this subject were identified as significant during public scoping; however, an important cultural resources issue of concern was identified as follows:

- The effects of weed infestations and treatments on cultural resources

The following indicators were used to evaluate the potential risk of effects to cultural resource sites

- Compliance with the NHPA as amended
- Compliance with the ARPA
- Compliance with EOs pertaining to the consultation and coordination with American Indian Tribal Governments
- Erosion or other ground disturbance at cultural resource sites
- Disturbance of plants used by Native Americans

The proposed project is primarily designed to treat potential future weed infestations in the W-CNF. It is not possible at this time to discuss site-specific environmental effects on

cultural resources from implementing the proposed project because it is unknown where or with what rigor the Proposed Action, or an alternative, would be implemented. These decisions would be made in the future and vary with the location, nature, severity, and species of weed infestation as well as other factors, such as the use of BMPs and protection and mitigation measures designed to protect Forest resources. Because of this, the following discussion of environmental consequences focuses on the types of effects that may occur from a type of treatment. A site-specific review meeting the requirements of Section 106 of the National Historic Preservation Act and National Environmental Policy Act would be implemented by the Forest Service Cultural Resources Specialist before any weed treatment activities occur each year to avoid or mitigate the potential for adverse effects.

4.4.6.1 Alternative A: No Action (Continuation of Current Management)

Direct and Indirect Effects

Compliance with the NHPA as Amended

The NHPA requires the identification of cultural resources during the planning phase of a project; a determination of significance for potential affected resources; and provisions for mitigation of any significant sites that may be affected for any Federally funded, permitted, or licensed activities on National Forests.

The No Action Alternative has a slight potential to impact cultural resources because there would be some localized ground disturbing activities from very limited hand pulling and chemical treatment of weeds. This would result in potential adverse effects if the roots of weeds are attached to archaeological deposits. It is anticipated, however, that these activities would result in no adverse effects on cultural resources because site-specific reviews by the Cultural Resources Specialist would occur before weed treatment activities commence each year.

Compliance with the Archaeological Resources Protection Act

The potential effects of very limited hand pulling and chemical treatment of weeds would be the same as described above for NHPA compliance and would not result in adverse effects on archaeological resources.

Compliance with Executive Orders Pertaining to the Consultation and Coordination with American Indian Tribal Governments

The potential effects of the No Action Alternative on cultural resources would be the same as described above for NHPA and ARPA compliance and would not result in adverse effects.

Erosion or Other Ground Disturbance at Cultural Resource Sites

As described previously, the No Action Alternative has a slight potential to impact cultural resources because there would be some localized ground disturbing activities from very limited hand pulling and chemical treatment of weeds. This would result in potential adverse effects if the roots of weeds are attached to archaeological deposits. It is anticipated, however, that these activities would result in no adverse effects on cultural

resources, because site-specific reviews by the Cultural Resources Specialist would occur before weed treatment activities commence each year.

Disturbance of Plants Used by Native Americans

The No Action Alternative includes very limited hand pulling and chemical treatment of weeds. The W-CNF archaeologist would identify areas to be treated and then consult with the Goshute, Northwestern Shoshone, and Ute Tribes prior to field activities to determine if culturally important plants have the potential to occur in the treatment area. Field crews would be trained to identify these plants so they can be avoided during weed-pulling and chemical treatment activities. This would result in no adverse effect from implementation of this alternative relative to the indicator.

Cumulative Effects

The No Action Alternative may result in exposure of archaeological deposits because of potentially increased weed infestations leading to increased soil erosion. This would increase the overall disturbance of cultural resources on the W-CNF when combined with other potential disturbance activities such as road and trail building, erosion from natural fires, and construction of facilities. Implementation of pre-disturbance clearance surveys and compliance with the various federal regulations pertaining to cultural resources would minimize the cumulative effects.

4.4.6.2 Alternative B—Proposed Action, Aerial and Ground-Based Herbicide Applications Plus Manual and Mechanical, Biological, and Cultural Control, and Combinations of Treatments

Direct and Indirect Effects

Compliance with the NHPA as Amended

Before the Proposed Action is implemented, the W-CNF archaeologist would identify areas of concern for historic preservation and Native American issues, and consult with the Idaho SHPO and the Goshute, Northwestern Shoshone, and Ute Tribes. Tribal staff would be informed and coordinated with relative to treatment areas, proposed treatment activities, and treatment schedules, prior to treatment, in order to avoid the potential for adversely impacting Indian Trust Assets. The Proposed Action complies with NHPA guidelines. Compliance would result in no adverse effect.

Compliance with the Archaeological Resources Protection Act

Under the Proposed Action, compliance with ARPA would be met through the identification of areas of concern for historic preservation and Native American issues and consultation with the Idaho SHPO and the Goshute, Northwestern Shoshone, and Ute Tribes. Compliance would result in no adverse effect.

Compliance with Executive Orders Pertaining to the Consultation and Coordination with American Indian Tribal Governments

The Proposed Action complies with EOs and would be accomplished through consultation with the Goshute, Northwestern Shoshone, and Ute Tribes during planning and prior to any treatment activities. Compliance would result in no adverse effect.

Erosion or Other Ground Disturbance at Cultural Resource Sites

The Proposed Action may include surface-disturbing effects associated with the treatment option selected. Any ground disturbance would have an increased risk of affecting cultural resources through erosion, visual modifications, soil compaction, flooding, or soil slumping. Treatment of noxious weeds may cause ground disturbance by bringing additional people in contact with the cultural resources or historic structures.

No effects from herbicide application on the ability to carbon date excavated material that has been contacted by herbicides are expected. Herbicide use could only damage potential radio carbon samples if the herbicide contained a large volume of petrochemicals (Hatfield et al. 2005).

In order to prevent any adverse impacts to cultural resources, the W-CNF archaeologist would identify areas of concern for historic preservation and Native American issues, and consult with the Idaho SHPO and the Goshute, Northwestern Shoshone, and Ute Tribes prior to field-associated activities. Tribal staff would be informed and coordinated with relative treatment areas, proposed treatment activities, and treatment schedules, prior to treatment, in order to avoid the potential for adversely impacting Indian Trust Assets. These actions would result in no adverse effect to cultural resources.

Disturbance of Plants Used by Native Americans

The Proposed Action would include activities that by their nature are designed to adversely affect plants. The W-CNF archaeologist would identify areas to be treated and then consult with the Goshute, Northwestern Shoshone, and Ute Tribes prior to field activities to determine if culturally important plants have the potential to occur in the project area and where they may be located relative to the treatment area. A qualified biologist and/or Tribal representatives would survey the treatment areas prior to treatment to ascertain whether culturally important plants are present. Treatments would be designed or modified to avoid those areas containing identified populations of culturally important plants. Field crews conducting manual and mechanical treatments would be trained to identify these plants so they can be avoided during manual and mechanical treatments. These actions would prevent adverse effects from occurring.

Cumulative Effects

Because implementation of actions described under Alternative B would result in no adverse effect to cultural resources, no cumulative effects on cultural resources would result from implementation of this Alternative.

4.4.6.3 Alternative C—Ground-Based Herbicide Applications Plus Manual and Mechanical, Biological, and Cultural Control, and Combinations of Treatments

Direct and Indirect Effects

Compliance with the NHPA as Amended

Under Alternative C, compliance with NHPA would be the same as discussed for the Proposed Action. Compliance would result in no adverse effect.

Compliance with the Archaeological Resources Protection Act

Under Alternative C, compliance with ARPA would be the same as discussed for the Proposed Action. Compliance would result in no adverse effect.

Compliance with Executive Orders Pertaining to the Consultation and Coordination with American Indian Tribal Governments

Alternative C would be the same as the Proposed Action. Compliance would result in no adverse effect.

Erosion or Other Ground Disturbance at Cultural Resource Sites

Alternative C would have the same or similar actions as the Proposed Action. These actions would result in no adverse effect to cultural resources.

Disturbance of Plants Used by Native Americans

Alternative C would employ the same or similar actions discussed for the Proposed Action. These actions would avoid adverse impacts to culturally important plants.

Cumulative Effects

Because implementation of actions described under Alternative C would result in no adverse effect to cultural resources, no cumulative effects on cultural resources would result from implementation of this Alternative.

4.4.6.4 Alternative D—Manual and Mechanical, Biological, and Cultural Control, and Combinations of Treatments

Direct and Indirect Effects

Compliance with the NHPA as Amended

Under Alternative D, compliance with NHPA would be the same as discussed for the Proposed Action. Compliance would result in no adverse effect.

Compliance with the Archaeological Resources Protection Act

Under Alternative D, compliance with ARPA would be the same as discussed for the Proposed Action. Compliance would result in no adverse effect.

Compliance with Executive Orders Pertaining to the Consultation and Coordination with American Indian Tribal Governments

Alternative D would be the same as the Proposed Action. Compliance would result in no adverse effect.

Erosion or Other Ground Disturbance at Cultural Resource Sites

Alternative D would have the same or similar actions as the Proposed Action. These actions would result in no adverse effect to cultural resources.

Disturbance of Plants Used by Native Americans

Alternative D would employ the same or similar actions discussed for the Proposed Action. These actions would avoid adverse impacts to culturally important plants.

Cumulative Effects

Because implementation of actions described under Alternative D would result in no adverse effect to cultural resources, no cumulative effects on cultural resources would result from implementation of this Alternative.

4.4.7 Environmental Justice

No significant issues or indicators associated with environmental justice were identified during public scoping. However, Executive Order 12898 requires federal agencies to conduct activities related to human health and the environment in a manner that does not discriminate or have the effect of discriminating against low-income and minority populations. As discussed in *Section 3.5.7*, *Environmental Justice*, there are few minorities in the W-CNF analysis area and no communities are considered low income. While there are individual households that are either minority or low income, the communities as a whole are not.

These individuals and households would not be disproportionately impacted by any of the alternatives. No groups would be disproportionately impacted by weed treatment activities under any of the alternatives, and there would be no direct, indirect, or cumulative adverse effects on environmental justice from the proposed project. Weed control efforts would be conducted on National Forest System lands. All contracts offered by the Forest Service contain Equal Employment Opportunity requirements.

4.5 Comparison of Alternatives

Of the three alternative evaluated, the Proposed Action would be the most effective in eradicating, controlling, and containing noxious weeds on the W-CNF, and in benefiting a broad range of W-CNF resources. Alternative 3 would be less effective than the Proposed Action because fewer acres would be treated annually, fewer methods (no herbicides) would be available for treating weed infestations, and less effective treatment methods would be used. The No Action Alternative would be the least effective of the

alternatives evaluated in treating weeds and in benefiting W-CNF resources because of the comparatively few acres of weeds that would be treated each year and the limited methods that would be available for weed treatment. Tables 2-1, 2-2, and 2-3 in Chapter 2 summarize and compare the potential environmental benefits and impacts of the three alternatives for each resource area previously analyzed in this chapter. Table 4-13 (in *Section 4.4.1, Economic Resources*) provides supporting information and assumptions used to estimate and compare annual costs for each of the treatment options associated with the three alternatives.

Potential risks for some W-CNF resources were identified for those alternatives that would use herbicides to treat weeds. These include aerial and ground-based herbicide applications under the Proposed Action and ground-based herbicide applications under the No Action Alternative. Such risks would be non-existent under Alternative 3. However, the potential risks from herbicide use need to be weighed against the ecological and other resource value losses known to result from increases in noxious weed infestations. In all instances involving herbicide and other potential risks, BMPs and mitigation measures would be implemented to avoid or minimize the potential for adverse effects to occur. In addition, the Proposed Action and Alternative 3 include the use of a site-specific implementation process, the Decision Tree (Figure 1-3 in Chapter 1), treatment option tables, and adaptive strategy. These management tools are designed to consider site-specific resource conditions that result in the selection of a treatment option that achieves weed management goals with the least impact on W-CNF resources. Label instructions would be followed whenever chemicals were applied and the protection of worker health and safety and public health and safety in selecting and implementing a site-specific treatment option would receive the very highest priority.

4.6 Probable Environmental Effects that Cannot be Avoided

Some potential environmental risks associated with the use of herbicides that cannot be avoided include possible effects on non-target plant species, possible entry of minute amounts into surface waters, and possible absorption by wildlife and fish. However, the extremely low amounts of herbicide that could potentially come in contact with these resources—together with the use of BMPs, mitigation measures, and a site-specific implementation process—would not be expected to result in a significant environmental impact under reasonably foreseeable circumstances. This same conclusion applies to human health and safety on the W-CNF. The anticipated continued expansion of noxious weeds on the W-CNF under the No Action Alternative, and probably to a lesser extent under Alternative 3, would result in serious unavoidable adverse effects on a broad range of W-CNF resources, as described in detail previously in this chapter.

4.7 Forest Plan Consistency

All alternatives are consistent with Forest-wide and management prescription standards and guidelines. As noted in Chapter 2 the Forest-wide Desired Condition for Non-Native Plants will be updated to reflect the W-CNF Weed Strategy. This is not considered an

amendment because desired conditions are an integrated visualization of what the Forest should look like in the future, not a binding limitation.

The Proposed Action would best meet management goals of the W-CNF RFP. Alternative 3, followed by the No Action Alternative, would be increasingly less effective than the Proposed Action in meeting W-CNF management goals. The No Action Alternative may only minimally meet some of the W-CNF management goals. Examples of management goals contained in the W-CNF RFP that are addressed by the actions evaluated in this DEIS include the following:

- Forest-wide Goal 2—Watershed Health: Maintain and/or restore overall watershed health (proper functioning of physical, biological and chemical conditions). Provide for long-term soil productivity. Watershed health should be addressed across administrative and political boundaries.
- Forest-wide Goal 3—Biodiversity and Viability: Provide for sustained diversity of species at the genetic, populations, community and ecosystem levels. Maintain communities within their historic range of variation that sustains habitats for viable populations of species. Restore or maintain hydrologic functions. Reduce potential for uncharacteristic high-intensity wildfires, and insect epidemics.

  To achieve sustainable ecosystems, meet properly functioning condition (PFC) criteria for all vegetation types that occur in the Wasatch–Cache National Forest. Focus on approximating natural disturbances and processes by restoring composition, age class diversity, patch sizes, and patterns for all vegetation types.
- Forest-wide Goal 4—Fire and Fuels Management: Wildlife fire use and prescribed fire provide for ecosystem maintenance and restoration consistent with land uses and historic fire regimes. Fire suppression provides for public and firefighter safety and protection of other federal, state and private property and natural resources. Fuels are managed to reduce risk of property damage and uncharacteristic fires.
- Forest-wide Goal 5—Road/Trail and Access Management: Provide a road and trail system that is safe, responsive to public and agency needs and desires, affordable and efficiently managed. Provide an access system that minimizes negative ecological effects and is in balance with available funding. Focus on achieving an integrated transportation system that serves multiple functions and is consistent with desired future conditions for a given area.
- Forest-wide Goal 6—Recreation: Manage for an array of recreation opportunities and settings to improve the quality of life for a variety of Forest recreation users. Balance growth and expansion of recreation by managing within the capability of sustainable ecosystems found on the Forest for today and the future.
- Forest-wide Goal 9—Heritage Resources: Inventory, evaluate, protect and enhance heritage sites and landscapes.
- Forest-wide Goal 10—Social/Economic Contributions: Contribute to the social and economic well-being of local communities by promoting sustainable use of renewable natural resources and by participating in efforts to devise creative solutions for economic health (diversity and resiliency). Provide timber for commercial harvest, forage for livestock grazing, exploration and development opportunities for mineral

resources, and settings for recreation consistent with goals for watershed health, sustainable ecosystems, biodiversity and viability, and scenic/recreation opportunities.

- Forest-wide Goal 13—Designated Wilderness: Maintain Wilderness ecosystems and character, primarily influenced by the forces of nature, to provide opportunities for public use, enjoyment, and understanding of Wilderness, and to preserve a high quality Wilderness resource for present and future generations. Manage Wilderness to sustain wild ecosystems for values other than those directly related to human uses.

4.8 Possible Conflicts with Planning and Policies of Other Jurisdictions

Neither the Proposed Action nor Alternative 3 would conflict with City, State and Federal water or air quality regulations, nor with FWS recovery plans for threatened and endangered species. However, the anticipated continued expansion of noxious weeds on the W-CNF under the No Action Alternative may threaten recovery of some federally listed species. A Biological Assessment of potential effects of the Proposed Action on Federally listed endangered, threatened, proposed, and candidate species will be completed for the proposed project.

4.9 Relationship Between Short-Term Uses and Long-Term Productivity

Neither the Proposed Action nor Alternative 3 would affect the short-term use of commodity-type resources. However, the adverse effects of noxious weed expansion on long-term productivity, which is most likely to occur under the No Action Alternative, were described previously in this chapter for a number of biological and physical resources on the W-CNF. Related adverse effects on human and socioeconomic resources, including a broad range of commercial and recreational uses that occur on the W-CNF and which support businesses adjacent to the W-CNF, could also result from poor W-CNF health. The Forest Service concluded that for the W-CNF, the more effective an alternative is at controlling the spread of noxious weeds, the better that alternative is at protecting the long-term productivity of natural resources of an area—despite potential minor, short-term impacts on the environment. That same conclusion applies to the W-CNF.

4.10 Irreversible and Irretrievable Commitment of Resources

Implementation of each of the alternatives would involve an irretrievable commitment of labor, fossil fuels, and economic resources to varying degrees. The expected continued expansion of noxious weeds on the W-CNF under the No Action Alternative and probably to a lesser extent under Alternative 3 may irretrievably reduce or eliminate existing plant diversity and associated resource values, including overall ecosystem function.

CHAPTER 5. LIST OF RECIPIENTS

List of Recipients of this DEIS

The following federal agencies, state and local governments, interested organizations, businesses, and individuals have received notice or copies of this Draft EIS (DEIS):

Federal Agencies

U.S. Department of Agriculture

- USDA APHIS PPD/EAD
- Natural Resources Conservation Service
- National Agricultural Library
- Office of Civil Rights

U.S. Department of the Interior

- Office of Environmental Policy and Compliance

Environmental Protection Agency

- Office of Federal Activities, EIS Filing Section
- Region 8 Office

American Indians

- Northern Ute
- Skull Valley Band of Goshute Indians
- Northwestern Band of Shoshoni

Other Federal Agencies

- Advisory Council on Historic Preservation
- NOAA Office of Policy and Strategic Planning
- U.S. Army Engineer Division, South Pacific
- U.S. Navy (USN)
- U.S. Coast Guard (USCG), Environmental Impact Branch
- FAA, Northwest Mountain Region
- Federal Highway Administration
- U.S. Department of Energy
- U.S Fish and Wildlife Service, Utah Fild Office
- Rural Utilities Service (RUS)

State and Local Government Agencies

- Alta Town Commissioner
- Brigham Young University, Dept of Botany & Range Science
- Box Elder County Commissioners
- Box Elder County Weed Supervisor
- Cache County Weed Supervisor
- Daggett County Commissioner
- Davis County Weed Supervisor
- Duchesne County Commissioners
- Morgan County
- Morgan County Court House, Weed Supervisor
- Rich County
- Salt Lake City Corporation, Department of Public Utilities
- Salt Lake County, Summit County Commissioner, Oakley
- Summit County Commissioners, Coalville
- Summit County Extension
- Summit County Weed Supervisor
- Tooele County Commissioner
- URMCC
- USU Agricultural Agent, Weber County Office
- USU Extension, Cache County Courthouse
- Utah County Commissioner Natural
- Utah Department of Agriculture and Food, Noxious Weed Program
- Utah Division of Wildlife Resources, Northern Region
- Utah State Extension, Department of Plants, Soils and Biometeorology
- Utah Resource Development Coordinating Committee

Wasatch County Commissioners
Weber County Weed Supervisor
Wyoming Game and Fish Department

Interested Organizations

Audubon Society
Citizens for Protection of Logan Canyon
Cottonwood Canyons Foundation
Ecological Planning Toxicology
Forest Guardians
Forest Watch
High Uintas Backcountry Horsemen
High Uintas Preservation Council
Save Our Canyons
Sierra Club
Sierra Club, Cache Group
Sierra Club, Utah Chapter
Utah Environmental Congress
Utah Rivers Council
Utah Society of Environmental Education
Utah Wildlife Leadership Coalition
Tooele County Wildlife Federation
Wild Law Southwest
Wild Utah Project
Wilderness Society
Wilderness Watch

Individuals and Businesses

Alfred Kearl and Sons, Inc.
Barrie & Kathy Gilbert
Blaine S. and Judith A. Russell
Blazzard Farms
Bountiful Livestock Company
Boyd Larsen
Brown's Diamond J Inc
Bruce Clegg
C. M. Cornwall
Caldwell Ranching Company
Charles and John Young
Chournos Land and Livestock
Clark Willis
Clinton R. Sagers
Clyde J. Campbell
Cornia, Mark
Dallan and Tennly Maughan
Darlene or George Eyre
Darrell Kunzler
Darwin Nielsen
David Lamborn, Dean M. Stuart Family Trust
Dean Olsen
Del Ray Campbell
Dennis and Carole Lazenby
Dennis and Vicki Covolo
Dennis Sorensen
Derle Nielsen
Diamond-W Ranch Co, Inc. C/O Ronald Stuart
E. Val Anderson
Edgar Hibbard
Elmer and Jean Mcneil
Estate of J. R. Broadbent
Forty Six Co. Inc.
Frank E. Weston and Son, C/O Theron Weston
Fuhriman and Fuhriman
Gary Jenson
Gary N. Call
Gene Gamble
Gene Hiibner
George Frazier
George Gamble, C/O Bill Gamble
George Razier
Georgia Monroe
Gerald H. and Camille M. Sagers
Gerald Young
Gilbert Marriott Investment Co, C/O Don Shaw
Glen and Fay Wadsworth
Glen and Joette Thomson
Gomer Jay Hess
H. Leroy and Marjean Thomson
Harold and Bessie Harvey
Harold and Nilda Hoffman
Harold Selman, Inc, C/O Fred Selman
Hazel and Dan Polson
Hazen and Klea Cornia
Helen Peters
Henry Ranch Partnership, C/O Garie Henry

