Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

Reserve
aSB612
.M9F56
2006

FINAL

Environmental Impact Statement
Noxious Weed
Treatment Project

Leafy spurge
Euphorbia esula

Spotted knapweed
Centaurea maculosa

Dalmation toadflax
Linaria genistifolia ssp. dalmatica

Helena National Forest

May 2006

The United States Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Ave., S.W., Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal employment opportunity provider and employer.

United States
Department of
Agriculture

National Agricultural Library

FINAL ENVIRONMENTAL IMPACT STATEMENT

HELENA NATIONAL FOREST WEED TREATMENT PROJECT

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

HELENA NATIONAL FOREST

Lewis and Clark, Powell, Jefferson, Broadwater, and Meagher Counties

May, 2006

U.S.D.A., NAL
JUN 0 5 2006
CATALOGING PREP

Responsible Official

Kevin T. Riordan
Forest Supervisor
Helena National Forest

For Further Information, Contact:

Jay Winfield
Helena National Forest
2880 Skyway Drive
Helena, MT 59601

ABSTRACT

The Helena National Forest is proposing to treat weeds using Integrated Pest Management (IPM) on approximately 23,000 acres of National Forest System lands over the next 12 years. The Proposed Action is considered as Alternative A. Treatment methods would be largely through aerial and ground application of herbicides, with mechanical and biological control where appropriate. Environmental protection measures would be included to protect sensitive resources (e.g., water quality, fish habitat, vegetation, human health, and cultural resources).

Two other alternatives were considered in detail in the Environmental Impact Statement. One is Alternative B, which includes fewer treatment acres and no aerial application of herbicides. Alternative C is the No Action Alternative, which continues the current weed treatment program, including some herbicide treatments.

SUMMARY

INTRODUCTION

This Environmental Impact Statement (EIS) discloses potential effects of implementing a noxious weed treatment project and alternatives on the Helena National Forest (Helena NF). Currently, about 22,668 acres of the Helena NF and 198 miles of roads are infested with noxious weeds. The main weed species of concern are spotted and diffuse knapweed, leafy spurge, Dalmatian and common (or yellow) toadflax, ox-eye daisy, and sulfur cinquefoil. Other weed species of concern include Russian knapweed, Canada and musk thistles, St. Johnswort, and houndstongue. The rate of spread of these weeds is expected to expand 14 percent per year (Asher 1998) and may increase due to large wildfires (recent and future). A shift from trees, shrubs, and bunchgrass vegetation to noxious weeds will cause a decrease in wildlife forage, a reduction in species diversity, and an increase in soil erosion and overland flow due to a