Heritage Title Co.,
C/O Raymond Park
Howard and Larue Lamborn
HR Livestock,
C/O Sheldon Richins
Ivan F. Christensen
J. Odell Rinderknecht
Jack and Garnett Lamb
Jack Hickey
Jacob Summers,
C/O Karen Rinderknecht
Jay Rinderknecht
Jensen Brothers
Jerry and Vickie Overy
Jerry W. and Larene Jaques
John Anderson
John Kirkham
Johnson Cattle
Johnson Cattle,
C/O Richard R. Johnson
Joseph O. Fawcett & Sons, Inc,
C/O Loren Fawcett
K and S Partnership
Kaycee and Jamie Simpson
Keith Cornia
Kelvin Pugmire
Kenneth and Dee Anne Brown
Kenneth and Richard Hoffman
Kent and Joan Rowberry
Kent Johnson
Kent Leavitt
Kirk Coombs
Kunzler Brothers
Kunzler Ranch, LLC,
C/O Alan Kunzler
Lamborn Limited Liability Co.,
C/O Paul Weston Lamborn
Larson Livestock, Inc.
Lavar Sagers
Lawrence Brown Trust,
C/O Anelisa Bell
Lex Anderson
Lloyd Marchant
Lloyd W. Keller
Logan Canyon Cattle Assoc,
C/O Darrell Kunzler
Lyle or Lapriel Clark
Lym Ranch,
C/O Carl R. Lym
Lyman Grazing Association
M + G Bertagnole
Martin Aimone and Co.
Martin Anderson
Max Baugh
Max Fabrizio
Megan Barker
Merlin Yonk Trust and Blanche Yonk
Michael and Mildred Sims
Michael Jenson and Marjorie Davis
Mike C. Worthington
Milton Beck
Monson Family Trust,
C/O George M. Monson
Moroni and Lily Marchant,
C/O Don Marchant
Newel Don Andrews
Norman T. Richins Livestock,
C/O Myron A. Richins
O. Ted Nelson
Oliver H. Low Trust,
C/O Margene Z. Low Trust
Orson and Louisa Cornia
Paul and Carmen McKinnon
Pete Clawson
Pinevalley Sheep Ranch
R. B. Nelson
Randolph Land and Livestock Co,
C/O Glen Thomson
Ray Todd Holton
Reed McBride
Reed McBride,
C/O Wayne McBride
Reese P. Jenson
Richard & Beulah Taylor
Richard and Carol Hamilton
Richard and Reed Yonk
Richard Anderson
Richard Nicholas
Robert and Sylvia Cronquist
Robert Byram and Sons,
C/O Darrell Byram
Robert D. Child
Robert E. Sadlier
Robert Sagers
Rod Fitzgerald

Roger and Bonnie Spackman
Roger B. Earley
Ronald Walker
Ropelato Properties Ltd Corp
Ross G. Argyle and Lynae A. Morris
Roy and Loudawn Hoffman
Russell and Kathryn Brown
Russell and Nancy Thomson
Russell Land and Livestock,
C/O William Russell
Sagers Livestock,
C/O John Sagers
Samuel Bankhead
Scott Johnson
Scott L. Jacobson
Scott Wangsgard
Sharell Summers
Shawn P. Summers
Sherie Goring
Skull Valley Company
Slash M Ranch,
C/O Chubb Munns
Steven T. Gillmor Sheep Co.,
C/O Shirley O. Gillmor
Summers Ranch
The Jenson Family Trust
Thelma Jenson Trust
Thousand Peaks Ranches, Inc.
Tom and Teana Lazenby
True Field and Verna Wilde
Tyler and Luann Page
Victor L. Powers + Company
W. F. Goring and Son, Inc.
W. L. Andrews Estate,
C/O Claude Andrews
Wayne Robb
Wendell Stembridge
Wesley and Dorothy Tingey
Wesley Baer
Willard Peak Meadows Corp
William and Cynthia Stuart
William and Debra Kennedy
William E. Cox
Wilson Wahlstrom
Yale Johnson
Young Brothers Livestock

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CHAPTER 7. ACRONYMS AND ABBREVIATIONS

ADI	Acceptable Daily Intake
AIRFA	The American Indian Religious Freedom Act
APHIS	Animal and Plant Health Inspection Service
ARPA	Archaeological Resources Protection Act
ATV	all-terrain vehicle
BA	Biological Assessment
BCI	biotic condition index
BO	Biological Opinion
BMPs	best management practices
CEQ	Council on Environmental Quality
CWMA	Cooperative Weed Management Area
DDT	dichlorodiphenyltrichloroethane
DEIS	Draft Environmental Impact Statement
DOD	Department of Defense
DPS	distinct population segment
E&MVRD	Evanston and Mountain View Ranger Districts
EDCs	endocrine disrupting chemicals
EEC	expected environmental concentration
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EOs	executive orders
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement

FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FLPMA	Federal Land Policy and Management Act
FS	U.S. Forest Service
FWS	U.S. Fish and Wildlife Service
GIS	geographical information system
HUC	hydrologic unit code
ICT	Incident Command Team
IMPROVE	Interagency Monitoring of Protected Visual Environments
IWWI	Inland West Watershed Initiative
IRIS	EPA's Integrated Risk Information System
IWM	Integrated Weed Management
kg	kilograms
KRD	Kamas Ranger District
LAU	Lynx Analysis Unit
LCT	landscape character themes
LCAS	Lynx Conservation Assessment and Strategy
LRD	Logan Ranger District
mg	milligrams
MIS	management indicator species
MOU	Memorandum of Understanding
mph	miles per hour
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native America Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966
NOELs	no observed effect levels

NRIS	Natural Resource Information System
NVUM	National Visitor Use Monitoring
OHV	off-highway vehicle
ORV	off-road vehicle
ORD	Ogden Ranger District
OSHA	Occupational Health and Safety Administration
PAOT	number of people at one time
PAR	pesticide application record
PM_{10}	particulate matter
ppm	parts per million
PNC	potential natural communities
POEA	polyoxyethylamine
PUP	pesticide use proposal
RFP	Revised Forest Plan
RNA	Research Natural Area
RQA	Risk Quotient Analysis
RVD	recreation visitor days
SAOT	skiers at one time
SAR	species-at-risk
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SLRD	Salt Lake Ranger District
SMP	smoke management plan
SOPA	Schedule of Proposed Activities
TCPs	Traditional Cultural Properties
TES	threatened, endangered, and sensitive species

TEPS	threatened, endangered, proposed, and sensitive species
UDAQ	Utah Department of Air Quality
UDEQ	Utah Department of Environmental Quality
UDWR	Utah Division of Wildlife Resources
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
W-CNF	Wasatch-Cache National Forest

CHAPTER 8. GLOSSARY

Definitions are derived from various sources as indicated in the *Sources* list at the end of the Glossary, or were formulated uniquely for this project.

Term	Definition
A	
Activity area	A land area impacted by a management activity, excluding specified transportation facilities, dedicated trails, and mining excavations and dumps. Activity areas include harvest units within timber sales, prescribed burn areas, and grazing areas within allotments. Riparian and other environmentally sensitive areas may be monitored and evaluated as individual activity areas within larger management areas
Aesthetic quality	A perception of the beauty of a natural or cultural landscape.
Affected environment	Existing biological, physical, social, and economic conditions of an area subject to change, both directly and indirectly, as the result of a proposed human action.
Air quality	Measure of the health-related and visual characteristics of the air, often derived from quantitative measurements of the concentrations of specific injurious or contaminating substances.
Allelopathic	The release into the environment by one plant of a substance that inhibits the germination or growth of other potential competitor plants of the same or another species.
Anadromous	Used to describe fish (such as salmon and steelhead) that return from the sea to the rivers where they were born in order to breed.
Annual	A plant that flowers, produces seed, and dies in one growing season.
Aquifer	A geological formation or structure that stores and/or transmits water, such as to wells and springs.
Archaeologist	A scientist who studies past human life through material remains.
B	
Beneficial uses	One of several uses of streams and lakes that may include drinking, fish habitat and recreation. This phrase has a specific technical connotation because the federal Clean Water Act requires states to adopt standards and procedures that protect designated beneficial uses of public waters.

Term	Definition
Best management practice	A practice or combination of practices determined by a state or an agency to be the most effective and practical means (technological, economic, and institutional) of controlling point and nonpoint source pollutants at levels compatible with environmental quality.
Biennial	A term used to describe a plant that lives for 2 years, and produces flowers and fruit in the second year.
Bioaccumulate	The accumulation of a harmful substance such as a radioactive element, a heavy metal, or an organochlorine in a biological organism, especially one that forms part of the food chain.
Biological control	A method of reducing or eliminating plant pests by introducing predators or microorganisms that attack the targeted pests but spare other species in the area.
Biodiversity	The range of organisms present in a given ecological community or system, which can be measured by the numbers and types of different species, or the genetic variations within and among species.
Biomagnify	To undergo biological magnification.
Biota	The types of plant and animal life found in specific regions at specific times.
Broadleaf	A term used to describe trees that have wide leaves rather than leaves that are thin, like (pine) needles.
Buffer	A vegetation strip or management zone of varying size, shape, and character maintained along a stream, lake, road, recreation site, or different vegetation zone to mitigate the impacts of actions on adjacent lands, to enhance aesthetic values, or as a best management practice.
C	
Calcareous	Plant matter growing on limestone or in earth containing limestone.
Candidate species	A state and federal designation. State candidate species are those that will be reviewed for possible listing as endangered, threatened, or sensitive. Species for which there is substantial information to support listing the species as threatened or endangered; listing proposals are either being prepared or are delayed by work on higher priority species.

Term	Definition
Colonizer	A plant that is established or becomes established in a biological colony in a new ecosystem.
Conifer	Any tree that has thin leaves (needles) and produces cones. Many types are evergreen.
Consumptive use	That part of water withdrawn that is evaporated, transpired by plants, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment. Also referred to as water consumed.
Contiguous	Touching or connected throughout in an unbroken sequence.
Critical habitat	**State:** Habitats of threatened or endangered species as designated by various state forest practices boards. **Federal:** Areas designated under the federal ESA that meet these criteria: 1. Areas within the geographic area occupied by a federally listed species on which are found physical and biological features essential to the conservation of the species, and that may require special management considerations or protection. 2. Areas outside the geographic area occupied by a listed species, when it is determined that such areas are essential for the conservation of the species.
Cultural resources	Sites, structures, landscapes, and objects of some importance to a culture or community for scientific, traditional, religious, or other reasons.
Cumulative impact	The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions—regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time (40 CFR 1508.7).
D	
Discharge	The volume of water that passes a given location within a given period of time. Usually expressed in cubic feet per second (cfs).
Diversity	see *Biodiversity*.

Term	Definition
Dolomitic	A white, reddish, or greenish mineral consisting of calcium magnesium carbonate, found in sedimentary rocks. It is used as a building stone and in the manufacture of cement and fertilizers.
E	
Ecosystem	The complex of a community of organisms and its environment functioning as an ecological unit.
Endangered species	Any species in danger of extinction throughout all or a significant portion of its range.
Endemic	Plants or animals that are native to a particular region or country.
Environment	The surrounding conditions, influences, or forces that affect or modify an organism or an ecological community and ultimately determine its form and survival.
Environmental Impact Statement	A formal public document prepared to analyze the impacts on the environment of the proposed project or action and released for comment and review. An EIS must meet the requirements of NEPA, CEQ guidelines, and directives of the agency responsible for the proposed project or action.
Ephemeral	A plant (or insect) that lives for only a short period of time.
Exotic	In ecology, a term that describes the introduction of a species from another place or region.
Extirpate	To destroy completely; wipe out.
F	
Fauna	The wildlife or animals of a specified region or time.
Federally listed	Species formally listed as a threatened or endangered species under the ESA. Designations are made by the USFWS or NOAA Fisheries.
Floodplain	The lowland that borders a stream or river, usually dry but subject to flooding.
Flora	Plant life, especially all the plants found in a particular country, region, or time regarded as a group. Also, a systematic set of descriptions of all the plants of a particular place or time.

Term	Definition
Forage	Food for animals. In this document, term applies to both availability of plant material for wildlife and crops grown to feed horses, cattle, and other livestock.
Freshwater	Water that contains less than 1,000 milligrams per liter (mg/L) of dissolved solids; generally, more than 500 mg/L of dissolved solids is undesirable for drinking and many industrial uses.
G	
Genetic introgression	Reproductive crosses between species that result in a sterile hybrid (such as brook trout/bull trout hybrids), as well as crosses between species that result in changes to the gene pool of one species (such as cutthroat/rainbow hybrids or introduction of genetic material from hatchery fish).
Geographic information system (GIS)	A computer system that stores and manipulates spatial data, and can produce a variety of maps and analyses. GISs are used to set landscape-level planning objectives. GISs can do the following: 1. Assign information and attributes to polygons and lines, which represent relationships on the ground. 2. Update and retrieve inventory, mapping, and statistical information.
Granitic	A term used to describe something composed of a coarse-grained igneous rock made up of feldspar, mica, and at least 20 percent quartz.
Grassland	An area covered with grass and grass-like vegetation.
H	
Habitat	The region where a plant or animal naturally grows or lives. A specific set of physical conditions that surround a single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and home range.
Half-life	The time required for half of something to undergo a process. As used in this document, it is the amount of time for half the herbicide to break down, becoming ineffective.
Harm	Habitat modification or degradation that injures or kills wildlife by significantly impairing essential behavioral patterns that include breeding, feeding, or sheltering.

Term	Definition
Herbicide	A chemical preparation designed to kill plants, especially weeds, or to otherwise inhibit their growth.
Holistic	An approach to ecology emphasizing the importance of the whole and the interdependence of its parts.
Hydrologic cycle	The sequence of conditions through which water passes from vapor in the atmosphere through precipitation upon land or water surfaces, and ultimately, back into the atmosphere as a result of evaporation and transpiration.
Hydrology	The science that studies the properties, distribution, and circulation of natural surface water and groundwater.
I	
Impact	A modification in the status of the environment brought about by a proposed action.
Infestation	To overrun a place in large numbers and become threatening, harmful, or unpleasant.
Infiltration	To cause (as a liquid) to permeate something by penetrating its pores or interstices.
Insoluble	Incapable of being dissolved in a liquid.
Integrated Weed Management	An interdisciplinary pest management approach for selecting methods for preventing, containing, and controlling noxious weeds in coordination with other resource management activities to achieve optimum management goals and objectives.
Invader	To become established and spread rapidly in an area, crowding out any preexisting plants.
Irretrievable commitments	Losses of resource production or use for a period of time.
Irreversible commitments	Permanent or essentially permanent resource uses or losses that cannot be reversed, except in the extreme long term.
L	
Landform	A term used to describe the many types of land surfaces that exist as a result of geologic activity and weathering (for example, plateaus, mountains, plains, and valleys).
LD_{50}	Lethal dose at which 50 percent of test organisms perish.

Term	Definition
Leaching	To dissolve out soluble constituents from soil by percolation.
Lek	An assembly area where animals carry on display and courtship behavior.
Long term	Greater than 15 years duration.
Long-term productivity	The ability of the land, supported by maintenance and enhancement activities, to produce a continuous supply of a resource.
M	
Minimum tool	Use of a weed treatment alternative that would accomplish management objectives and have the least impact on resources.
Mitigate	To alleviate, reduce, or render less intense or severe.
Mitigation	Action taken to avoid, reduce the severity of, or eliminate an adverse impact.
Mobility	Of or relating to the capability of moving or being moved.
N	
National Environmental Policy Act (NEPA) of 1969	Public Law 91-190. Establishes environmental policy for the nation. Among other items, NEPA requires federal agencies to consider environmental values in decision-making processes.
National Oceanic and Atmospheric Administration (NOAA) Fisheries	The federal agency that is the listing authority for marine mammals and anadromous fish under the ESA.
National Register of Historic Places	A listing of architectural, historical, archaeological, and cultural sites of local, state, or national significance, established by the Historic Preservation Act of 1966 and maintained by the National Park Service.
Native vegetation	Vegetation originating in a certain region or country.
Naturalization	To cause a plant or animal from another region to become established in a new environment or to adapt successfully to new environmental conditions.
Non-native	A plant that is not growing naturally in a particular place, and that has been introduced by an outside force or agent.

Term	Definition
Noxious weeds	Plants that may cause harm to collectors, or invasive exotics or parasites and their host plants that may harm the ecosystem or agriculture of an area.
P	
Paleontology	A science dealing with the life of past geological periods as known from fossil remains.
Particulate matter	Minute, separate particles, such as dust or other air pollutants.
Perennial	Lasting, or active through the whole year. May refer to rivers, streams, or plants.
Permeability	The measure of the ease with which a fluid can diffuse through a particular porous material.
Policy	A guiding principle upon which is based a specific decision or set of decisions.
Predators	Any organism that exists by preying upon other organisms.
Primitive	An area that is not developed, a pristine natural area.
Programmatic	Of, having, advocating, or following a plan, policy, or program, as in a *Programmatic EIS*.
Project Design Features	Best management practices, standard operating procedures, identified design features, and Forest management requirements that must be included in a project to protect Forest resources.
Q	
Quartzite	A pale, metamorphic (and sometimes sedimentary) rock composed mainly of quartz, formed by the action of heat and pressure on sandstone.
R	
Range	A large, open area of land over which livestock can wander and graze.
Raptor	A bird of prey.
Rare	A plant or animal restricted in distribution. May be locally abundant in a limited area or few in number over a wide area.

Term	Definition
Reclamation	Returning disturbed lands to a form and productivity that will be ecologically balanced.
Redd	A spawning nest constructed by a fish. A depression excavated in gravels where eggs are deposited.
Region	A large tract of land generally recognized as having similar character types and physiographic types.
Residual	Relating to the material left after weathering of a rock and removal of its soluble constituents.
Revegetation	The reestablishment and development of self-sustaining plant cover. On disturbed sites, this normally requires human assistance such as reseeding.
Rhizomes	A thick underground horizontal stem that produces roots and has shoots that develop into new plants.
Right-of-way	Strip of land acquired by legal means, over which utility corridors and access roads pass.
Riparian	Of, or pertaining to, the area surrounding the banks of a stream that supports vegetation dependent on high levels of water.
Riparian area	Areas of land directly influenced by water or that influence water. Riparian areas usually have visible vegetative or physical characteristics reflecting the influence of water. Riversides and lake borders are typical riparian areas.
S	
Sacred site	Any specific, discrete, narrowly delineated location on Federal land identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the Tribe or appropriately authoritative representative has informed the agency of the existence of such a site.
Salmonid	Fish species belonging to the family Salmonidae, including trout, steelhead, salmon, char, and whitefish species.
Scoping	The process of determining the range of proposed actions, alternatives, and impacts to be discussed in an EIS; includes public meetings.

Term	Definition
Sediment	A generic term used loosely to describe silt or sand-sized particles that may settle out of flowing water onto the bottom of streams and rivers, which may cover gravels otherwise used by salmonid fish for spawning and rearing young. Sediments may also inhibit oxygen uptake by fish eggs and therefore reduce reproductive success.
Sediment/Sedimentary	Solid fragmental material, either mineral or organic, that is transported or deposited by air, water, gravity, or ice.
Semi-arid	A climate or region characterized by little yearly rainfall and by the growth of a number of short grasses and shrubs.
Sensitive species	Species whose populations are small and widely dispersed or restricted to a few localities. Species that are listed or candidates for listing by the state or federal government.
Sensitivity	The state of being readily affected by the actions of external influence.
Short term	Greater than 3 years to 15 years duration.
Short-term uses	Those uses of the environment that generally occur annually.
Site	In archaeology, any locale showing evidence of human activity.
Socioeconomic	Of or involving both social and economic factors.
Soluble	Able to be dissolved in another substance, such as water.
Solubility	The quality or state of being soluble. Expressed in this document as the quantity of a herbicide that can be dissolved in water.
Species	A group of individuals of common ancestry that closely resemble each other structurally and physiologically, and in nature interbreed to produce fertile offspring.
Subspecies	Any natural subdivision of a species that exhibits small, but persistent morphological variations from other subdivisions of the same species living in different geographical regions or times.
Synergistic relationship	The simultaneous action of separate physical factors that when combined have a greater total effect than the sum of their individual effects.
T	
Take	To kill or capture a species covered by the ESA.

Term	Definition
Tap-root	A prominent and often bulky root that extends downward below the stem of some plants and has fine lateral roots. It often serves as a food storage organ.
Temporary	Zero to 3 years duration.
Threatened species	Any species likely to become endangered within the foreseeable future throughout all or a significant part of its range.
Topography	The relative positions and elevations of surface features of an area.
Traditional cultural property	A term referring to a tangible site, district, structure, building, or object with defensible boundaries that is important to a contemporary human community and has been for 50 years or more, that has significance under one or more criteria of the National Register of Historic Places, and with integrity of location, design, setting, materials, workmanship, feeling, and association in the perspective of those who value the place.
Transpiration	The process by which water that is absorbed by plants, usually through the roots, is evaporated into the atmosphere from the plant surface, such as leaf pores.
Tributary	A stream or river that flows into a larger stream or river.
Turbidity	The amount of solid particles that are suspended in water and that cause light rays shining through the water to scatter. Turbidity makes the water cloudy or even opaque in extreme cases.
U	
Upland	Land or an area of land lying above the level where water flows or where flooding occurs. Land that is generally dry, as opposed to lowland, meadow, marsh, swamp, and the like. See *riparian* for comparison.
U.S. Fish and Wildlife Service (USFWS)	The federal agency that is the listing authority for species other than marine mammals and anadromous fish under the ESA.
V	
Vegetation community	Species of plants that commonly live together in the same region or ecotone.

Term	Definition
Viable population	A population of sufficient size and distribution to be able to persist for a long period of time in the face of demographic variations, random events that influence the genetic composition of the population, and fluctuations in environmental conditions, including catastrophic events.
Volcanic soils	Soil materials weathered from rocks or material that were produced by volcanic eruptions.
W	
Water Quality Limited Stream	A stream listed under the Clean Water Act as not fully supporting designated beneficial uses. It is for these waterbodies that Total Maximum Daily Loads are required to be developed.
Watershed	The catchment area of land draining into a river, river system, or body of water; the drainage basin contributing water, organic matter, dissolved nutrients, and sediments to a stream or lake.
Wetlands	Lands or areas exhibiting hydric soils, saturated or inundated soil during some portion of the plant growing season, and plant species tolerant of such conditions (includes swamps, marshes, bogs).

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CHAPTER 9. LIST OF PREPARERS

Preparers and Contributors

Table 9-1 lists the individuals who contributed to the development of this EIS.

TABLE 9-1
List of Preparers

Name	Agency/Firm	Role	Location
Denny Mengel	CH2M HILL	Project Manager/Soils/Forestry	Boise, Idaho
Lynn Foster	CH2M HILL	Senior Consultant QA/QC Technical Lead/Fisheries Biologist	Boise, Idaho
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Chuck Blair	CH2M HILL	Wildlife Biologist	Boise, Idaho
Doug Bradley	CH2M HILL	Fisheries Biologist	Boise, Idaho
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Jim Sharpe	CH2M HILL	Archaeologist/Cultural Resources	Richland, Washington
Dawn Shepard	CH2M HILL	GIS Analyst	Boise, Idaho
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Appendix A

Integrated Weed Management Strategy

Wasatch-Cache National Forest
Integrated Weed Management Strategy
Revised 2005

FOREST WEED BOARD

The Wasatch-Cache Forest Leadership Team (FLT) has designated a Forest Weed Board to guide implementation of the Forest noxious weed program. The Weed Board represents a cross section of resources and offices across the Forest. Currently (January 2005) the Forest Weed Board consists of the following individuals:

Jen Colby – I & E – Kamas RD
Paul Chase – Fisheries/Hydro – Logan R
Beth Corbin – Fire – SO
Mike Duncan – Forest Botanist – weed board coordinator - SO
Michael Barry – Wilderness/Recreation – SO
Dano Jauregui – Wildlife – Evanston/Mt. View RD
Tom Flannagan – Archeology/RHWL - SO
Roger Kesterson – Timber/oil & gas – Evanston/Mt. View/Kamas RD
Ann Robins – Range - Logan RD
Jim Chard - Range – Ogden RD
Chip Sibbernsen – Forest Leadership Team Liaison
Craig Weir – Engineering - SO
Sean Wetterberg – Recreation – Salt Lake RD

For 2004, the FLT committed the Weed Board to develop a noxious weed strategy for the Forest (this document), and to conduct a minimum of one hour training on noxious weeds and mapping for all field-going personnel. Beyond that, the Weed Board is expected to help implement action items as designated priorities by the FLT, and to continue sharing noxious weed information between each member’s resource peers, home unit, and the Weed Board.

Wasatch-Cache National Forest
Integrated Weed Management Strategy
Revised 2005

Wasatch Cache National Forest Noxious Weed Strategy

INTRODUCTION AND PURPOSE

The Wasatch Cache National Forest (WCNF) administers a variety of lands under many different management prescriptions including highly developed sites, range lands, timber lands, ski areas and the 309,079 acres of congressionally designated Wilderness. The purpose of this Strategy is to establish and document a management position regarding noxious weeds and noxious weed management practices on all of these lands administered by the WCNF. In doing so, it will also help meet the challenge set by Chief Dale Bosworth to manage all Wilderness areas to standard by 2014. It is well documented that the occurrence and spread of noxious weeds has the potential to negatively affect natural ecosystem processes, decrease biological diversity, adversely affect soil stability, recreational values, Wilderness values, scientific research potential and forage for wildlife and livestock.

This Strategy will provide a framework for development of an integrated Noxious Weed Program for the Forest. The program will emphasize the use of an interdisciplinary, ecological and integrated approach in identification and selection of methods for preventing, containing or controlling noxious weeds. It is based on these cornerstones: Prevention, Early Detection, Timely Control, and Revegetation

This Strategy will include all available resources in establishing a program that provides for education; prevention; physical, mechanical, biological and chemical means of treatment; monitoring protocols; and incorporate economics, social values and land management resource objectives. It will make a distinction between general forest areas and designated Wilderness areas and recognize that there may be differences in noxious weed management between those areas.

An interdisciplinary team that is the Forest Weed Board developed this strategy. The Weed Board consists of one member from each resource and geographical area of the Forest.

This Strategy will be updated and/or supplemented as appropriate to reflect changes in policy, priorities, and ecological conditions (including results of treatment).

BACKGROUND

Invasive species rank #1 on a parallel priority level with Homeland Security (Per Forest Service Chief Dale Bosworth) and is in the top 4 priorities of the USFS because of their impacts and threat to our mission (USDA 2003a). Emphasis on noxious weeds has increased significantly in recent years, as more people recognize invasive species' effect on all other resource areas. In addition to the national emphasis, locally the Wasatch-Cache National Forest Revised Forest Plan (USDA 2003b) provides clear increased direction on noxious weed management.

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Prior to 2004, there has been no systematic approach Forest-wide to weed treatment objective and priority setting. Traditionally the weed program for the WCNF has been associated with other activities and areas easily accessed while performing other work. Currently there is one person per district that is trained and assigned the collateral duty of weed identification and treatment. In addition, weed infestations that are outside of that employee's resource area go undetected and treated.

Currently the Forest is an active participant in 2 Cooperative Weed Management Areas (CWMA) Utah & Idaho CWMA and the Weber River CWMA, and developing partnerships with Summit County CWMA and Bonneville CWMA. The term CWMA refers to a local organization that integrates all noxious weed management resources across jurisdictional boundaries in order to benefit entire communities (USDA 2003a). CWMAs have proven their ability to acquire grants and leverage existing money to complete priority noxious weed abatement projects on the ground (VanBebber 2003). These organizations may or may not have had specific direction on the management of weeds through all of the different prescription classes. Specifically, direction may have been lacking with regards to weed management in Wilderness areas. This is critical not only to meeting agency goals but it is mandated by Congress to protect these areas as naturally functioning ecosystems.

The Wasatch-Cache has an urgent need to implement an aggressive, effective, and interdisciplinary noxious weed program, in response to national emphasis, the revised forest plan, Chief Bosworth's 10-year Wilderness challenge and the mandate in the Wilderness Act. The location of national forest lands (including wilderness areas) adjacent to cities, towns, and other developed areas means there is abundant seed source and vectors for noxious weed spread to national forest. Several species, such as dyer's woad, musk thistle, leafy spurge, and knapweeds are aggressive and are now established on the Forest.

Throughout the document the following terms are used: weed, noxious weed, invasive species, and invasive exotics or aliens. These terms are often used interchangeably; some distinctions between them should be clarified.

> ***Weed* –** Any plant out of place. In natural ecosystems, weeds are often defined as any plant not native to a particular area (that is, not present before European contact).
>
> ***Noxious weed* –** Plants listed as noxious by the federal government (USDA APHIS), state, or county. Noxious weeds are generally designated as such because they have significant negative effects (or potential) on agriculture, economics, or ecosystems, and are usually not so abundant that eradication is infeasible.[1] Noxious designation has legal ramifications for interstate transport, nursery stock inspections, and seed certifications.

[1] As an example, Scotch thistle is listed as a state noxious weed on virtually every western state's list because it degrades rangeland productivity, and current infestations are controllable with reasonable effort. Cheatgrass, however, is not listed as a noxious weed because, although exotic and highly detrimental to ecosystems, it is so widespread that the opportunity to eliminate it, or even significantly reduce its range, has long since passed.

Invasive species **–** Any organism (plant, animal, or microbe) that spreads or has the potential to spread beyond its native range, resulting in negative environmental or economic effects on the invaded area or human health. (Executive Order 13112). Also called invasive exotics or invasive aliens.[2]

See Appendix 2 for the noxious weed list for the Wasatch-Cache National Forest, and for the noxious weed lists for counties and states of Utah and Wyoming.

Other weeds that are not designated as noxious (for example cheatgrass or smooth brome) may be important for management implications on proper functioning ecosystem conditions. Noxious weed prevention and soil stabilization practices will assist in limiting these weeds' spread. However, we do not anticipate expending effort on mapping or eradication for non-noxious weeds because although exotic and highly detrimental to ecosystems, they are so widespread that the opportunity to eliminate them, or even significantly reduce their ranges, has long since passed.

FOREST PLAN DIRECTION

The 2003 Wasatch-Cache Revised Forest Plan (RFP) has the following forestwide (including Wilderness) subgoals for noxious weed control (p 4-20):

- Greatly reduce known infestations of **noxious weeds** and rigorously prevent their introduction and/or spread.

- **Improve** Forest users' **awareness** of what noxious weeds are and how they spread and **increase** Forest users' **active participation** in reducing and preventing infestations.

The (RFP) has the following forest wide objective relating to noxious weeds (p 4-28 & 4-32):

- Develop key messages for focus areas within 1 year and set measurable education/enforcement goals. Focus areas are: OHV use recreation user ethics, role of fire and fuels hazards, noxious weeds, and watershed health.
- Assess and prioritize noxious weed infestations for appropriate treatment within 1 year.

Noxious weed management will greatly compliment RFP objectives for vegetation management to achieve desired conditions (p 4-29-32)

[2] Sometimes plants native to a particular ecosystem are called invasive if they increase in localized extent or density. One example is the increase in pinyon and juniper over recent decades as a result of fire suppression and grazing. In this case, a distinction between "invasive species" and "invasive exotics" is warranted. However, most people limit the term invasive to non-native species.

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Forestwide Standard and Guidelines in the RFP include the following for noxious weeds (p 4-43):

> (G25) Integrated weed management should be used to maintain or restore habitats for threatened, endangered, proposed and sensitive plants and other native species of concern where they are threatened by noxious weeds or non-native plants. When treating noxious weeds comply with policy in Intermountain Region's Forest Service Manual 2080, Supplement #R4 2000-2001-1.

Forest Plan Goal for Wilderness Management (p4-25):

> (Goal 13) "Maintain wilderness ecosystems and character, primarily influenced by the forces of nature, to provide opportunities for public use, enjoyment, and understanding of wilderness, and to preserve a high quality wilderness resource for present and future generations. Manage wilderness to sustain wild ecosystems for values other than those directly related to human use.

The Wasatch-Cache RFP includes the following desired conditions for non-native plants (p 4-10):

> Established noxious weed infestations are not increasing or are reduced to low densities. New invader species are not becoming established. New infestations of species are contained or reduced. New populations of existing noxious weeds are eradicated or reduced in highly susceptible, often disturbed, areas. Native plants dominate most landscapes that have been rehabilitated.

Wilderness Act Direction: 1964:

> "A wilderness, in contrast with those areas where man and his works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man,… and area of undeveloped Federal Land retaining its primeval character and influence,… which is protected and managed so as to preserve its natural conditions and which 1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable…"

The following specific goals of this noxious weed strategy tier to the above RFP and Wilderness Act direction.

1. **Identify, inventory and monitor Forest infestations.**

2. **Prioritize treatment areas based on analysis of infestations and their effect on ecological, economic and social values.**

3. **Identify resources, means of funding and pursue cost-share programs.**

4. **Develop strategies for prevention and methodologies for treatment.**

The following sections of this document address more in-depth considerations for these goals, set objectives and identify recommendations for the future management practices and treatments. An action item timeline can be found in Appendix 3.

GOALS AND RECOMMENDATIONS FOR ACTION:

Goal # 1-Identify, Inventory and Monitor Forest Infestations

A current list of noxious and invasive weeds that the forest is tracking can be found in Appendix 2 as well as other relevant weed lists. The Forest list is dynamic in nature and species will be added to or removed as needed. The list is based on local knowledge of infestations and needs to be updated with accurate mapping and population information. Current noxious weed data is lacking critical population and geographic information required to prioritize treatment objectives.

Recommendations:

- Identify, inventory and monitor existing and new infestations on the forest using Natural Resources Inventory System (NRIS) Terra standards. NRIS Terra is a National Forest Service database that can be used to map (using GIS) and track infestations. Plant species information may be gathered by FS field going personnel, contractors, volunteers, and specialists and from existing files.
  - -Migrate (and validate) existing data into NRIS Terra. From the inventory; analyze plant species location; infested acres and critical risk areas, which will be used to prioritize treatment.
- Develop a training curriculum for field going personnel and volunteers in weed identification, mapping and treatment to be given, at a minimum, one hour annually. This training will make distinctions with regard to treatment options and procedures in Wilderness areas versus general forest areas.
- Make noxious weed site forms readily available to personnel across the forest, and encourage them to fill out and turn in the forms for inclusion into the noxious weed database.
- Insure proper monitoring is established and documented on all infestations. This will aid in determining effectiveness of treatment of infestations.

Goal #2- Set Objectives and Priorities for Treatment:

The Forest Service Manual (FSM) 2080 for noxious weed management (see Appendix 1) prioritizes prevention and control measures such that the first priority is **prevention** of new invaders, the second priority is **early treatment of new infestations**, and the third priority is to **contain and control** established infestations. The WCNF builds on this and provides further guidance based on both the number of infestations and the aggressiveness (invasiveness) of those species. In order to evaluate infestations on the WCNF, we developed a 2-tiered rating system that incorporates infestation number (Tier 1) as well as potential

invasiveness in our area (Tier 2). Because the WCNF is so diverse, we decided to evaluate infestations for each of the 4 separate and distinct eco-regions. See Appendix 2 for the ratings for each WC noxious weed.

Tier 1 – Number/Extent of Infestations (per Eco-region)

We first grouped the noxious weeds based on the number of mapped infestations in each eco-region. While one weed species may have numerous infestations in one Eco-region, in another eco-region it may still be possible to prevent or eradicate the same weed species.
Group 0 No known infestations
1 less than 10 known infestations
2 10-20 known infestations
3 >20 known infestations

Group 1: Noxious weeds that are known from only a few sites (less than about 10). These are species for whom eradication is most likely, and whose elimination is likely to be most cost-effective in the long term. The objective for treatment is to eradicate these presumably new populations, including all viable seeds and vegetative propagules.

Group 2 : Noxious weeds that are known from between 10 and 20 sites. These are the next priority because it is still economically feasible to expect eradication of these infestations. Treating these infestations is likely to be most effective in halting the spread of noxious weeds into weed-free areas

Group 3 : 20+ known infestations or relatively large established populations are managed by a containment and control strategy. The objective for treatment is to hold existing populations to their current size and reduce, over time, existing populations. Contain is defined to collectively include preventing weeds from expanding beyond the perimeter of the infestation; perhaps providing only limited treatment within the infestation; and treating to eradicate or control the weed outside the perimeter of the infestation. Control is defined to collectively include preventing seed production throughout the target area; decrease the area coverage of the weed over time, and prevent the weed from dominating an area's vegetation, but accepting low levels of the weed in the original area if elimination is not feasible. Treatment efforts may focus on working in from the edges, or treating specific areas identified as a particular seed/plant spreading source (ex: trailhead). In Group 3, biological treatment efforts are emphasized. Determination that a noxious weed species is in Group 3 should be coordinated with weed management partners.

Tier 2 – Invasiveness

The second tier considers the biological threat of the weed in question for our particular forest. It considers how aggressive and invasive the weed is likely to be in our plant communities. Invasiveness was determined subjectively by the Forest Vegetation Staff based on local knowledge. A letter designation was assigned to the individual weed species:

A - highly invasive,
B - moderately invasive,
C - invasive.

Thus, each weed in each eco-region is given a number-letter combination (ex: 2A) to describe its abundance and potential aggressiveness in that eco-region. This rating is then used to prioritize treatment, in accordance with FSM direction.

Prioritization:
Following the FSM's stated priorities, the following activities would be rated from highest to lower priority.

Prevention
Weeds rated as 0A, 0B, and 0C (in that order) would be the highest priority for prevention. These would be the potential invaders (i.e. species that are listed in neighboring states or counties but are not recorded on or near the WCNF).

Eradication
All 1A and 2A are the highest priority for treatment because it is still possible to eradicate those infestations and, because of their invasiveness, they have the highest potential for rapid spread. 1B and 1C infestation would follow because of their sparse nature and the high probability of success in eradication. 2B and 2C will be assessed based on resources at risk and potential spread.

Containment and Control
For well-established weeds, infestations classified as 3A will be highest priority for control (due to their invasive nature), followed by 3B and 3C.

Table 1. Weed Prioritization Rating. See appendix 2 for a complete list of mapped weeds and their priority ranking.

		Invasiveness		
		A	B	C
Infestation Group	0	Highest		
	1			
	2			
	3			Lowest

Recommendations:

Maintain and update weed lists and prioritizations.

GOAL #3 Identify Resources, Means Of Funding And Pursue Cost-Share Programs.

Past funding has been limited. Obtaining funding is a high priority for implementing an effective and integrated noxious weed program.

Recommendations:

- Pursue a multi-funded project work plan (PWP) for noxious weed management, potentially including the Forest Weed Board, on the Wasatch-Cache National Forest.

- Develop and be an active participant in Cooperative Weed Management Areas (CWMA) across the forest. Pursue all grants available for cooperative noxious weed work on and adjacent to the forest.

- Where logging activity is planned or where existing timber sales may contribute to the encroachment of noxious weeds, Sale Area Improvement and K-V collection plans as defined in FSM 2577.22, shall be prepared or modified to include provision for collection of K-V funds.

- Project-related noxious weed treatment (be it fuels, recreation, Wilderness or whatever type of project) is to plan those costs needed for inventory and project-related treatment into the up-front costs of the project. Noxious weed inventory within a project area should be funded with project-specific planning funds (the same way we fund TES or archeological surveys). If noxious weed treatment will be needed because the project will increase or spread noxious weeds, then that weed treatment cost analysis and implementation needs to be included in part of the project planning and implementation funding.
    - Coordinate with District Weed Specialists on monitoring for and appropriate treatment.
    - Require weed free material (i.e. fill, gravel, mulch, seed) for any material brought onto the Forest.
    - Require washing for any earth moving equipment brought onto the Forest.

- Explore effective and cost efficient inventory and treatment alternatives; i.e., one weed crew per district, shared crews, one forest wide crew or contract out the inventory and treatment.

GOAL #4—Develop Strategies For Prevention And Methodologies For Treatment

Limited spraying, hand pulling, mechanical and biological control treatments have been used in treating infestations. In spite of limited treatment existing infestations have spread, and continue to spread on National Forest System lands. In a few cases, the infestations have grown too large or the seed reserve in the soil is too extensive for these treatments to be totally effective, especially in regard to the cost of labor and Federal funding allocations.

Environmental analyses for projects and maintenance programs will assess weed risks, analyze high-risk sites for potential weed establishment and spread, and identify prevention practices (Clark 2003). Determine weed prevention and management needs at the onset of project planning, as per National and Regional direction on noxious weed management (Appendix 1 & 2).

Recommendations:

Prevention:

- Develop noxious weed prevention and control educational programs to build awareness and involvement for forest users and agency personnel.
  - Work with all potential cooperators on developing educational materials to increase the public awareness of noxious weed issues, such as videos, brochures, displays, classroom materials, TV, radio and community clipboard spots, world wide web, etc. Messages can be targeted for the various values associated with the prescription areas (i.e. forage for livestock on range lands, big game winter range or ecological integrity on Wilderness lands).
  - Educate through networking, media, educational materials, video advertisement and working partnership(s) to increase awareness and understanding of noxious weed issues.
  - Develop interagency interpretive signs for placement at portals, trailheads, and along roadsides to alert Forest users of the Noxious weed Program, and their role in prevention and control.
- Encourage research opportunities into prevention (i.e. how effective is the weed free hay order at preventing establishment of new weed infestations)
- Institutionalize management of noxious weeds in planning and project analysis of all Forest activities and uses.
- Require the use of certified weed free material, i.e. hay, seed, straw bales, and erosion blankets. Intermountain Region Weed Free Hay Order # 04-00-097
- Where practical under Federal authority, use fill and rock from noxious weed-free pits and rock quarries on Forest and off. Work with Forest Engineering to identify weed-free pits and quarries.
- Outline the direction and management tools available to prevent introduction or spread of noxious weeds during restoration efforts following large disturbances, such as, fires, floods, landslides, and other ground disturbing activities.
- Address prevention measures with Outfitters and Guides, range and ski area permittees through annual operating plans and allotment updates.
- For all ground disturbing activities (including fire), require that heavy equipment be cleaned, or is free of noxious weed seeds, prior to beginning new project work. Include these requirements in future contracts and permits, for heavy equipment that is arriving from off the Forest, or that is moving from a noxious weed infestation area, to another area.

- Incorporate the recommended practices from the Region 4 noxious weed management supplement and other references or guides as available.

Methodologies For Treatment

To effectively control and reduce the spread of infestations, large or small, will require multiple methods of treatment and re-treatments. Integrated weed management methods, outlined in the R4 supplement should be implemented to enable the Forest to act quickly and aggressively on small and new infestations and control the spread of large infestations. Treatment methods will vary depending on management prescription and special area designations (i.e. Research Natural areas, Wilderness areas etc). There may also be additional procedural requirements (i.e. Minimum Requirement Decision Guide) necessary to determine appropriate treatment methods. (See Appendix 4)

- Biological control
- Chemical applications
- Grazing
- Manual pulling, grubbing, or seed head removal
- Mechanical; mowing, cutting with a stringed trimmer, disking
- Seeding and/or fertilization, and
- Prescribed Fire
- Because different treatments have different effects on archeological sites this should be used as a guide to determine the need for archeological clearance prior to treatment.
    - Contact heritage program manager when it is planned to use:
        - Mechanical treatment.
        - Hand digging in areas with known site potential (area with slope less than 30%).
        - An archeological site is found during treatment of weeds.
    - There is no need to contact the heritage program when:
        - Spraying or hand pulling/shovel digging within 20 feet from road corridors.
        - Spraying or hand pulling/shovel digging on slopes over 30%.
- Rehabilitate weed treatment sites to discourage a rebound of the infestation or introduction of another invasive species.
- Use competitive seeding (from appropriate sources).
- Consider harvesting seed, for revegetation, from project sites prior to ground disturbance in small project sites across the forest.
- Create and pursue research opportunities.
- Based on infestation priorities explore opportunities to establish Biological Control Agent insectaries for a source of redistribution to other areas on the Forest and/or the partners. The insectaries would be both convenient and economically feasible.

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APPENDIX 1 – National Forest Service Noxious Weed Management Direction – FSM-2080

APPENDIX 2 – Weed Lists:
- Wasatch-Cache NF
- Utah State & County
- Wyoming State
- WCNF Potential Invaders

APPENDIX 3 – Action Items and Timeline and Progress Report.

APPENDIX 4 - Decision Tree: Sensitive Condition Factors and WCNF Response and WCNF Response and Treatment Options Table

APPENDIX 1 –

2080

SERIES 2000 - NATIONAL FOREST RESOURCE MANAGEMENT

WO AMENDMENT 2000-95-5

EFFECTIVE 11/29/95

ZERO CODE 2080 - NOXIOUS WEED MANAGEMENT

2080.1 - Authority.

1. The Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 et seq.), requires cooperation with State, local, and other Federal agencies in the application and enforcement of all laws and regulations relating to management and control of noxious weeds. The Federal Noxious Weed Act directs the Secretary of Agriculture to:

a. Develop and coordinate a management program for control of undesirable plants which are noxious, harmful, injurious, poisonous, or toxic on Federal lands under the agency's jurisdiction,

b. Establish and adequately fund the program,

c. Complete and implement cooperative agreements and/or memorandums of understanding regarding the management of noxious weeds on Federal lands under the agency's jurisdiction, and

d. Establish Integrated Weed Management to control or contain species identified and targeted under cooperative agreements and/or memorandums. Forest Service regulations at 36 CFR 222.8 acknowledges the Agency's obligation to work cooperatively in identifying noxious weed problems and developing control programs in areas where National Forest System lands are located.

2. The National Environmental Policy Act (42 U.S.C. 4321-4346) and implementing regulations found at 40 CFR Parts 1500-1508 (FSM 1950; FSH 1909.15) govern environmental analysis and disclosure requirements conducted by the Forest Service on National Forest System lands for proposed noxious weed control activities, such as ground disturbing activities, herbicide application, or changes in use of resources.

3. Departmental Regulation 9500-10 (DR 9500-10) sets forth Departmental policy for the management and coordination of noxious weed activities among agencies of the Department of Agriculture and other executive agencies, organizations, and individuals. DR 9500-10 specifically establishes Integrated Pest Management (FSM 2080.5) as the preferred approach to noxious weed prevention, control, and eradication.

2080.2 - Objectives. To use an integrated weed management approach to control and contain the spread of noxious weeds on National Forest System lands and from National Forest System lands to adjacent lands. Specific objectives to be achieved through noxious weed management include:

1. Prevention of the introduction and establishment of noxious weed infestations.

2. Containment and suppression of existing noxious weed infestations.

3. Formal and informal cooperation with State agencies, local landowners, weed control districts and boards, and other Federal agencies in the management and control of noxious weeds.
4. Education and awareness of employees, users of National Forest System lands, adjacent landowners, and State agencies about noxious weed threats to native plant communities and ecosystems.

2080.3 - Policy. In consultation with Federal, State, and local government entities and the public, develop and implement a program for noxious weed management on National Forest System lands. Activities implementing the noxious weed management program must be consistent with the goals and objectives identified in Forest Land and Resource Management Plans (FSM 1910, 1920, and 1930).

2080.4 - Responsibility.

2080.41 - Washington Office Director of Range Management. The Director of Range Management is responsible for:

1. Representing the Chief on national committees and ad hoc groups concerned with noxious weed management.
2. Maintaining contact with the Forest Service Research, Agricultural Research Service (ARS), Animal and Plant Health Inspection Service (APHIS), and Cooperative State Research, Education, and Extension Service (CSREES) program managers, to review current noxious weed research programs, identify additional research needs, set priorities, and help coordinate research efforts for control or prevention of noxious weeds.
3. Coordinating with other Federal agencies in the establishment, application, and use of an Integrated Weed Management approach for the control and containment of noxious weeds.
4. Providing national program leadership for the noxious weed management program through the Forest Service budget process, national program directives, and input to the Resources Planning Act (RPA) program.
5. Determining national noxious weed information needs.
6. Monitoring and reporting on regional compliance with national policy.
7. Establishing standards for noxious weed management training and continuing education.

2080.42 - Regional Forester. Regional Foresters are responsible for:

1. Appointing a Regional coordinator for the noxious weed program.
2. Maintaining a consolidated noxious weed inventory for the Region in accordance with section 2083 of this chapter.
3. Developing and implementing noxious weed management cooperative agreements or memorandums of understanding with other Federal and State agencies.
4. Offering a recurring noxious weed management regional training program.

5. Developing public information and education programs to improve awareness of noxious weeds and Integrated Weed Management.
6. Cooperating with State agencies to enforce State legislation requiring noxious weed-free forage or seed on National Forest System lands.

2080.43 - Forest Supervisor. Forest Supervisors are responsible for:

1. Appointing a Forest coordinator for the noxious weed program.
2. Developing and implementing a noxious weed management program that is consistent with the goals and objectives identified in Forest Land and Resource Management Plans (FSM 1910, 1920, and 1930).
3. Providing information on the status and threat of noxious weed infestation as part of the Forest planning process.
4. Maintaining a noxious weed inventory for the Forest in accordance with section 2083 of this chapter.
5. Offering training to employees to identify noxious weeds in and surrounding the Forest.
6. Cooperating with State agencies to enforce State legislation requiring noxious weed-free forage or seed on National Forest System lands.
7. If needed, issuing orders under the authority of 36 CFR Parts 261.50(a) and 261.58(t) to control the introduction of noxious weed seeds on National Forest System lands.
8. Enforcing closure or prohibition orders issued under 36 CFR Parts 261.50(a) and 261.58(t) and enforcing contract specifications intended to prevent and control the spread of noxious weeds.
9. Coordinating with State and county agencies and landowners in prevention, control, containment, and monitoring efforts involved with the management of noxious weeds.
10. Ensuring that contracts and permits contain appropriate clauses concerning the prevention or spread of noxious weeds.

2080.44 - District Ranger. District Rangers are responsible for:

1. Preventing the introduction and establishment, as well as providing for the containment and suppression, of noxious weeds.
2. Appointing a District coordinator for the noxious weed program.
3. Maintaining a noxious weed inventory for the District in accordance with section 2083 of this chapter.
4. Monitoring noxious weed infestations and estimating the current and potential impacts to all resources.
5. Training employees to identify noxious weeds in and surrounding the District.
6. Determining the risk of noxious weed introduction or spread as part of the NEPA process for proposed actions, especially for ground disturbing and site altering activities.

7. Cooperating with State agencies to enforce State legislation requiring noxious weed-free forage or seed on National Forest System lands.

8. Enforcing closure or prohibition orders issued under 36 CFR Parts 261.50(a) and 261.58(t) and enforcing contract specifications intended to prevent and control the spread of noxious weeds.

9. Coordinating with State and county agencies and landowners in the prevention, control, and monitoring efforts involved with the management of noxious weeds.

10. Ensuring that contracts and permits contain appropriate clauses concerning the prevention or spread of noxious weeds.

11. Maintaining the day-to-day working relationship with the local weed district or board.

2080.5 - Definitions. The following special terms are used in this chapter:

Cooperative Agreement. A written agreement between the Forest Service and a county, State, or Federal agency entered into pursuant to the Federal Noxious Weed Act of 1974, as amended by section 1453 of the Food, Agriculture, Conservation and Trade Act of 1990, when there is an exchange of funds from one agency to another (FSM 1580).

Integrated Weed Management. An interdisciplinary pest management approach for selecting methods for preventing, containing, and controlling noxious weeds in coordination with other resource management activities to achieve optimum management goals and objectives. Methods include: education, preventive measures, herbicide, cultural, physical or mechanical methods, biological control agents, and general land management practices, such as manipulation of livestock or wildlife grazing strategies, that accomplish vegetation management objectives.

Memorandum of Understanding. A written agreement between the Forest Service and local, State, or Federal entities entered into pursuant to the Federal Noxious Weed Act of 1974, as amended by section 1453 of the Food, Agriculture, Conservation, and Trade Act of 1990, when there is no exchange of funds from one agency to another (FSM 1580).

Noxious Weed. Those plant species designated as noxious weeds by the Secretary of Agriculture or by the responsible State official. Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being native or new to or not common to the United States or parts thereof.

State Agency. A State department of agriculture, other State agency, or political subdivision thereof, responsible for the administration or implementation of State laws pertaining to noxious weeds, exotic, and undesirable plants.

Undesirable Plants. Plant species that are classified as undesirable, noxious, harmful, exotic, injurious, or poisonous pursuant to State or Federal laws. Species listed as threatened

or endangered by the Secretary of the Interior according to the Endangered Species Act of 1973 are not classified as undesirable plants.

2081 - MANAGEMENT OF NOXIOUS WEEDS.

2081.03 - Policy. When any ground disturbing action or activity is proposed, determine the risk of introducing or spreading noxious weeds associated with the proposed action.

1. For projects having moderate to high risk of introducing or spreading noxious weeds, the project decision document must identify noxious weed control measures that must be undertaken during project implementation.
2. Make every effort to ensure that all seed, feed, hay, and straw used on National Forest System lands is free of noxious weed seeds. (FSH 6309.12, sec. 42 and 42.1).
3. Where States have enacted legislation and have an active program to make weed-free forage available, Forest Officers shall issue orders restricting the transport of feed, hay, straw, or mulch which is not declared as weed-free, as provided in 36 CFR 261.50(a) and 261.58(t).
4. Use contract and permit clauses to prevent the introduction or spread of noxious weeds by contractors and permittees. For example, where determined to be appropriate, use clauses requiring contractors or permittees to clean their equipment prior to entering National Forest System lands.

2081.1 - Forest Planning. Manage noxious weeds on National Forest System lands to achieve the goals and objectives identified in Forest Land and Resource Management plans (FSM 1910, 1920, and 1930).

2081.2 - Prevention and Control Measures. Determine the factors, which favor the establishment and spread of noxious weeds and design management practices or prescriptions to reduce the risk of infestation or spread of noxious weeds. Where funds and other resources do not permit undertaking all desired measures, address and schedule noxious weed prevention and control in the following order:

1. First Priority: Prevent the introduction of new invaders,
2. Second Priority: Conduct early treatment of new infestations, and
3. Third Priority: Contain and control established infestations.

When assigning management priorities for prevention and control measures, utilize Noxious Weed Classification Systems developed at the State, county, or local level to provide a coordinated approach. Particular consideration should be given to emergency staging areas, trailheads, campgrounds, and gravel pits. Ensure that environmental controls and objectives are met for threatened and endangered or other species, as specified in applicable laws, policy, and regulations for project-level noxious weed control actions, as provided in the National Environmental Policy Act process.

2082 - COOPERATION. Cooperate with State agencies, landowners, local governments, universities, and other Federal agencies to coordinate programs for the prevention and control of noxious weeds.

2082.1 - Memorandums of Understanding and Cooperative Agreements. Use a memorandum of understanding (MOU) or a cooperative agreement (FSM 1580) to outline ways of cooperating with State or other Federal agencies to prevent, contain, and control noxious weeds. Use a cooperative agreement when funds are exchanged. Any project-level MOU or cooperative agreement must, as a minimum:

1. Describe the Integrated Weed Management System to be used to control or contain the targeted plant species or group of species,
2. Detail the means of implementing the Integrated Weed Management approach, including defining the duties of the cooperators,
3. Establish a timeframe for the initiation and completion of the tasks specified in the Integrated Weed Management approach, and
4. Specify in cooperative agreements the contributions to be made by each party.

2082.2 - Methods of Cooperation. Assist and promote cooperative efforts with other Federal, State, local, and international agencies, and universities in the following ways:

1. Assist in identifying, rearing, releasing, and distributing biological control agents in North America.
2. Formulate and implement Integrated Weed Management prescriptions and measures based on beneficial uses of noxious weeds.
3. Research and use desirable plant species that are competitive with noxious weeds.
4. Develop an interagency database and share noxious weed inventory information.
5. Develop educational and public awareness material and handbooks. Emphasize cooperative research that defines the ecological requirements of noxious weeds, cost-effective management strategies, and beneficial uses.

2083 - INFORMATION COLLECTION AND REPORTING. A current noxious weed inventory must be established and maintained in the Forest Service Range Management Information System (FSRAMIS), or other Nationally approved data base (FSM 2270). The inventory must include acres infested with noxious weeds, by species and location, and by Forest, Ranger District, State, and county.

Report the level of infested acres as follows: low (5 percent or less canopy cover); moderate (6 – 25 percent canopy cover); and high (over 25 percent canopy cover).

Regions are to report annually to the Washington Office, the number of acres treated or retreated during the previous fiscal year using the Management Attainment Reporting (MAR) system (FSH 1909.13, sec. 38.3 and ch. 50). For acres treated biologically, report only those acres which had biological agents introduced on them during the reporting period (FSM 6550; FSH 6509.11k).

Wasatch-Cache National Forest
Integrated Weed Management Strategy
Revised 2005

APPENDIX 2 – Weed Lists

- WCNF List
- Utah State
- County List
- Wyoming List
- Potential Invaders List

WCNF Weed List		
Scientific Name	**Common Name**	**Status**
*Aegilops cylindrica**	Jointed Goatgrass	County Noxious
*Arctium minus***	Common Burdock	State Noxious (WY)
*Cardaria draba**	White Top/Hoary Cress	State Noxious
*Carduus nutans**	Musk Thistle	State Noxious
*Cirsium arvense**	Canada Thistle	State Noxious
*Centaurea diffusa**	Diffuse Knapweed	State Noxious
*Centaurea maculosa**	Spotted Knapweed	State Noxious
*Centaurea repens**	Russian Knapweed	State Noxious
Centaurea solstitialis	Yellow Star Thistle	State Noxious
*Cirsium arvense**	Canada Thistle	State Noxious
*Conium maculatum**	Hemlock (Poison?)	County Noxious
*Convolvulus arvensis**	Field Bindweed	State Noxious
Cynodon dactylon	Bermudagrass	State Noxious
Cynoglossum officinale	Houndstongue	County Noxious
*Euphorbia esula**	Leafy Spurge	State Noxious
*Hyoscyamus niger**	Black Henbane	County Noxious
*Hypericum perforatum**	St. Johns Wort	County Noxious
*Isatis tinctora**	Dyers Woad	State Noxious
*Lepidium latifolium***	Perennial pepperweed	State Noxious
*Linaria dalmatica**	Dalmatian toadflax	County Noxious
Linaria vulgaris	Yellow toadflax	County Noxious
Lythrum salicaria	Purple Loosestrife	State Noxious
*Onopordum acanthium**	Scotch Thistle	State Noxious
Taeniatherum caput-medusae	Medusahead	State Noxious
Tamarix sp.	Saltcedar	Exotic Invasive
*Tribulus terrestris***	Puncturevine	County Noxious
*Verbascum virgatum***	Wand Mullein	Exotic Invasive
Euphorbia myrsinites	Blue spurge	Invasive

* Recorded infestations on the WCNF
**Known locations but no formal documentation.

Copied from Utah Department of Agriculture Website: 1/13/04

Utah Noxious Weed List

The following weeds are officially designated and published as noxious for the State of Utah, as per the authority vested in the Commissioner of Agriculture under Section 4-17-3, Utah Noxious Weed Act:

- Bermudagrass** (*Cynodon dactylon*)
- Canada thistle (*Cirsium arvense*)
- Diffuse knapweed (*Centaurea diffusa*)
- Dyers woad (*Isatis tinctoria*)
- Field bindweed (Wild Morning Glory) (*Convolvulus arvensis*)
- Hoary cress (*Cardaria draba*)
- Johnsongrass (*Sorghum halepense*)
- Leafy spurge (*Euphorbia esula*)
- Medusahead (*Taeniatherum caput-medusae*)
- Musk thistle (*Carduus nutans*)
- Perennial pepperweed (*Lepidium latifolium*)
- Perennial sorghum (*Sorghum halepense* & *Sorghum almum*)
- Purple loosestrife (*Lythrum salicaria* L.)
- Quackgrass (*Agropyron repens*)
- Russian knapweed (*Centaurea repens*)
- Scotch thistle (*Onopordum acanthium*)
- Spotted knapweed (*Centaurea maculosa*)
- Squarrose knapweed (*Centaurea squarrosa*)
- Yellow starthistle (*Centaurea solstitialis*)

** Bermudagrass shall not be a noxious weed in Washington County and shall not be subject to provisions of the Utah Noxious Weed Act within the boundaries of the county.

County Noxious Weeds 2003
(Taken from Utah Department of Agriculture Website 1/13/04)

County	Weeds
Beaver	Bull Thistle
Box Elder	St. Johswort
Cache	Goatsrue
	Poison Hemlock
	Puncture Vine
Carbon	Russian Olive
Davis	Yellow Nutsedge
	Buffalobur
	Poison Hemlock
Duchesene	Russian Olive
Iron	Western Whorled Milkweed
Juab	Blue Flowereing Lettuce
Millard	Buffalobur
Morgan	Puncturevine
	Burdock
Rich	Black Henbane
	Dalmation toadflax
	Poison hemlock
San Juan	Silverleaf Nightshade
	Buffalobur
	Whorled Milkweed
	Jointed goatgrass
	Camel thorn
Sanpete	Houndstongue
	Black Henbane
	Velvet leaf
Sevier	Russian Olive
Toole	Yellow toadflax
	Houndstongue
	Dalmation toadflax
	Jointed goatgrass
Uintah	Russian olive
	Salt cedar
Washington	Poison Milkweed
	Silverleaf Nightshade
Wasatch	Yellow toadflax
	Dalmation toadflax
Wayne	Russian Olive
Weber	Puncturevine

WYOMING WEED & PEST CONTROL ACT DESIGNATED LIST
Designated Noxious Weeds .S. 11-5-102 (a)(xi)
and
Prohibited Noxious Weeds W.S. 11-12-104

(1) Field bindweed (*Convolvulus arvensis* L.)
(2) Canada thistle (*Cirsium arvense* L.)
(3) Leafy spurge (*Euphorbia esula* L.)
(4) Perennial sowthistle (*Sonchus arvensis* L.)
(5) Quackgrass (*Agropyron repens* (L.) Beauv.)
(6) Hoary cress (whitetop) (*Cardaria draba* and *Cardaria pubescens* (L.) Desv.)
(7) Perennial pepperweed (giant whitetop) (*Lepidium latifolium* L.)
(8) Ox-eye daisy (*Chrysanthemum leucanthemum* L.)
(9) Skeletonleaf bursage (*Franseria discolor* Nutt.)
(10) Russian knapweed (*Centaurea repens* L.)
(11) Yellow toadflax (*Linaria vulgaris* L.)
(12) Dalmatian toadflax (*Linaria dalmatica* (L.) Mill.)
(13) Scotch thistle (*Onopordum acanthium* L.)
(14) Musk thistle (*Carduus nutant* L.)
(15) Common burdock (*Arctium minus* (Hill) Bernh.)
(16) Plumeless thistle (*Carduus acanthoides* L.)
(17) Dyers woad (*Isatis tinctoria* L.)
(18) Houndstongue (*Cynoglossum officinale* L.)
(19) Spotted knapweed (*Centaurea maculosa* Lam.)
(20) Diffuse knapweed (*Centaurea diffusa* Lam.)
(21) Purple loosestrife (*Lythrum salicaria* L.)
(22) Saltcedar (*Tamarix* spp.)
(23) Common St. Johnswort (*Hypericum perforatum*)
(24) Common Tansy (*Tanacetum vulgare*)

Designated Pests W.S. 11-5-102 (a)(xii)

(1) Grasshoppers
(2) Mormon crickets
(3) Prairie dogs
(4) Ground squirrels
(5) Mountain pine beetle
(6) Beet Leafhopper

WCNF Potential Invaders	
Absinth wormwood	Artemisia absinthium
Bull thistle	Cirsium vulgare
Common crupina	Crupina vulgaris
Camel thorn	Alhagi pseudalhagi
Bur ragweed	Franseria tomintosa
Goatsrue	Galega officinalis
Hemp (marijuana)	Cannabis sativa
Horse nettle	Solanum carolinense
Johnsongrass	Sorghum halepense
Matgrass	Nardus stricta
Meadow knapweed	Centaurea pratensis
Milium	Milium vernale
Orange hawkweed	Hieracium aurantiacum
Ox-eye daisy	Chrysanthemum
Perennial sorghum	Sorghum halepense L & sorghum almum
Perennial sowthistle	Sonchus arvensis
Pignut	Hoffmannseggia densiflora
Plumeless thistle	Carduus acanthoides
Quackgrass	Agropyron repens
Rush skeletonweed	Chondrilla juncea
Russian olive	Elaeagnus angustifolia
Scotch broom	Cytisus scoparius
Silverleaf nightshade	Solanum elaeagnifolium
Skeletonleaf bursage	Franseria discolor
Syrian bean caper	Zygophyllum fabago L
Tansy ragwort	Senecio jacobaea
Toothed spurge	Euphorbia dentate
Velvet leaf	Abutilon theophrasti
Yellow hawkweed	Hieracium pratense
Yellow nutsedge	Cyperus esculentus

This list is comprised of plants that are on local county lists and regional weed free hay list but have not yet identified on the Wasatch Cache National Forest.

APPENDIX 3

Wasatch-Cache National Forest Noxious Weed Action Plan and Timeline and Progress Report.

Following are specific action items pulled from the recommendations to implement each of the four goals in this noxious weed strategy. Action items are listed in order of priority and anticipated completion date.

Wasatch-Cache National Forest Noxious Weed Action Plan and Timeline and Progress Report					
Action	**Goal #**	**Responsible Party**[3]	**Anticipated Completion**	**Actual Completion**	**Comments**
Organize Forest Weed Board	1-4	FLT and FWB	December '03	December '03	
Develop W-C Noxious Weed Strategy	1-4	FWB	Draft, March '04	April '04	To be revised annually.
Approve W-C Noxious Weed Strategy	1-4	FLT	April '04	May '04	
Develop teaching program and ID manual for employee orientation.	1,4	FWB, I&E Forest Veg Staff	May '04	May '04	Update annually New action Item.
Conduct noxious weed trainings on each unit	1,4	FWB	June '04	D1,3,6,7 May/June '04	Repeat annually.
Create data dictionary for weed mapping and inventory.	1	M Duncan, Sean	May '04		Will complete by May 05.
Determine cost effective way to establish a baseline inventory of the forest. - Contract out or hire crews	1	FLT			FY05 Work plan for IM for mapping/will follows national and local strategy.
Coordinate weed mapping and inventory	1	M. Duncan, District Weed Specialists, FWB	Ongoing	Ongoing NRIS	Mapping involves 1. an intensive effort with Weed Specialists, 2. incidental mapping by field going personnel, 3. County and CWMAs
Migrate existing location data into NRIS	1	M. Duncan, T. Rhoades	March '04		Validate existing data then input into NRIS.

[3] Abbreviations: FLT = Forest Leadership Team
FWB = Forest Weed Board

Wasatch-Cache National Forest Noxious Weed Action Plan and Timeline and Progress Report					
Action	**Goal #**	**Responsible Party**[3]	**Anticipated Completion**	**Actual Completion**	**Comments**
Validate existing location data and input into NRIS	1	M. Duncan, Inventory Crew	Ongoing		Validate existing data then input into NRIS.
Develop Forest noxious weed list; designate species Priority rating.	1,2	FWB	March '04	December '04	Ongoing
Develop fact sheets for each noxious weed species (biology, distribution, habitat, preferred treatment method, timing, etc.)	1	M. Duncan & FWB	June '04?		Treatment options table partially fulfills this.
New action Item. Determine weed crew staffing, funding, and coverage	1,3,4	FLT, FWB	May 2006		Develop a Cost efficiency outline. -dedicated crew, contract out, collateral duties should address in forest org. review
Implement weed crew: inventory and treatment	1,2,3,4	FLT, M. Duncan	TBA		Ongoing
Each spring, prioritize treatment locations and species for crew work for the upcoming field season	2	District Weed Specialists, District Rangers, M. Duncan, FWB	Ongoing, April each year		Still needed.
Have copies of maps of infested areas available and a list of current species for identification.	1	FWB, Teresa Rhoades	May 2005		Now have capability.
Write a contract for forest wide Noxious Weed Treatment NEPA	3,4	M. Blackwell, Mike Duncan	June '04	September '04	Kick off meeting completed 10 Jan.
Implement weed NEPA Decision	3,4	M. Duncan, W. Padgett	2006		
Actively participate in CWMAs	3	M. Duncan, District weed staff.	Ongoing		4 on the forest, developing agreements break down agreements barrier
Find or Create & Distribute noxious weed educational material; conduct public weed presentations	4	J. Colby, M. Duncan, FWB	Ongoing	status	Still needed. Coordinate with I&E, County and CWMA

Wasatch-Cache National Forest Noxious Weed Action Plan and Timeline and Progress Report					
Action	**Goal #**	**Responsible Party[3]**	**Anticipated Completion**	**Actual Completion**	**Comments**
Analyze noxious weed effects for all ground-disturbing projects as part of the ITD process. Include noxious weed treatment as part of the proposed action, as appropriate. (Risk Assessment)	4	M. Duncan, W. Padgett, District Weeds Specialists, FWB,	See 04 Project list		FSM 2081.3 Design project mitigation checklist that would indicate that this is accomplished.
New Action Item Develop a running list of ground disturbing projects per year that need to be checked for weeds annually	4	Julie Hubbard, Veg Staff	Spring Annually		
Design project mitigation checklist that would address noxious weed prevention. Available for Project leaders to ensure weed mitigations are accomplished.	4	FWB	November 2005		Adapt existing measures and clauses.
Implement standardized monitoring methods per NRIS Terra Invasives protocol.	1	M. Duncan, weed crew	June '05	As a part of Mapping efforts	Still needed. Obtained 5 PDRs and GPS that is compatible with NRIS protocol
Identify infestations that threaten other resource areas.	4	FWB	Fall 04	Ongoing	Partially completed for development of Chapter 2 of the EIS.
Inventory quarry sites for noxious weeds.	4	Craig Weir, Mike Duncan	Ongoing	10 August 04	Completed for quarries used on the Ogden and Logan RD
Develop a list of approved quarries.	4	Craig Weir	May 2005	Update annually.	Provide list of inventoried, clean quarries.
Create a supplement for all contracts (including Fire) outlining requirements for cleaning and inspection of vehicles and equipment used in ground disturbing activities.	4	Craig Weir, Mike Duncan	ASAP		Review and adapt Park Service and DOD Protocol.
Create a list of local vendors that supply weed free materials.	4	FWB	August each year		Available from Utah Department of Agriculture.

Wasatch-Cache National Forest Noxious Weed Action Plan and Timeline and Progress Report					
Action	**Goal #**	**Responsible Party[3]**	**Anticipated Completion**	**Actual Completion**	**Comments**
New Action Item. Implement and enforce Regional Weed Free Hay Order # 04-00-097.	4	LEO, FPO, Rec Rangers.	Ongoing	Ongoing	Has been in place for several years. Need to ensure enforcement.
New Action Item. Provide guidelines for project managers to address prevention measures with permittees.	4	FWB	November 2005		Include contract clauses as developed.
New Action Item Identify and incorporate the appropriate recommended prevention practices from the Region 4 noxious weed management supplement and other references or guides as available.	4	FWB	November 2005	Ongoing	

[3]Abbreviations: FLT = Forest Leadership Team
FWB = Forest Weed Board

APPENDIX 4

Sensitive Condition Factors and Decision Tree

Sensitive Condition Factors (left side) and WCNF Response (right side) to each factor. Each condition factor will be addressed independently and the course of action will follow the most limiting response.

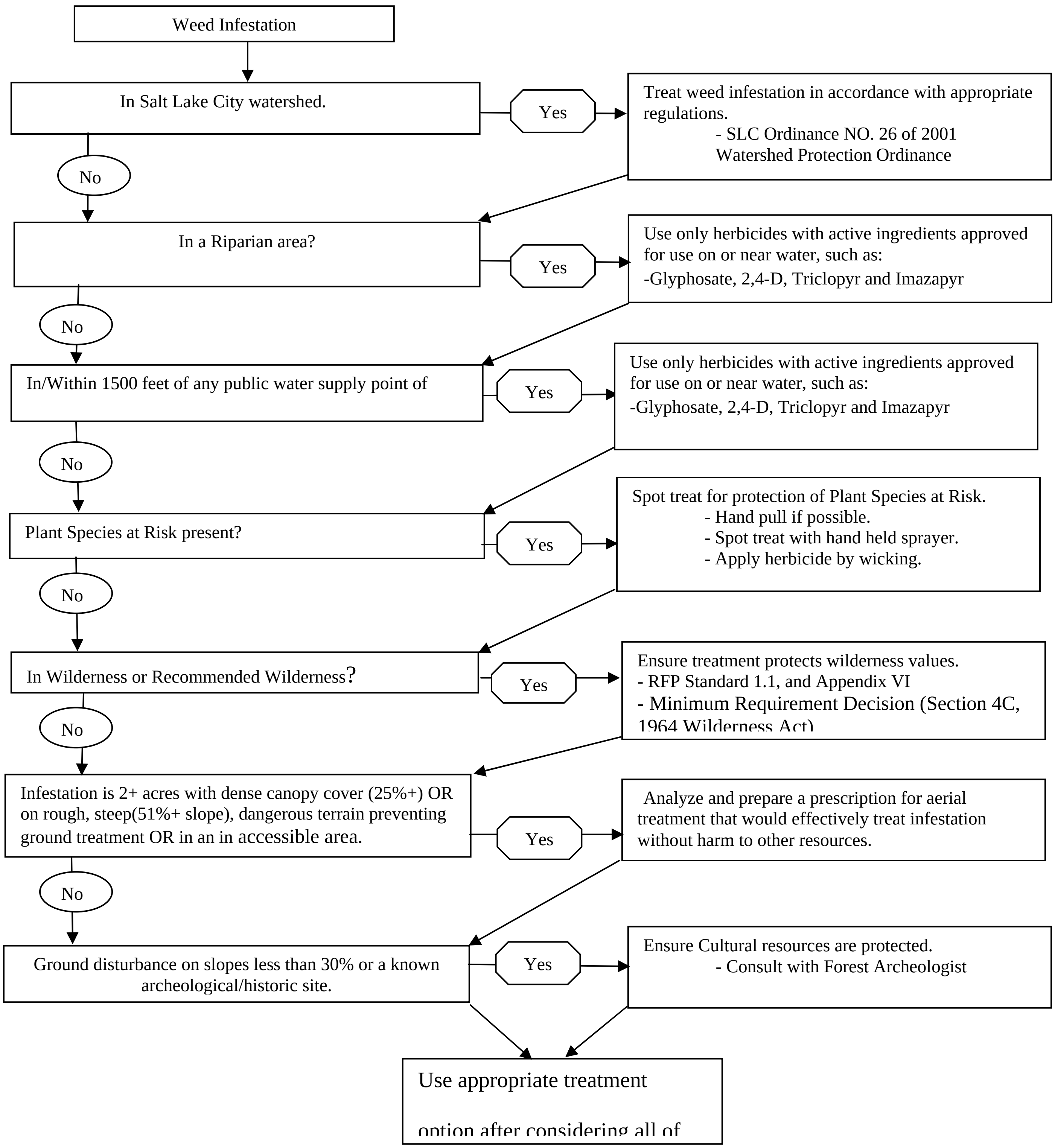
and

Treatment Option Table

Possible Treatment Options Available, Life Cycle, and Mode of Reproduction for Known Established, New, and Potential Invaders of Weed Species on or Adjacent to the Wasatch-Cache National Forest. Sensitive condition factors must be considered prior to choosing the appropriate treatment method. The most ecologically sound method that would achieve the management objective for that species and or infestation should be used.

Wasatch-Cache National Forest
Integrated Weed Management Strategy
Revised 2005

Sensitive Condition Factors and WCNF Responses



APPENDIX 4

Possible Treatment Options Available, Life Cycle, and Mode of Reproduction for Known Established, New, and Potential Invaders of Weed Species on or Adjacent to the Wasatch-Cache National Forest. Sensitive condition factors must be considered prior to choosing the appropriate treatment method. The most ecologically sound method that would achieve the management objective for that species and or infestation should be used.

Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
				ESTABLISHED INVADERS			
Aegilops cylindrica	Jointed goatgrass	Winter annual	Seeds (viable in soil up to 6 years).	None known.	• glyphosate • oust	Establish and maintain native vegetation.	Spring tillage or hand removal for small outbreaks.
Arctium minus ARMI2	Common Burdock	Biennial	Seed only (viable 2 years[reported up to 10])	None currently available	• Escort +2,4-D • Telar+2,4-D • Picloram	Mowing/remove seed source	Hand treat with tool. Grazing Tilling
Cardaria draba	Whitetop (Hoary cress)	Perennial	Seeds (viable 3 years) and deep creeping roots.	None currently available.	• glyphosate • 2,4-D • chlorsulfuron • metasulfuron • amitrole New potentially effective: WOW and Scythe.	Presence of competing vegetation, particularly shrubs, vetch, lupine, and other nitrogen-fixing legumes.	Mowing or grazing with sheep or goats during bud stage and again during re-bud (follow by herbicide). Hand-pulling or digging must remove all roots and continue for 2 to 5 years to eradicate.

APPENDIX 4
Possible Treatment Options Available, Life Cycle, and Mode of Reproduction for Known Established, New, and Potential Invaders of Weed Species on or Adjacent to the Wasatch-Cache National Forest. Sensitive condition factors must be considered prior to choosing the appropriate treatment method. The most ecologically sound method that would achieve the management objective for that species and or infestation should be used.

Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Carduus nutans	Musk thistle	Biennial or winter annual	Seeds (prolific seed producer, seeds viable up to 10 years).	• rosette weevil (*Trichosirocalus horridus*) • flea beetle (*Psylliodes chalcomera*) • syrphid fly (*Cheilosia corydon*) • thistle-defoliating beetle (*Cassida rubiginosa*) [The seedhead weevil (*Rhinocyllus conicus*) is not recommended because it attacks some native, rare thistles.]	• glyphosate • 2,4-D • dicamba • piclorarn • metsulfuron methyl • clopyralid • 2,4-D amine + • glyphosate + 2,4-D New potentially effective: WOW and Scythe.	Revegetation for shade.	Mowing before flowering, continuously. Cutting plant below crown.

APPENDIX 4
Possible Treatment Options Available, Life Cycle, and Mode of Reproduction for Known Established, New, and Potential Invaders of Weed Species on or Adjacent to the Wasatch-Cache National Forest. Sensitive condition factors must be considered prior to choosing the appropriate treatment method. The most ecologically sound method that would achieve the management objective for that species and or infestation should be used.

Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Centaurea diffusa	Diffuse knapweed	Biennial or short-lived perennial	Abundant seed production.	• seed head gall fly (*Urophora affinis*) • seed head gall fly (*U. quadrifasciata*) • peacock fly (*Chaetorellia acrolophi*) • seed head weevil (*Bangasternus fausti*) • root weevil (*Cyphocleonus achates*) • root moth (*Agapeta zoegana*)	• glyphosate • picloram • 2,4-D • clopyralid • clopyralid + 2,4-D • dicamba	Revegetation for shade. Spring burning.	Hand-pulling of small infestations (usually takes 7 to 10 years).

APPENDIX 4

Possible Treatment Options Available, Life Cycle, and Mode of Reproduction for Known Established, New, and Potential Invaders of Weed Species on or Adjacent to the Wasatch-Cache National Forest. Sensitive condition factors must be considered prior to choosing the appropriate treatment method. The most ecologically sound method that would achieve the management objective for that species and or infestation should be used.

Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Centaurea maculosa *(C. biebersteinii)*	Spotted knapweed	Biennial or short-lived perennial	Seeds, lateral shoots.	• seed head gall fly (*Urophora affinis*) • seed head gall fly (*U. quadrifasciata*) • seed head moth (*Metzneria paucipunctella*) • black leaf blight fungus *(Alternaria alternata*) • root moth (*Agapeta zoegana*) • verdant seed fly (*Terellia virens*) • root weevil (*Cyphocleonus achates*)	• glyphosate • picloram • 2,4-D • clopyralid + 2,4-D • dicamba clopyralid (not recommended for sites with other weed species) • picloram New potentially effective: WOW and Scythe.	Revegetation for shade. Regular cultivation/ seeding. Spring burning.	Hand-pulling of small infestations (usually takes 7 to 10 years). Grazing

APPENDIX 4
Possible Treatment Options Available, Life Cycle, and Mode of Reproduction for Known Established, New, and Potential Invaders of Weed Species on or Adjacent to the Wasatch-Cache National Forest. Sensitive condition factors must be considered prior to choosing the appropriate treatment method. The most ecologically sound method that would achieve the management objective for that species and or infestation should be used.

Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Centaurea repens or *Acroptilon repens*	Russian knapweed[Int]	Long-lived perennial (75 years)	Rhizomes (new shoots arise from creeping roots, up to 27 root shoots/ft^2 and roots can reach depths to 23 feet). Relatively few seeds are produced (viable for 2-3 years).	• gall-forming nematode (*Subanguina picridis*) • seed head gall fly (*U. quadrifasciata*) • seed head gall fly (*Urophora affinis*)	• picloram • clopyralid • glyphosate	The healthier the native vegetation, the less susceptible it will be to Russian knapweed invasion. (Once established, it emits allelopathic compounds to inhibit other plants).	Cultivation, cutting/mowing, and/or hand-pulling not recommended unless done three times per year (spring, summer, fall) to force the plants to use nutrient reserve stored in roots, followed by herbicide treatment. This protocol must be followed for at least 3 years otherwise it will stimulate sprouting from rhizomes. It is difficult to remove all roots with a one-time effort. Severed root pieces as small as 2.5 cm can generate new shoots from depths to 15 cm.

APPENDIX 4
Possible Treatment Options Available, Life Cycle, and Mode of Reproduction for Known Established, New, and Potential Invaders of Weed Species on or Adjacent to the Wasatch-Cache National Forest. Sensitive condition factors must be considered prior to choosing the appropriate treatment method. The most ecologically sound method that would achieve the management objective for that species and or infestation should be used.

Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Centaurea solstitialis	Yellow starthistle	Winter annual or biennial	Seeds (up to 10 years dormancy and viability).	• seed head weevil (*Bangastemus orientalis*) • peacock fly (*Chaetorellia australis*) • flower weevil (*Larinus curtus*) • yellow starthistle hairy weevil, (*Eustenopus villosus*) • flies (*Urophora sirunaseva and U. jaculata*) (All of the above are approved.) • false peacock fly (*Chaetorellia succinea*) (Effective, but waiting for final approval.)	• glyphosate • picloram • *clopyralid* • 2,4-D amine + • dicamba • Imazapyr • metsulfuron • triclopyr	Revegetation with native species for shade.	Handpulling/digging small infestations. Get at least 2"of root. Mowing, burning early in flower (timing is critical). Grazing before spine production (toxic to horses). (Hard to control seed ban with mechanical methods.)

APPENDIX 4
Possible Treatment Options Available, Life Cycle, and Mode of Reproduction for Known Established, New, and Potential Invaders of Weed Species on or Adjacent to the Wasatch-Cache National Forest. Sensitive condition factors must be considered prior to choosing the appropriate treatment method. The most ecologically sound method that would achieve the management objective for that species and or infestation should be used.

Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Cirsium arvense	Canada thistle	Perennial	Seeds, shoots from lateral roots (dormant, buried seeds can remain viable for up to 26 years).	• stem-boring beetle (Ceutorhyncus litura) • gall fly (Urophora cardui) • shoot fungus (Sclerotinia sclerotiorum)	• 2,4-D • clopyralid + 2,4-D • clopyralid • dicamba New potentially effective: WOW and Scythe.	Revegetation for shade. Cultivation not recommended.	Removing flowers to prevent seed production.
Conium maculatum	Poison hemlock	Biennial, winter annual, or rarely perennial	Seeds.	• defoliating moth (Agonopterix alstroemeriana)	• glyphosate • 2,4-D • hexazinone • metribuzin • tebuthiuron	Establish and maintain healthy native vegetation.	Frequent low mowing or cutting (no grazing, poisonous to livestock). Hand-pulling (gloves) or cultivating works well, continue as long as viable seed remains in seed bank.
Convolvulus arvensis	Field bindweed	Perennial	Seeds (viable up to 50 years) and creeping deep roots.	• leaf-galling mites (*Aceria malherbae / A. convolvuli*)	• glyphosate • 2,4-D + dicamba • picloram • metsulfuron	Establish and maintain healthy native vegetation, especially perennial grasses.	Hand-pulling (and cultivating) must be done for 3 to 5 years every 2 weeks to be effective. Neither grazing nor mowing are effective controls.
Cynodon dactylon *CYDA*	Bermudagrass	Perennial	Seed/rhizome	None currently available	• glyphosate	Drought Revegetate to promote shade	Tilling during drought conditions. l

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Cynoglossum officinale	Houndstongue	Biennial	Seeds, attach to fur and clothing.	None currently available.	• picloram • dicamba (Apply at rosette stage, late summer or early fall.)	Keep and maintain vigorous vegetative cover.	Hand-pull before flowering.
Euphorbia esula	Leafy spurge	Perennial	Seeds, spreading roots.	• flea beetle (*Aphthona abdominalis*) • flea beetle (*Aphthona nigriscutis*) • hawk moth (*Hyles euphorbiae*)	• glyphosate • dicamba • picloram • glyphosate + 2,4-D • piclorarn + 2,4-D	Seeding with sod-forming perennials. Fall burning.	Mowing/cutting before flowering. Cultivation every 14 days. Hand-pulling of small infestations before seed production. Grazing with sheep or goats.
Euphorbia myrsinites	Myrtle spurge Blue Spurge	Biennial or Perennial	Seeds, spreading roots.	• flea beetle (*Aphthona abdominalis*) • flea beetle (*Aphthona nigriscutis*) • hawk moth (*Hyles euphorbiae*)	• glyphosate • dicamba • picloram • glyphosate + 2,4-D • piclorarn + 2,4-D	Seeding with sod-forming perennials. Fall burning.	Mowing/cutting before flowering. Cultivation every 14 days. Hand-pulling of small infestations before seed production. Grazing with sheep or goats.

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Hyoscyamus niger	Black henbane	Annual or biennial	Seeds (seeds viable for 4 years).	None currently available.	• glyphosate		Hand-pulling, mowing, or digging to prevent seed production, must remove tap root to kill the plant. Burning mature plants will kill the seed. Regular cultivation. Toxic to livestock, including sheep.
Hypericum officinale	St. Johnswort	Perennial	Seeds and rhizomes.	• beetle (*Agrilus hyperici*) • moth (*Aplocera plagiata*) • beetle (*Chrysolina hyperici*) • beetle (*Chrysolina quadrigemina*) • Klamath weed midge (*Zeuxidiplosis giardi*)	• 2,4-D • picloram (spring) • glyphosate (spring) • metsulfuron methyl Repeated applications necessary.	Maintain competitive, closed-canopy plant community. This species is not shade tolerant.	Hand-pulling or digging of young, isolated plants. Cutting and mowing not recommended, may reduce seed but promotes sprouting from rhizomes. Regular cultivation.
Isatis tintoria	Dyer's woad	Winter annual, biennial, or short-lived perennial	Seeds.	• rust (*Puccinia thlaspeos*) [Occurs naturally, not currently approved.]	• 2,4-D • chlorsulfuron • Metsulfuron		Hand-pulling, cultivation, or digging below the crown before seed production are very effective, must remove crown to prevent resprouting.

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Lepidium latifolium	Perennial pepperweed	Perennial	Seeds and creeping roots.	None approved.	• chlorsulfuron • imazapyr [Should be applied at flower-bud stage.]	Establish and maintain healthy riparian vegetation.	Fall-disking, spring mowing, followed by herbicides, including glysophates has some good results.
Linaria genistifolla ssp. delmatica	Dalmatian toadflax	Perennial	Seeds, vegetative growth from lateral root buds (seeds viable 10-15 years).	• toadflax moth (*Calophasia lunula*) • root-boring moths (*Eteobalia intermediella and E. serratella*) • seed capsule-feeding weevils (*Gymnetron antirrhini and G. linariae*) • stem-boring weevil (*Mecinus janthinus*) • ovary-feeding beetle (*Brachypterolus pulicarius*)	Waxy coat typically makes this method ineffective. Two stages of vulnerability: fall rosette stage or when flowering, so root reserves are lower: • glyphosate • dicamba • picloram The preemergent WOW may also be effective.	Toadflax seedling are initially very vulnerable to competition from established, vigorous vegetation. Restrict spring cattle grazing on sites with toadflax to maintain vigorous competition from native species.	Hand-pulling must remove all roots, best in sandy or moist soils (annually, 10 to 15 years to eradicate). Regular cultivation (every 7 to 10 days starting in June, for 2 years). Do not mow.

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Linaria vulgaris	Yellow toadflax	Perennial	Seeds and creeping lateral roots (seeds viable 10-15 years).	• toadflax moth (*Calophasia lunula*) • root-boring moths (*Eteobalia intermediella* and *E. serratella*) • seed capsule-feeding weevils (*Gymnetron antirrhini* and *G. linariae*) • stem-boring weevil (*Mecinus janthinus*) • ovary-feeding beetle (*Brachypterolus pulicarius*)	• glyphosate (See Dalmatian toadflax.)	Intense competition with native vegetation. Restrict spring cattle grazing on sites with toadflax to maintain vigorous competition from native species.	Hand-pulling must remove all roots (annually, 10 to 15 years to eradicate). Regular cultivation. Do not mow.
Lythrum salicaria	Purple loosestrife	Perennial	Seeds and rhizomes.	• weevil (*Hylobius transversovittatus*) • black-margined and golden leaf eating beetles (*Galerucella calmariensis* and *G. pusilla*) • flower weevil (*Nanophyes marmoratus*)	• glyphosate (When plants begin to flower.) [Rodeo™ has approval for wetlands.][3]	Revegetation can be effective.	Hand-pulling or cutting before flowering, followed immediately by flooding (general mowing or cutting not recommended).

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Onopordum acanthium	Scotch thistle	Biennial	Seeds.	• seed-head weevil (*Rhinocyllus conicus*) • thistle crown-weevil (*Trichosirocalus horridus*)	• glyphosate • picloram • dicamba • 2,4-D • 2,4-D + dicamba	Establish and maintain dense, vigorous native vegetation, especially important to have vegetative cover in the fall when seeds germinate (adjust grazing regimes to avoid late summer/fall rotations).	Digging must cut plant off below soil level, leaving no above-ground biomass.
Taeniatherum caput-medusae	Medusahead	Annual	Seeds	None currently available	• glyphosate • oust • 2,4-D	Burning Nitrogen fertilization and seeding desired species.	Intensive grazing. Disking/plowing
Tamarix sp.	Saltcedar	Perennial	Seeds/Rhizomes	None currently available	Combine w/cultural and mechanical • glyphosate • picloram • dicamba • 2,4-D • imazapyr	Burning	Cut stump method combined with herbicide.
Tribulus terrestris	Puncturevine	Annual	Seeds (viable in soil 4-5 years).	• weevils (*Microlarinus lareynii* and *M. lypriformis*)	• glyphosate • picloram	Establish and maintain native vegetation.	Repeated cultivation. Neither mowing or grazing is effective.

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Verbascum thapsus	Common mullein	Biennial or short-lived perennial	Seeds (one plant can produce 100,000-180,000 seeds with viability up to 100 years).	• mullein seedhead weevil (*Gymnetron tetrum*) Pending approval: mullein moth (*Cucullia verbasci*).	• glyphosate New potentially effective: WOW.	Chickens are successful at eradicating. Cattle and sheep avoid it so decreasing livestock utilization can help native vegetation compete.	Easy to pull in loose soils because of shallow taproot (before flowering). Hand-hoeing or digging also effective. Mow or scythe just before flowering.
Verbascum virgatum	Wand mullein	Biennial	Seeds (one plant can produce 100,000-180,000 seeds with viability up to 100 years).	• mullein seedhead weevil (*Gymnetron tetrum*) Pending approval: mullein moth (*Cucullia verbasci*).	• glyphosate New potentially effective: WOW.	Chickens are successful at eradicating. Cattle and sheep avoid it so decreasing livestock utilization can help native vegetation compete.	Easy to pull in loose soils because of shallow taproot (before flowering). Hand-hoeing or digging also effective. Mow or scythe just before flowering.

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
POTENTIAL INVADERS							
Abutilon theophrasti	Velvet leaf	Annual	Seeds (viable for up to 60 yrs.).	Scentless plant bug. (*Niesthrea louisianica)* Tobacco budworm *(Heliothis virescens)* Bollworm *(H.zea)* Root nematdes *(Heterodera marioni, Medoidogyne ssp.)*	• 2,4-D • glyphosate	Prevent from creating seed bank. Burning.	Hand pull small infestations. Mowing prior to seed set.
Agropyron repens	Quackgrass	Perennial	Seeds/Rhizomes	None known	• Glyphosate • Imazapyr	Promote native vegetation that produces shade. Late spring burning	Intensive early spring grazing reduces vigor.
Alhagi pseudalhagi	Camel thorn	Perennial	Seed/Roots	None known.	• 2,4-D • picloram • tryclopyr		Mowing repeatedly to deplete nutrient reserves in the roots (not the most effective method. Better to combine with chemical treatment as mowing induces suckering)
Ambrosia tomentosa	Skeletonleaf bursage	Perennial	Seeds and deep creeping rhizomes.	None currently available.	• 2,4-D • picloram		Avoid disking or cultivating as it spreads root fragments.

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Artemisia absinthium	Absinth wormwood	Perennial	Seed	Pyralid moth *Euzophera cinerosella*	• glyphosate • picloram • dicamba • 2,4-D		Frequent Mowing
Cannabis sativa	Hemp (marijuana)	Annual	Seed	•	• 2,4-D+ dicamba • picloram	Does not compete well in properly functioning ecosystem.	Hand removal prior to seed set. Mowing Prior to seed set.
Cardus acanthoides	Plumless thistle	Winter annual/Biennial	Seeds	Rosette Weevil (*Trichosirocalus horridus)*	• 2,4-D • picloram		Hand Removal Mowing Tilling
Centaurea pratensis	Meadow knapweed	Perennial	Seeds.	• seed head gall fly, (*Urophora quadrifasciata*)	• glyphosate • 2,4-D • picloram • clopyralid	Establish and maintain good vegetation, particularly perennial grasses.	Hand-pulling is effective. Cultivation must be repeated several times a year for several years.
Chondrilla juncea	Rush skeletonweed	Perennial	Seeds, lateral roots and root fragments.	• gall midge (*Cystiphora schmidti*) • gall mite (*Eriophyes chondrillae*) • rush skeletonweed rust (*Puccinia chondrillina*)	Difficult to control with herbicides. Takes consistent spraying for 3 to 5 years. • 2,4-D • picloram • clopyralid + • dicamba	Heavy seeding rates and fertilizing with nitrogen works best.	Hand-pulling must remove all roots (3 to 6 times per year for 6 to 10 years to eradicate new shoots and seedlings). Mowing not recommended (increase growth from roots). Cultivation and/or digging, if within 5 weeks after germination.

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Chrysnathemum leucanthemum	Ox-eye daisy	Perennial	Seed/Rhizome	None known.	• 2,4-D • clopyralid	Fertilization to promote native grasses + herbicide to kill weeds.	Repeated mowing (most effective when used with herbicide) Digging small infestations (insure as much of root as possible) Intensive grazing.
Cirsium vulgare	Bull thistle	Biennial	Seeds.	• gall fly (*Urophora stylata*)	• picloram New potentially effective: WOW and Scythe.	Revegetation for shade (the presence of tall herbs reduces bull thistle seedling survival. When grass growth was reduced by herbicide spraying, bull thistle increased in frequency).	Hand-pulling, mowing, burning, digging will kill if aboveground portions of the plant are completely removed or consumed because It does not sprout from the root crown or root. If 8 inches or more of stem remains alive, it may sprout from remaining portions of the stem.
Crupina vulgaris	Common crupina	Winter annual	Seeds (viable 3 years or less).	None known.	• glyphosate • 2,4-D + dicamba	Establish and maintain healthy native vegetation (must revegetate after removal).	Preventing all seed production for at least two generations (hand-pulling, plowing, and hoeing).
Cyperus esculentus	Yellow netsedge	Perennial	Seeds (minimally) Rhizomes/tubers	Rust fungus (*Cyperus esculentus)*	• Glyphosate Mainly effects the shoot and stems.		Frequent tilling to expose and dry tubers.

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Cytisus scoparius	Scotch broom	Woody perennial	Seed, some sprouting (seeds remain viable in soil for up to 80 years).	None have proven effective in Idaho.	• 2,4-D • triclopyr ester • picloram + 2,4-D	Revegetation for shade.	Hand-pulling (must be repeated for many years due to long dormancy of seed in soil). Grazing with goats (or chickens).
Elaeagnus angustifolia	Russian olive	Perennial	Seed/Suckers	None known for effective control.	• Glyphosate Most effective and specific when used in the cut stump method.		Hand pull seedlings/saplings. Bulldozing/brushcutting large stands must be followed by herbicide treatment.
Euphorbia dentata	Toothed spurge	Annual	Seeds.	None currently available.	• glyphosate	Reduce disturbance. Change grazing regime to allow native species to thrive.	Hand-pulling or grubbing is effective.
Franseria tomintosa	Bur ragweed	Perennial	Seed/Root	None known.	• 2,4-D • picloram • glyphosate • dicamba • Imazapic		Tillage
Galega officinalis	Goatsrue	Perennial	Seed	None known.	• 2,4-D+ dicamba • picloram	Cultivation is a poor means of control.	None are effective. Removal of seed pod

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Hieracium pratense	Yellow hawkweed	Perennial	Seed/Rhizome/ Stolons	None known.	• 2,4-D • Chlorsulfuron		Grazing reduces vigor. Hand pull and remove plants from site Tilling annually will reduce vigor.
Hieraclum aurantiacum	Orange hawkweed	Perennial	Seeds (wind-adapted), stolons, and rhizomes.	None currently available.	• 2,4-D + picloram • glyphosate • clopyralid • dicamba + 2,4-D • Spray in spring before bloom.	Revegetation for shade by seeding and fertilization. Annual cultivation.	Hand-pulling not recommended (stimulates sprouting from rhizomes) difficult to remove all roots.
Hoffmannseggia densiflora	Pignut	Perennial	Seed/Root (small tubers)	None known.	• 2,4-D • picloram		Digging (get as much of the root as possible) Cultivation
Milium vernale	Milium	Winter annual	Seeds.	None currently available.	• glyphosate • chlorsulfuron	Revegetation is effective.	Spring plowing.
Nardus stricta	Matgrass	Perennial	Seeds.	None known.	• glyphosate		

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Senecio jacobaea	Tansy ragwort	Biennial (rarely annual or perennial)	Seeds (viable for several years) and can regenerate top-growth when cut.	• seed fly (*Pegohyllemyia seneciella*) • flea beetle (*Longitarsus jacobaeae*) • cinnabar moth (*Tyria jacobaeae*)	• 2,4-D • picloram • dicamba • 2,4-D + dicamba • metsulfuron methyl • clopyralid • clopyralid + 2,4-D Spring is usually the best time to spray.	The healthier the native vegetation, the less likely this plant will become established (needs disturbance to create openings in native vegetation in order to establish).	Mowing just prior to flowering when the plant has exhausted the greatest amount of its stored reserves and before its seeds have started to develop. Although mowing can prevent flowering, it appears to increase rosette density. Hand-pulling small infestations before flowering must remove all roots. Grazing heavy infestations with sheep prior to flowering.
Solanum carolinense	Horse nettle	Perennial	Seed/Rhizome	None known.	• 2,4-D • triclopyr • picloram		Hand Removal Mowing
Solanum elaeagnifolium	Silverleaf nightshade	Perennial	Seeds and spreading rhizomes.	None known.	• glyphosate picloram • imazapyr	Establish dense canopy-forming vegetation.	Cultivation must be frequent and thorough or will spread. Cutting and mowing ineffective.

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Sonchus arvensis	Perennial sowthistle	Perennial	Seeds (2-5 year viability), and spreading, thickened horizontal roots (rhizomes).	• cyst-forming nematode (*Heterodera sonchophila*) • seedhead fly (*Tephritis dilacerata dilacerata*) (Waiting for final approval.)	• glyphosate • clopyralid • dicamba • 2,4-D • amitrol (Herbicides not very effective for this species.)	Establish and maintain healthy native vegetation.	Cutting, grazing, and mowing can be effective at depleting root stores, if done selectively and frequently. Hoeing and cultivating can be effective if done at 6-leaf rosette stage.
Sorghum halepense	Johnsongrass Perennial sorghum	Perennial	Seeds and rhizomes.	None known.	• glyphosate (Must be used together with mechanical to be effective.)	Establish and maintain native vegetation.	Repeated mowing or grazing to reduce rhizome vigor followed by herbicide. Repeated and continuous tillage (do not till at all if cannot repeat continuously).
Tanacetum vulgare	Common tansy	Perennial	Seeds, rhizomes.	None currently available.	• dicamba + • picloram • metsulfuron methyl	Revegetation for shade.	Hand-pulling not recommended (stimulates sprouting from rhizomes) and must remove all roots. Constant cultivation, otherwise the infestation can increase infestation by chopping roots that sprout. Mowing to reduce seed production. Grazing by sheep and goats.

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Scientific Name	Common Name	Life Cycle	Modes Of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)

[1] .

[2]Potential invaders comprised of plants that are on local county lists and regional weed free ha lists but have not yet been identified on the Wasatch-Cache National Forest.

[3] Spot application of Rodeo™ directly onto *L. salicaria* would ensure that no large holes would appear in the marsh vegetation and that competition would be unaffected. The safest method of applying glyphosate herbicide is to cut off all stems at about 6 inches and then paint or drip onto the cut surface a 20-30% solution (Henderson 1987).

[Int]Must use integrated weed management approach to successfully eradicate this species.

Henderson, R. 1987. Status and control of purple loosestrife in Wisconsin. Research management findings, Number 4, Bureau of Research, Wisconsin DNR, Madison.

Sources of information used on this table include:

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Appendix B

Characteristics of Herbicides

TABLE B-1
Characteristics and Properties of Herbicides

	Herbicide Properties			Behavior in Soils			Behavior in Water		Degradation Mechanism			Toxicity & EPA Toxicity Categories[e]					
Herbicide and Chemical Name	**Examples of Available Products**	**Target Weed Species**	**Mode of Action**	**Average Soil Half-life[a]**	**Soil Sorption (Koc)[b]**	**Mobility[c]**	**Water Solubility[d]**	**Average Half-life in Water**	**Microbial**	**Chemical**	**Solar**	**Oral LD50: Mammals[f]**	**LD50: Birds[g]**	**LC50: Fish[h]**	**Dermal LD50: Rabbit**	**Application Rate[i]**	**Notes**
2,4 D (2,4-dichlorophenoxy) acetic acid	Navigate®, Class®, Weed-Pro®, Justice® Weedar 64, Weed-B-Gon	broadleaf weeds	Auxin mimic	10 days	20 mL/g (acid/salt), 100 mL/g (ester)	moderate-high	900 mg/L (acid), 100 mg/L (ester), 796,000 mg/L (salt)	varies from hours to months	Primary mechanism	Minor mechanism	Low potential	764 mg/kg [low]	500 mg/kg (BW) [moderate]	263 mg/L [moderate]	>2,000 mg/kg	0.475 to 4.0 pounds per acre Typical S-CNF = 0.5 to 1.5 pounds per acre Maximum label = 4.0 pounds per acre	Inexpensive and common herbicide used for over 50 years.
Chlorsulfuron 2-chrloro-N-[(4-methoxy-6-methyl-1,3,5-triazin-2-yl) aminocarbonyl)] benzenesulfonamide	Telar®	broadleaf weeds and some annual grass weeds	Stops production of an amino acid, which inhibits cell division in roots	1 to 3 months	no data available	high	no data available	no data available	no data available	no data available	no data available	<5,000 mg/kg [low]	<5,000 mg/kg (BW, M) [low]	<300 ppm [low]	>3,400 mg/kg	0.25 to 3.0 ounces per acre Typical S-CNF = 0.25 to 3.0 ounces per acre Maximum label = 3.0 ounces per acre	Practically nontoxic to fish, birds, and mammals
Clopyralid 3,6-dichloro-2-pyridinecarboxylic acid	Reclaim®, Curtail®, Transline®	annual and perennial broadleaf weeds	Auxin mimic	40 days	avg 6 mL/g but ranges to 60 mL/g	moderate-high	1,000 mg/L (acid), 300,000 mg/L (salt)	8-40 days	Primary mechanism	Minor mechanism	Low potential	4,300 mg/kg [low]	1,465 mg/kg (M) [low]	125 mg/L [moderate]	>2,000 mg/kg	0.0625 to 0.5 pound per acre Typical S-CNF = 0.1 to 0.375 pound per acre Maximum label = 0.5 pound per acre	Highly selective herbicide developed as an alternative to picloram.
Corn Gluten Meal	WOW!®, Bio-Weed®	broadleaf weeds and annual and perennial grasses	Inhibits the growth of a seed's feeder roots by breaking down the cell wall, so seedlings cannot hold moisture.	5 to 6 weeks	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	20 pounds per 1,000 square feet	Corn gluten is a by-product of wet milling process to make cornstarch. It is an animal feed for cattle, poultry, other livestock, fish and some dog foods.
Dicamba 3,6-dichloro-2-methoxybenzoic acid	Banvel®, Banex®, Trooper®	broadleaf weeds, vines, and brush	Growth regulator	1 to 6 weeks	no data available	high	6,500 mg/L	no data available	Primary mechanism	Very minor mechanism	Very low potential	566 to 3,000 mg/kg [low]	673 to 2,000 mg/kg [low]	>100 ppm [low]	2,000 mg/kg (note: rat, not rabbit)	0.25 to 2 pounds per acre. Maximum S-CNF = 2 pounds per acre per year on a treatment area.	Does not injure most grasses. It will kill broadleaf weeds before and after they sprout.
Fosamine ethyl hydrogen (aminocarbonyl) phosphonate	Krenite®	trees and bushes	Mitotic inhibitor	8 days	150 mL/g	moderate[b]	1,790,000 mg/L	stable in water	Primary mechanism	Very minor mechanism	Very low potential	24,000 mg/kg [slight]	10,000 mg/kg (BW/M) [slight]	670 mg/L [low]	>1,683 mg/kg	6 to 12 pounds per acre	Not registered for use in California or Arizona.

TABLE B-1
Characteristics and Properties of Herbicides

	Herbicide Properties			Behavior in Soils			Behavior in Water		Degradation Mechanism			Toxicity & EPA Toxicity Categories[e]					
Herbicide and Chemical Name	**Examples of Available Products**	**Target Weed Species**	**Mode of Action**	**Average Soil Half-life[a]**	**Soil Sorption (Koc)[b]**	**Mobility[c]**	**Water Solubility[d]**	**Average Half-life in Water**	**Microbial**	**Chemical**	**Solar**	**Oral LD50: Mammals[f]**	**LD50: Birds[g]**	**LC50: Fish[h]**	**Dermal LD50: Rabbit**	**Application Rate[i]**	**Notes**
Glyphosate N-(phosphonomethyl) glycine	RoundUp®, Rodeo®, Accord®	annual and perennial weeds	Inhibits the shikimac acid pathway, depleting aromatic amino acids	47 days	24,000 mL/g	low	15,700 mg/L (acid), 900,000 mg/L (IPA salt), 4,300,000 mg/L	12 days to 10 weeks	Primary mechanism	Minor mechanism	Low potential	5,600 mg/kg [slight]	> 4,640 mg/kg (BW/M) [low]	120 mg/L [moderate]	>5,000 mg/kg	0.3 to 3.75 pounds per acre Typical S-CNF = 0.5 to 2.0 pounds per acre Maximum label = 3.75 pounds per acre	Little to no soil activity. Some formulations are highly toxic to aquatic organisms.
Imazapic (±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-methyl-3-pyridinecarboxylic acid	Plateau®, Plateau Eco-Pak®, Cadre®	annual and perennial weeds	Inhibits AHAS synthesis, blocking amino acid synthesis	120-140 days	206 mL/g	low?	36,000 mg/L (pH 7)	< 8 hours	Primary mechanism	Very minor mechanism ?	Low?	> 5,000 mg/kg [slight]	> 2,150 mg/kg (BW) [low]	> 100 mg/L [moderate]	> 5,000 mg/kg	Typical S-CNF = 0.06 to 0.2 pound per acre Maximum label = 0.75 pound per acre	Degree of control depends on selectivity of individual plants.
Metsulfuron methyl Methyl-2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)-amino]carbonyl]amino] sulfonyl]benzoate	Escort®, Ally®	brush, woody plants, annual and perennial broadleaf and annual grassy weeds	Inhibits cell division and stops growth	120 to 180 days	no data available	no data available	109 mg/L	29 to >84 days	no data available	no data available	no data available	> 5,000 mg/kg [low]	<2,150 mg/kg [low]	<150 ppm [low]	>2,000 mg/kg [low]	0.33 to 2.0 ounces per acre Typical S-CNF = 0.25 to 0.75 ounce per acre Maximum label = 2.0 ounces per acre	Will leach in some soils, but is practically nontoxic to birds, fish, invertebrates, and honeybees.
Pelargonic acid C8H17COOH natural fatty acid	Scythe®	annual and perennial broadleaf and grass weeds, as well as most mosses and other cryptogams	Disrupts cell membrane permeability, which results in cell leakage and death of all contacted tissue	no data available	no data available	no data available	no data available	no data available	Primary mechanism	no data available	no data available	>5,000 mg/kg	no data available	no data available	>2,000 mg/kg	9.45 pounds to 84 pounds per acre	Pelargonic acid has been found to occur naturally in low concentrations in soil. It is considered safe for humans and non-toxic.
Picloram 4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid	Tordon K®	annual and perennial broadleaf weeds, vines, and woody plants	Auxin mimic	90 days	16 mL/g (can range -17-160 mL/g)	moderate-high	430 mg/L (acid), 200,000 (salts)	2-3 days	Primary mechanism	Primary mechanism	Moderate potential	> 5,000 mg/kg [slight]	> 2,510 mg/kg (M) [low]	>14.4 mg/L [high]	>2,000 mg/kg	• As triisopro-panolamine salt: 0.27 to 2.16 pounds per acre • As isooctyl ester: used for basal bark treatment • As potassium salt: 1.0 to 8.5 pounds per acre Typical S-CNF = 0.125 to 0.50 pound per acre Maximum label = 1.0 pound per acre	Environmental persistence can endanger non-target plants and animals.

TABLE B-1
Characteristics and Properties of Herbicides

Herbicide and Chemical Name	Herbicide Properties: Examples of Available Products	Target Weed Species	Mode of Action	Behavior in Soils: Average Soil Half-life[a]	Soil Sorption (Koc)[b]	Mobility[c]	Behavior in Water: Water Solubility[d]	Average Half-life in Water	Degradation Mechanism: Microbial	Chemical	Solar	Toxicity & EPA Toxicity Categories[e]: Oral LD50: Mammals[f]	LD50: Birds[g]	LC50: Fish[h]	Dermal LD50: Rabbit	Application Rate[i]	Notes
Sulfometuron methyl methyl 2-[[[[(4,6-dimethyl-2-pyrimidinyl) amino]carbonyl]amino] sulfonyl]benzoate	Oust Weed Killer®, DPX 5648®	annual and perennial grasses and broadleaf weeds	Inhibits cell division in tips, roots, and shoots	1 month	no data available	moderate-high	Insoluble	1 to 3 days	Primary mechanism	Primary mechanism	High potential	>5,000 mg/kg [slight]	<5,620 ppm (BW) and <5,000 ppm (M) [slight]	<12.5 ppm [slight]	>2,000 mg/kg	Up to 2.25 ounces per acre Typical S-CNF = 0.25 to 0.75 ounce per acre Maximum label = 2.25 ounces per acre	Readily absorbed through the gastrointestinal tract and rapidly broken down and removed.
Triclopyr [(3,5,6-trichloro-2-pyridinyl)oxy]acetic acid	Garlon®, Remedy®	woody and annual broadleaf weeds	Auxin mimic	30 days	20 mL/g (salt), 780 mL/g (ester)	moderate-high	430 mg/L (acid), 23 mg/L (ester), 2,100,000 mg/L (salt)	4 days	Primary mechanism	Minor mechanism	Moderate potential	713 mg/kg [low]	1,698 mg/kg (M) [low]	148 mg/L [moderate]	>2,000 mg/kg	0.25 to 9 pounds acid equivalent per acre	Commonly used herbicide. The ester formulation is highly toxic to aquatic organisms.

Adapted from Weed Control Methods Handbook, The Nature Conservancy, Tu et al. 2001. Other sources include Environmental Health Clearinghouse 2002, EXTOXNET 2002, PEMP 2002, and Wisconsin Master Gardener Program 2002.

[a] Half-life: The time required for half of something to undergo a process. As used in this document, it is the amount of time for half the herbicide to break down, becoming ineffective.

[b] Koc: The partitioning of a chemical between soil or sediment, usually expressed as K (the concentration of a chemical in soil (ug/g) to that in water (ug/ml)) or as Koc (which is K divided by the organic carbon content of the soil or sediment). The higher the number, the more binding the herbicide is to soil particles.

[c] Mobility: Relating to the capability of moving or being moved.

[d] Based on Helling's classification system - Helling & Turner 1968 (as cited in Tu et al. 2001). Solubility: The quality or state of being soluble. Expressed in this document as the quantity of a herbicide that can be dissolved in water.

[e] Based on EPA Toxicity Categories

[f] Rats

[g] BW—bobwhite quail; M—mallards

[h] bluegill sunfish

[i] Application rates for "Typical S-CNF" and "Maximum Label" are from the S-CNF 2002 Programmatic Biological Assessment for Fish (U.S. Forest Service 2002).

Appendix C

Treatment Options Table

APPENDIX C
Possible Treatment Methods Available, Life Cycle, and Mode of Reproduction for Weed Species on or Adjacent to the Wasatch-Cache National Forest

Common Name	Scientific Name	Life Cycle	Modes of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Whitetop (Hoary cress)	*Cardaria draba*	Perennial	Seeds (viable 3 years) and deep creeping roots.	None currently available.	• glyphosate • 2,4-D • metasulfuron New potentially effective: WOW and Scythe.	Presence of competing vegetation, particularly shrubs, vetch, lupine, and other nitrogen-fixing legumes.	Mowing or grazing with sheep or goats during bud stage and again during rebud (follow by herbicide). Hand pulling or digging must remove all roots and continue for 2 to 5 years to eradicate.
Musk thistle	*Carduus nutans*	Biennial or winter annual	Seeds (prolific seed producer, seeds viable up to 10 years).	• rosette weevil (*Trichosirocalus horridus*) • flea beetle (*Psylliodes chalcomera*) • syrphid fly (*Cheilosia corydon*) • thistle-defoliating beetle (*Cassida rubiginosa*) [The seedhead weevil (*Rhinocyllus conicus*) is not recommended because it attacks some native, rare thistles.]	• glyphosate • 2,4-D • dicamba • piclorarn • metsulfuron methyl • clopyralid • 2,4-D amine + • glyphosate + 2,4-D New potentially effective: WOW and Scythe.	Revegetation for shade.	Mowing before flowering, continuously. Cutting plant below crown.

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Possible Treatment Methods Available, Life Cycle, and Mode of Reproduction for Weed Species on or Adjacent to the Wasatch-Cache National Forest

Common Name	Scientific Name	Life Cycle	Modes of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Spotted knapweed	*Centaurea maculosa*	Biennial or short-lived perennial	Seeds, lateral shoots.	• seed head gall fly (*Urophora affinis*) • seed head gall fly (*U. quadrifasciata*) • seed head moth (*Metzneria paucipunctella*) • black leaf blight fungus (*Alternaria alternata*) • root moth (*Agapeta zoegana*) • verdant seed fly (*Terellia virens*) • root weevil (*Cyphocleonus achates*)	• glyphosate • picloram • 2,4-D • clopyralid + 2,4-D • dicamba clopyralid (not recommended for sites with other weed species) New potentially effective: WOW and Scythe.	Revegetation for shade. Regular cultivation/ seeding. Spring burning.	Hand pulling of small infestations (usually takes 7 to 10 years).
Canada thistle	*Cirsium arvense*	Perennial	Seeds, shoots from lateral roots (dormant, buried seeds can remain viable for up to 26 years).	• stem-boring beetle (Ceutorhyncus litura) • gall fly (Urophora cardui) • shoot fungus (Sclerotinia sclerotiorum)	• 2,4-D • clopyralid + 2,4-D • clopyralid • dicamba New potentially effective: WOW and Scythe.	Revegetation for shade. Cultivation not recommended.	Removing flowers to prevent seed production.
Bull thistle	*Cirsium vulgare*	Biennial	Seeds.	• gall fly (*Urophora stylata*)	• picloram New potentially effective: WOW and Scythe.	Revegetation for shade (the presence of tall herbs reduces bull thistle seedling survival. When grass growth was reduced by herbicide spraying, bull thistle increased in frequency).	Hand pulling, mowing, burning, digging will kill if aboveground portions of the plant are completely removed or consumed because It does not sprout from the root crown or root. If 8 inches or more of stem remains alive, it may sprout from remaining portions of the stem.

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Common Name	Scientific Name	Life Cycle	Modes of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Leafy spurge	*Euphorbia esula*	Perennial	Seeds, spreading roots.	• flea beetle (*Aphthona abdominalis*) • flea beetle (*Aphthona nigriscutis*) • hawk moth (*Hyles euphorbiae*)	• glyphosate • dicamba • picloram • glyphosate + 2,4-D • piclorarn + 2,4-D	Seeding with sod-forming perennials. Fall burning.	Mowing/cutting before flowering. Cultivation every 14 days. Hand pulling of small infestations before seed production. Grazing with sheep or goats.
Black henbane	*Hyoscyamus niger*	Annual or biennial	Seeds (seeds viable for 4 years).	None currently available.	• glyphosate		Hand pulling, mowing, or digging to prevent seed production, must remove tap root to kill the plant. Burning mature plants will kill the seed. Regular cultivation. Toxic to livestock, including sheep.
Cheatgrass	*Bromus tectorum*	Winter annual	Seeds.	None currently available. [Two rhizobacteria, *Pseudomonas fluorescens* (strain D7), and *Pseudomonas syringae* (strain 3366) are under study.]	Spring: • glyphosate Apply in early spring when the plants were 10 cm (3.9 in) high or less and growing vigorously. New potentially effective: WOW and Scythe.	Must revegetate sites that have been disked or sprayed to provide competition.	Cutting is not recommended. Deep disking several times at intervals to bury seeds 4 to 6 inches then overseeding. Shallow disking to initiate seed germination, then either disking again or spraying with glyphosate, followed by broadcast or drill seeding.

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Common Name	Scientific Name	Life Cycle	Modes of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Common mullein	*Verbascum thapsus*	Biennial or short-lived perennial	Seeds (one plant can produce 100,000-180,000 seeds with viability up to 100 years).	• mullein seedhead weevil (*Gymnetron tetrum*) Pending approval: mullein moth (*Cucullia verbasci*).	• glyphosate New potentially effective: WOW.	Chickens are successful at eradicating. Cattle and sheep avoid it so decreasing livestock utilization can help native vegetation compete.	Easy to pull in loose soils because of shallow taproot (before flowering). Hand-hoeing or digging also effective. Mow or scythe just before flowering.
Hoary alyssum	*Berteroa incana*	Annual, biennial, or short-lived perennial	Seeds.	None currently available.	• glyphosate • 2,4-D New potentially effective: WOW and Scythe.	Presence of competing plants. Seeding and fertilizing.	Hand pulling or digging.
Russian knapweed	*Centaurea repens* or *Acroptilon repens*	Long-lived perennial (75 years)	Rhizomes (new shoots arise from creeping roots, up to 27 root shoots/ft^2 and roots can reach depths to 23 feet). Relatively few seeds are produced (viable for 2-3 years).	• gall-forming nematode (*Subanguina picridis*) • seed head gall fly (*U. quadrifasciata*) • seed head gall fly (*Urophora affinis*)	• picloram • clopyralid • glyphosate	The healthier the native vegetation, the less susceptible it will be to Russian knapweed invasion. (Once established, it emits allelopathic compounds to inhibit other plants).	Cultivation, cutting/mowing, and/or hand pulling not recommended unless done three times per year (spring, summer, fall) to force the plants to use nutrient reserve stored in roots, followed by herbicide treatment. This protocol must be followed for at least 3 years otherwise it will stimulate sprouting from rhizomes. It is difficult to remove all roots with a one-time effort. Severed root pieces as small as 2.5 cm can generate new shoots from depths to 15 cm.

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Common Name	Scientific Name	Life Cycle	Modes of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Rush skeletonweed	*Chondrilla juncea*	Perennial	Seeds, lateral roots and root fragments.	• gall midge (*Cystiphora schmidti*) • gall mite (*Eriophyes chondrillae*) • rush skeletonweed rust (*Puccinia chondrillina*)	Difficult to control with herbicides. Takes consistent spraying for 3 to 5 years. • 2,4-D • picloram • clopyralid + • dicamba	Heavy seeding rates and fertilizing with nitrogen works best.	Hand pulling must remove all roots (3 to 6 times per year for 6 to 10 years to eradicate new shoots and seedlings). Mowing not recommended (increase growth from roots). Cultivation and/or digging, if within 5 weeks after germination.
Houndstongue	*Cynoglossum officinale*	Biennial	Seeds, attach to fur and clothing.	None currently available.	• picloram • dicamba (Apply at rosette stage, late summer or early fall.)	Keep and maintain vigorous vegetative cover.	Hand pull before flowering.
St. Johnswort	*Hypericum perforatum*	Perennial	Seeds and rhizomes.	• beetle (*Agrilus hyperici*) • moth (*Aplocera plagiata*) • beetle (*Chrysolina hyperici*) • beetle (*Chrysolina quadrigemina*) • Klamath weed midge (*Zeuxidiplosis giardi*)	• 2,4-D • picloram (spring) • glyphosate (spring) Repeated applications necessary.	Maintain competitive, closed-canopy plant community. This species is not shade tolerant.	Hand pulling or digging of young, isolated plants. Cutting and mowing not recommended, may reduce seed but promotes sprouting from rhizomes. Regular cultivation.
Dyer's woad	*Isatis tintoria*	Winter annual, biennial, or short-lived perennial	Seeds.	• rust (*Puccinia thlaspeos*) [Occurs naturally, not currently approved.]	• 2,4-D		Hand pulling, cultivation, or digging below the crown before seed production are very effective, must remove crown to prevent resprouting.

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Possible Treatment Methods Available, Life Cycle, and Mode of Reproduction for Weed Species on or Adjacent to the Wasatch-Cache National Forest

Common Name	Scientific Name	Life Cycle	Modes of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Dalmatian toadflax	*Linaria genistifolla ssp. delmatica*	Perennial	Seeds, vegetative growth from lateral root buds (seeds viable 10-15 years).	• toadflax moth (*Calophasia lunula*) • root-boring moths (*Eteobalia intermediella and E. serratella*) • seed capsule-feeding weevils (*Gymnetron antirrhini and G. linariae*) • stem-boring weevil (*Mecinus janthinus*) • ovary-feeding beetle (*Brachypterolus pulicarius*)	Waxy coat typically makes this method ineffective. Two stages of vulnerability: fall rosette stage or when flowering, so root reserves are lower: • glyphosate • dicamba • picloram The preemergent WOW may also be effective.	Toadflax seedling are initially very vulnerable to competition from established, vigorous vegetation. Restrict spring cattle grazing on sites with toadflax to maintain vigorous competition from native species.	Hand pulling must remove all roots, best in sandy or moist soils (annually, 10 to 15 years to eradicate). Regular cultivation (every 7 to 10 days starting in June, for 2 years). Do not mow.
Yellow toadflax	*Linaria vulgaris*	Perennial	Seeds and creeping lateral roots (seeds viable 10-15 years).	• toadflax moth (*Calophasia lunula*) • root-boring moths (*Eteobalia intermediella* and *E. serratella*) • seed capsule-feeding weevils (*Gymnetron antirrhini* and *G. linariae*) • stem-boring weevil (*Mecinus janthinus*) • ovary-feeding beetle (*Brachypterolus pulicarius*)	• glyphosate (See Dalmatian toadflax.)	Intense competition with native vegetation. Restrict spring cattle grazing on sites with toadflax to maintain vigorous competition from native species.	Hand pulling must remove all roots (annually, 10 to 15 years to eradicate). Regular cultivation. Do not mow.

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Possible Treatment Methods Available, Life Cycle, and Mode of Reproduction for Weed Species on or Adjacent to the Wasatch-Cache National Forest

Common Name	Scientific Name	Life Cycle	Modes of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Scotch thistle	*Onopordum acanthium*	Biennial	Seeds.	• seed-head weevil (*Rhinocyllus conicus*) • thistle crown-weevil (*Trichosirocalus horridus*)	• glyphosate • picloram • dicamba • 2,4-D • 2,4-D + dicamba	Establish and maintain dense, vigorous native vegetation, especially important to have vegetative cover in the fall when seeds germinate (adjust grazing regimes to avoid late summer/fall rotations).	Digging must cut plant off below soil level, leaving no above-ground biomass.
Sulfur cinquefoil	*Potentilla recta*	Perennial (long-lived)	Seeds (broken roots can regenerate).	• root moth (*Tinthia myrmosae-formis*) • flower-head weevil (*Anthonomus rubripes*)	• picloram (fall) • 2,4-D (spring, rosette stage)	Regular cultivation and reseeding.	Hand pulling of small infestations (must remove root crown). Regular cultivation. Mowing not recommended.
Tansy ragwort	*Senecio jacobaea*	Biennial (rarely annual or perennial)	Seeds (viable for several years) and can regenerate top-growth when cut.	• seed fly (*Pegohyllemyia seneciella*) • flea beetle (*Longitarsus jacobaeae*) • cinnabar moth (*Tyria jacobaeae*)	• 2,4-D • picloram • dicamba • 2,4-D + dicamba • clopyralid • clopyralid + 2,4-D Spring is usually the best time to spray.	The healthier the native vegetation, the less likely this plant will become established (needs disturbance to create openings in native vegetation in order to establish).	Mowing just prior to flowering when the plant has exhausted the greatest amount of its stored reserves and before its seeds have started to develop. Although mowing can prevent flowering, it appears to increase rosette density. Hand pulling small infestations before flowering must remove all roots. Grazing heavy infestations with sheep prior to flowering.

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Common Name	Scientific Name	Life Cycle	Modes of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Common tansy	*Tanacetum vulgare*	Perennial	Seeds, rhizomes.	None currently available.	• dicamba + • picloram	Revegetation for shade.	Hand pulling not recommended (stimulates sprouting from rhizomes) and must remove all roots. Constant cultivation, otherwise the infestation can increase infestation by chopping roots that sprout. Mowing to reduce seed production. Grazing by sheep and goats.
Field pennycress	*Thlaspi arvense*	Annual/ winter annual	Seeds	None known.	• glyphosate New potentially effective: WOW	Revegetation after site disturbance.	Mowing to reduce seed production. Fall tillage.
Bur buttercup	*Ranunculus testiculatus*	Annual	Seeds.	None known.	• glyphosate	Establish and maintain healthy native vegetation.	Hoeing or cultivation before seeds form.
Blue mustard	*Chlorispera tenella*	Annual/ winter annual	Seeds	None known.	• glyphosate	Revegetation after site disturbance.	Cultivation/tillage in early spring. Mowing in early flowering period.
Jointed goatgrass	*Aegilops cylindrica*	Winter annual	Seeds (viable in soil up to 6 years).	None known.	• glyphosate	Establish and maintain native vegetation.	Spring tillage or hand removal for small outbreaks.
Skeletonleaf bursage	*Ambrosia tomentosa*	Perennial	Seeds and deep creeping rhizomes.	None currently available.	• 2,4-D • picloram		Avoid disking or cultivating as it spreads root fragments.

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Common Name	Scientific Name	Life Cycle	Modes of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Diffuse knapweed	*Centaurea diffusa*	Biennial or short-lived perennial	Abundant seed production.	• seed head gall fly (*Urophora affinis*) • seed head gall fly (*U. quadrifasciata*) • peacock fly (*Chaetorellia acrolophi*) • seed head weevil (*Bangasternus fausti*) • root weevil (*Cyphocleonus achates*) • root moth (*Agapeta zoegana*)	• glyphosate • picloram • 2,4-D • clopyralid • clopyralid + 2,4-D • dicamba	Revegetation for shade. Spring burning.	Hand pulling of small infestations (usually takes 7 to 10 years).
Meadow knapweed	*Centaurea pratensis*	Perennial	Seeds.	• seed head gall fly, (*Urophora quadrifasciata*)	• glyphosate • 2,4-D • picloram • clopyralid	Establish and maintain good vegetation, particularly perennial grasses.	Hand pulling is effective. Cultivation must be repeated several times a year for several years.
Yellow starthistle	*Centaurea solstitialis*	Winter annual or biennial	Seeds (up to 10 years dormancy and viability).	• seed head weevil (*Bangastemus orientalis*) • peacock fly (*Chaetorellia australis*) • flower weevil (*Larinus curtus*) • yellow starthistle hairy weevil, (*Eustenopus villosus*) • flies (*Urophora sirunaseva and U. jaculata*) (All of the above are approved.) • false peacock fly (*Chaetorellia succinea*) (Effective, but waiting for final approval.)	• glyphosate • picloram • *clopyralid* • 2,4-D amine + • clopyralid	Revegetation with native species for shade.	Mowing, burning early in flower (timing is critical). Grazing before spine production (toxic to horses). (Hard to control seed ban with mechanical methods.)

APPENDIX C
Possible Treatment Methods Available, Life Cycle, and Mode of Reproduction for Weed Species on or Adjacent to the Wasatch-Cache National Forest

Common Name	Scientific Name	Life Cycle	Modes of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Poison hemlock	*Conium maculatum*	Biennial, winter annual, or rarely perennial	Seeds.	• defoliating moth (*Agonopterix alstroemeriana*)	• glyphosate • 2,4-D	Establish and maintain healthy native vegetation.	Frequent low mowing or cutting (no grazing, poisonous to livestock). Hand pulling (gloves) or cultivating works well, continue as long as viable seed remains in seed bank.
Field bindweed	*Convolvulus arvensis*	Perennial	Seeds (viable up to 50 years) and creeping deep roots.	• leaf-galling mites (*Aceria malherbae / A. convolvuli*)	• glyphosate • 2,4-D + dicamba • picloram • metsulfuron	Establish and maintain healthy native vegetation, especially perennial grasses.	Hand pulling (and cultivating) must be done for 3 to 5 years every 2 weeks to be effective. Neither grazing nor mowing are effective controls.
Common crupina	*Crupina vulgaris*	Winter annual	Seeds (viable 3 years or less).	None known.	• glyphosate • 2,4-D + dicamba	Establish and maintain healthy native vegetation (must revegetate after removal).	Preventing all seed production for at least two generations (hand pulling, plowing, and hoeing).
Scotch broom	*Cytisus scoparius*	Woody perennial	Seed, some sprouting (seeds remain viable in soil for up to 80 years).	None have proven effective in Idaho.	• 2,4-D • picloram + 2,4-D	Revegetation for shade.	Hand pulling (must be repeated for many years because of long dormancy of seed in soil). Grazing with goats (or chickens).
Toothed spurge	*Euphorbia dentata*	Annual	Seeds.	None currently available.	• glyphosate	Reduce disturbance. Change grazing regime to allow native species to thrive.	Hand pulling or grubbing is effective.

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Common Name	Scientific Name	Life Cycle	Modes of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Meadow hawkweed	*Hieracium pratense*	Perennial	Seeds (wind-adapted), stolons, and rhizomes.	None currently available.	• glyphosate • 2,4-D + picloram • clopyralid • dicamba + 2,4-D [Spray in spring before bloom.]	Revegetation for shade by seeding and fertilization. Annual cultivation.	Hand pulling not recommended (stimulates sprouting from rhizomes) must remove all roots.
Orange hawkweed	*Hieraclum aurantiacum*	Perennial	Seeds (wind-adapted), stolons, and rhizomes.	None currently available.	• 2,4-D + picloram • glyphosate • clopyralid • dicamba + 2,4-D • Spray in spring before bloom.	Revegetation for shade by seeding and fertilization. Annual cultivation.	Hand pulling not recommended (stimulates sprouting from rhizomes) difficult to remove all roots.
Perennial pepperweed	*Lepidium latifolium*	Perennial	Seeds and creeping roots.	None approved.	[Should be applied at flower-bud stage.]	Establish and maintain healthy riparian vegetation.	Fall disking, spring mowing, followed by herbicides, including glysophates has some good results.
Purple loosestrife	*Lythrum salicaria*	Perennial	Seeds and rhizomes.	• weevil (*Hylobius transversovittatus*) • black-margined and golden leaf eating beetles (*Galerucella calmariensis* and *G. pusilla*) • flower weevil (*Nanophyes marmoratus*)	• glyphosate (When plants begin to flower.) [Rodeo™ has approval for wetlands.][3]	Revegetation can be effective.	Hand pulling or cutting before flowering, followed immediately by flooding (general mowing or cutting not recommended).
Milium	*Milium vernale*	Winter annual	Seeds.	None currently available.	• glyphosate	Revegetation is effective.	Spring plowing.

APPENDIX C
Possible Treatment Methods Available, Life Cycle, and Mode of Reproduction for Weed Species on or Adjacent to the Wasatch-Cache National Forest

Common Name	Scientific Name	Life Cycle	Modes of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Eurasian watermilfoil	*Myriophyllum spicatum*	Perennial	Produces seeds (rarely), but prolifically spread by runners and autofragments.	• native midge (*Cricotopus myriophylli*) • weevil (*Euhrychiopsis lecontei*) • caddisfly (*Triaenodes tarda*)	(Plant die-off from spraying has caused fish die-off because of oxygen depletion in water.)		Water drawdowns in reservoirs prior to freezing temperatures can expose the plant and kill it. Cover small patches with opaque fabric, such as burlap.
Matgrass	*Nardus stricta*	Perennial	Seeds.	None known.	• glyphosate		
Silverleaf nightshade	*Solanum elaeagnifolium*	Perennial	Seeds and spreading rhizomes.	None known.	• glyphosate picloram	Establish dense canopy-forming vegetation.	Cultivation must be frequent and thorough or will spread. Cutting and mowing ineffective.
Buffalo bur	*Solanum rostratum*	Annual	Seeds.	None known.	• glyphosate	Establish and maintain healthy native vegetation, particularly important to limit heavy grazing.	Avoid methods that disturb the soil.
Perennial sowthistle	*Sonchus arvensis*	Perennial	Seeds (2-5 year viability), and spreading, thickened horizontal roots (rhizomes).	• cyst-forming nematode (*Heterodera sonchophila*) • seedhead fly (*Tephritis dilacerata dilacerata*) (Waiting for final approval.)	• glyphosate • clopyralid • dicamba • 2,4-D (Herbicides not very effective for this species.)	Establish and maintain healthy native vegetation.	Cutting, grazing, and mowing can be effective at depleting root stores, if done selectively and frequently. Hoeing and cultivating can be effective if done at 6-leaf rosette stage.
Johnsongrass	*Sorghum halepense*	Perennial	Seeds and rhizomes.	None known.	• glyphosate (Must be used together with mechanical to be effective.)	Establish and maintain native vegetation.	Repeated mowing or grazing to reduce rhizome vigor followed by herbicide. Repeated and continuous tillage (do not till at all if cannot repeat continuously).

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Possible Treatment Methods Available, Life Cycle, and Mode of Reproduction for Weed Species on or Adjacent to the Wasatch-Cache National Forest

Common Name	Scientific Name	Life Cycle	Modes of Reproduction	Biocontrol Agents	Herbicide	Cultural (Restoration) Methods	Mechanical Methods (Includes Grazing)
Puncturevine	*Tribulus terrestris*	Annual	Seeds (viable in soil 4-5 years).	• weevils (*Microlarinus lareynii* and *M. lypriformis*)	• glyphosate • picloram	Establish and maintain native vegetation.	Repeated cultivation. Neither mowing or grazing is effective.
Syrian bean caper	*Zygophyllum fabago*	Perennial	Seeds and lateral roots and root pieces.	None known.	Leaf surfaces are smooth and waxy, making herbicide control difficult.		Hand pulling of entire root system.

[1]Approved for release 4/4/97; FWS concurrence pending.

[2]Approved for release 6/17/98; FWS concurrence pending.

[3] Spot application of Rodeo™ directly onto *L. salicaria* would ensure that no large holes would appear in the marsh vegetation and that competition would be unaffected. The safest method of applying glyphosate herbicide is to cut off all stems at about 6 inches and then paint or drip onto the cut surface a 20-30% solution (Henderson 1987).

[Int]Must use integrated weed management approach to successfully eradicate this species.

Sources of information used on this table include:

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Appendix D

Forest Service Manual 2080—
Appendix III, Noxious Weed Management Guidance

Appendix III
Noxious Weed Management Guidance

	FOREST SERVICE MANUAL **INTERMOUNTAIN REGION (REGION 4)** **OGDEN, UT**

FSM 2000 – NATIONAL FOREST RESOURCE MANAGEMENT

ZERO CODE 2080 – NOXIOUS WEED MANAGEMENT

Supplement No.: R4 2000-2001-1

Effective Date: May 07, 2001

Duration: Effective until superseded or removed

Approved: JACK A. BLACKWELL
Regional Forester

Date Approved: 04/24/2001

Posting Instructions: Supplements are numbered consecutively by Title and calendar year. Post by document name. Remove entire document and replace with this supplement. Retain this transmittal as the first page of this document.

New Document(s):	2080	10 Pages
Superseded Document(s): (Last supplement was 2000-97-1 to 2080.)	2080 (Supplement 2000-97-1)	3 Pages

Digest:

2080.5	Adds Noxious Weed definitions for infested, gross, treated acres, and biological releases.
2081.2	Removes priorities that are now listed in parent text. Adds Noxious Weed prevention and mitigation measures.

2080.5 - DEFINITIONS

Biocontrol Release. The dispersal or release of biocontrol agents on a noxious weed infestation (see definition of infested acre), with the intent of establishing a population of a biological control agents. An agent can be an insect, fungus, bacterium, or any other life form that preys on the weed of concern. The release of agents can occur at a single location or scattered over a site. The release can be a few individuals, a container of many individuals, or several containers with thousands of individual agents. Releases at different locations, with the intent of establishing separate populations (at least 1/4 mile apart), constitute separate releases. Release of two species of biological control agents, at the same location, in the same year, is a single release.

Gross Area. An area of land occupied by one or more noxious weed species. The area is defined by drawing a line around the general perimeter of the infestation, not the canopy cover of the plants. The gross area may contain significant parcels of land that are not occupied by weeds.

Infested Acre. (Occupied Area, Net Area). A contiguous area of land occupied by one or more weed species. The infested area is defined by drawing a line around the actual perimeter of area occupied by the canopy of the weed plants.

Treated Acre. An infested area (see definition of infested acre) where weeds have been treated or retreated by an acceptable method (chemical, biological, mechanical, cultural, manual) for the specific objective of controlling their spread and/or reducing their density (generally reported in increments of not less than 0.1 acre for chemical and mechanical treatment).

2081.2 - Prevention and Control Measures

1. Recommended Practices. Stop the spread of existing noxious weeds and prevent invasion of new sites or new noxious weeds by applying prevention and control mitigation measures where applicable and appropriate. Potential practices to consider:

a. Project Design and NEPA. Incorporate noxious weed prevention into all project layout, design, and alternative evaluation.

Environmental analyses should consider noxious weed risk in evaluating project location and design, and in the development of alternatives and mitigating measures, including any or all of the following, as determined to be appropriate by the Forest Officer in charge:

(1) The presence of existing noxious weeds within the project site by species and magnitude.

(2) The susceptibility of the habitat type to noxious weed invasion.

(3) The risk for invasion or spread of noxious weeds that could be caused by the project.

(4) The evaluation of alternative sites, which are noxious weed-free and/or low risk, for project implementation.

(5) The evaluation of alternative implementation methods where they exist, which would reduce risk of invasion or spread of noxious weeds.

(6) The inclusion of other mitigation measures (practices) designed to minimize risk of invasion or spread of noxious weeds.

(7) The evaluation of direct, indirect, and cumulative effects of the project to noxious weed species and populations.

b. Ground Disturbing Activities. Project implementation for ground-disturbing operations within noxious weed infested areas, as deemed appropriate, should include provisions for monitoring and inspecting as determined through the analysis process.

(1) Comply with mitigation measures for ground disturbing operations within noxious weed infested areas which are generally recommended by the Forest or District Weed Management Specialist and approved by the responsible Forest Officer.

(2) Select noxious weed-free project construction staging areas.

(3) Maintain as much microhabitat for desirable vegetation as feasible in areas that will have ground disturbance to help suppress noxious weeds. Minimize the removal of trees and other roadside vegetation during construction, reconstruction, and maintenance, particularly on southerly aspects, except when removal is required for public safety.

(4) Re-establish vegetation (native where practical) on bare ground caused by ground-disturbing activities to minimize noxious weed spread. Guidelines to consider include:

(a) Revegetate disturbed soil in a manner that optimizes plant establishment for that specific site, unless ongoing disturbance at the site will prevent noxious weed establishment or spread. Monitor and re-treat as needed until site is successfully revegetated according to project standards.

Exceptions to this mitigation measure should require monitoring and treatment of invading noxious weeds. Exceptions include:

Grading and blading of travel ways, borrow ditches, rights-of-way, and drainage ways on system roads that are routinely maintained.

Areas where management objectives would be adversely affected by seeding grass species, that is: reforestation plantations.

(b) Weed seed free topsoil should be stockpiled and replaced on disturbed areas such as road embankments, cuts, fills, and shoulders; gravel pits; skid trails; landings; staging areas; and so forth, where practical.

(c) Replant as soon as practical after the disturbance activity to take advantage of the seedbed and to establish desirable species before the arrival of invading noxious weeds. Use local seeding recommendations. To avoid weed contaminated seed, each lot shall be tested by a certified seed laboratory against the State Noxious Weed List and documentation of seed inspection test provided for.

(d) Use local seeding guidelines for detailed procedures and appropriate mixes. If the risk for invasion by noxious weeds is high, use aggressive, early season species. If the risk is low, use a more diverse mixture of native species that may take longer to establish. Include natives, pioneer species, and/or nurse crops. Select for low nutrient demanding species to reduce the need for fertilization. Monitor seeded sites. Spot re-seed as needed.

(5) Restoration practices for disturbed areas should be based on local prescriptions.

(6) Use certified weed-seed free straw and mulch on road stabilization and erosion control projects.

(7) Eliminate the movement of existing and new noxious weed species caused by moving infested gravel and fill material.

(a) Consider the potential for moving noxious weeds when establishing new material sources on sites where noxious weeds are present, and take necessary corrective action.

(b) Active gravel and borrow sources should be inspected and determined to be noxious weed free before use. A source supporting noxious weeds should be considered for closure until it is weed free.

c. Roads and Road Work. Minimize roadside sources of noxious weed seed that could be transported to other areas, and maximize effectiveness of weed control.

(1) Ranger District noxious weed prevention and control programs should include a monitoring plan for annual inspection of system roads and rights-of-way for invasion of noxious weeds. If noxious weeds become established, inventory and schedule for treatment.

(2) Schedule and coordinate blading or pulling of noxious weed-infested roadsides or ditches with the Forest or District Weed Management Specialist to ensure that appropriate mitigation measures are applied. Coordinate with a weed management specialist before blading or pulling roadsides and ditches infested with noxious weeds that are on the routine maintenance schedule.

(3) When necessary to blade noxious weed infested roadsides or ditches, schedule work for spring or early summer prior to the seed-set stage or later in the fall after seeds have fallen. Minimize surface disturbance and isolate bladed material to the infested site. (Also see item b. Ground Disturbing Activities above).

d. Reclamation/Restoration. Reduce noxious weed establishment in obliteration/reclamation projects. Treat noxious weeds in obliteration and reclamation projects before roads are made undriveable. Monitor and retreat as necessary. (Also see item b. Ground Disturbing Activities above).

e. Public Use. Minimize transport and establishment of noxious weeds on National Forest System lands by considering these preventive measures:

(1) Treat noxious weeds at trailheads, boat launches, outfitter and public campsites, airstrips, and roads leading to trailheads.

(2) Close infestations of noxious weeds to camping until noxious weeds have been eradicated.

(3) Inspect campgrounds, trailheads, and similar areas that are open to public vehicle use and consider as high-risk areas. Inspected annually for invasion of noxious weeds. Include established infestations in strategies for eradication.

(4) Remove seed sources that could be picked up by passing vehicles to limit seed transport. (Also see item b. Ground Disturbing Activities above).

f. Noxious weed awareness and prevention efforts.

(1) Use education programs to increase noxious weed awareness and prevent noxious weed spread by Forest users.

(2) Post and enforce the statewide Noxious Weed Hay, Straw, and Mulch Closure Order.

(3) Post pictures and descriptions of noxious weeds at National Forest System trailheads and at roadsides in noxious weed areas to inform recreationists of noxious weed presence and dangers of spreading.

(4) Post prevention practices at National Forest System trailheads and at roadsides in noxious weed areas. Recommended prevention practices include:

(a) Pack and saddle stock should be fed only weed-seed free feed for several days prior to traveling off roads in the Forest and should be brushed to remove any noxious weed seed.

(b) Stock should be tied and held in the backcountry in such a way as to minimize soil disturbance and avoid loss of native/desirable vegetation.

(c) Motorized trail users should inspect and clean their vehicles of noxious weeds and their seeds prior to using National Forest System lands.

(5) Post notices in publicly accessible noxious weed treatment areas where and when there is a likelihood of contact with herbicide-treated- vegetation.

g. Archeological Excavations. Reduce noxious weed establishment and spread at archeological excavations. Archeological excavation areas are considered as high-risk ground disturbing areas and should be inspected for invasion of noxious weeds. If noxious weeds become established, they should be inventoried and scheduled for treatment. (Also see item b. Ground Disturbing Activities above).

h. Wildlife and Fisheries. Ensure noxious weed prevention and control are considered in management of wildlife and fisheries. Forest noxious weed prevention and control programs should include a monitoring plan for inventory and annual inspection of areas where wildlife concentrate in the winter and spring, which results in overuse and/or soil scarification. Inventory and schedule for treatment noxious weeds when found. (Also see item b. Ground Disturbing Activities above).

i. Domestic Grazing Activities. Ensure noxious weed prevention and control are considered in management of all grazing allotments. Consider the following:

(1) Annual Operating Instructions for every grazing allotment should include noxious weed prevention monitoring and reporting direction, and provisions for annual inspection of areas where livestock concentrate, which results in overuse and/or soil scarification. If noxious weeds become established, they should be inventoried and scheduled for treatment.

(2) For each grazing allotment containing noxious weed infestations, include direction in the Annual Operating Instructions (AOI) for prevention and control of noxious weeds. Items to be addressed in the AOI might include: season of use, exclusion, minimizing ground disturbance, noxious weed seed transportation, maintaining healthy vegetation, control methods, revegetation, monitoring, reporting, and education.

Include ways to minimize ground disturbance and bare soil caused by livestock operations (for example: salt licks, watering sites, yarding/loafing areas, corrals, and other heavy use areas) in Allotment Management Plans (AMPs) and/or Annual Operating Instructions.

Minimize transport of noxious weed seed into and within allotments by considering the following:

(a) Avoid driving, walking, riding, and/or herding through noxious weed infestations.

(b) Entry units grazed by livestock transported onto the Forest from noxious weed-infested areas should be inspected annually for new noxious weeds. If noxious weeds become established, they should be inventoried and scheduled for treatment.

(5) Maintain healthy desirable vegetation that is resistant to noxious weed establishment by considering the following:

(a) Manage forage utilization to maintain the vigor of desirable plant species as described in the Allotment Management Plan.

(b) Minimize and/or exclude grazing on restoration areas until vegetation is well established.

(6) Promote noxious weed awareness and prevention efforts among livestock permittees by considering the following:

(a) Use education programs and/or Annual Operating Instruction direction to increase noxious weed awareness and prevent noxious weed spread by permittees' livestock and/or management activities.

(b) Encourage permittees who are certified herbicide applicators to participate in allotment and Cooperative Weed Management Area noxious weed control programs. (Also see item b. Ground Disturbing Activities above).

j. Forest Management. Minimize the creation of sites suitable for noxious weed establishment during timber harvest by considering the following:

(1) Avoid driving, walking, skidding, landing, and/or hauling through noxious weeds.

(2) Minimize soil disturbance during forest management operations by considering winter skidding; broadcast burning over pile burning; smaller slash piles and burning under conditions that minimize heat transfer to the soil; minimizing fire line construction; seeding skid trails, landings, and other disturbed sites.

(3) Monitor for noxious weeds after sale activity and treat noxious weeds as needed.

(4) Where logging activity on planned or existing timber sales may contribute to the encroachment of noxious weeds, use Sale Area Improvement and K-V collections to control or prevent the encroachment of noxious weeds within sale areas as provided for in FSM 2477. Enter planned expenditure of K-V funds for noxious weed control on Development and Budget System Plan. (Also see item b. Ground Disturbing Activities above).

k. Mining, Mineral, Oil and Gas. Minimize noxious weed establishment in mining operations and reclamation by considering the following:

(1) Retain sufficient bonding until an appropriate percent of the potential vegetation ground cover, as determined by the responsible Forest Officer, for the site is reestablished.

(2) Mining and mineral exploration areas are considered as high-risk areas and should be inspected for invasion of noxious weeds. If noxious weeds become established, they should be inventoried and scheduled for treatment. (Also see item b. Ground Disturbing Activities above).

l. Soil and Watershed Improvement. Integrate noxious weed prevention and management in all soil and watershed, and stream restoration projects. Forest noxious weed prevention and control programs should include a monitoring plan for early detection of noxious weed spread or establishment in riparian areas, particularly from existing infestations and previously eradicated sites. New infestations should be treated for eradication before they become well established. (Also see item b. Ground Disturbing Activities above).

m. Special Use Permits and Easements. Reduce noxious weed establishment and spread in special use permits and easements by considering the following:

(1) Holders of special use permits and easements are responsible for the prevention and control of noxious weeds on the area authorized when prescribed by the Forest Service.

(2) Require noxious weed prevention and control requirements in Operating and Maintenance Plans when authorized activities present a high risk for invasion by noxious weeds or the location of the activity is vulnerable to invasion by noxious weeds.

n. Wildfire and Prescribed Fire Operations. Mitigate and reduce noxious weed spread during wildfire and prescribed fire operations by considering the following:

(1) Increase noxious weed awareness among fire personnel. Include noxious weed risk factors and noxious weed prevention considerations in the Resource Coordinator duties on Incident Overhead Teams and Fire Rehabilitation Teams.

(2) Where practical and timely, establish fire camps, vehicle and crew staging areas, helibases, helispots, cargo and net loading areas, and airstrips in noxious weed-free areas.

(3) Assign a local Weed Specialist Resource Advisor to the Incident Command Team when the wildfire or control operation occurs in or near a noxious weed area.

(4) When noxious weed infested areas are used for fire operations, implement appropriate mitigation measures, as determined by the Weed Specialist Resource Advisor. Identify high-risk noxious weed infestations in areas of fire operations, and avoid when possible.

(5) All vehicles sent off Forest for fire assistance in noxious weed areas should be cleaned before returning to home units.

(6) Emphasize Minimal Impact Suppression Tactics (MIST) to reduce soil and vegetation disturbance. Minimize fire and dozer line.

(7) Avoid or minimize all types of travel through noxious weed areas.

(8) Avoid ignition and burning in noxious weed areas, unless it is part of a noxious weed control strategy.

(9) Avoid ignition and burning in areas with a high risk for invasion of noxious weeds.

(10) Unplanned burning of noxious weed areas might require post treatment of noxious weed infestations.

(11) Utilize noxious weed-free helibases and helispots for aerial ignition projects.

(12) Minimize fireline and soil disturbance and:

(a) Encourage desirable vegetation during fire rehabilitation activities.

(b) Seed the entire burn, all cat lines, and severely disturbed areas when there is a high risk of noxious weed spread or invasion, and such action is recommended by the local Weed Specialist Resource Advisor and approved by the Responsible Forest Officer. Hand seed catlines and severely disturbed areas.

(c) Prioritize treatment of noxious weeds on fire access roads as part of rehabilitation plan to reduce noxious weed spread into burned areas.

(13) Apply for restoration funding for noxious weed infestations as determined by Burned Area Rehabilitation teams. (Also see item b. Ground Disturbing Activities above).

o. <u>Noxious Weed Program Continuity</u>. Ensure continuity in noxious weed management programs. Each Forest should have access to a Weed Specialist who is trained and proficient in noxious weed management.

2. <u>Closure Orders</u>. Product certification shall be accepted from any State Department of Agriculture, County Agriculture Officer, or their authorized agents, on National Forest System lands for the certified hay, feed, straw, and mulch closure orders. Pelletized feed does not fall under the hay products closure orders.

2083 - INFORMATION COLLECTION AND REPORTING

Inventory noxious weeds and plot their location on a map(s). Update the inventory as needed. Coordinate information with local/county weed boards. Inventory information can be supplemental to post-treatment evaluation as described in FSM 2155.1. The inventory and summary shall be by weed species and acreage infested. Do not duplicate the acreage count where more than one weed species occurs on the same site.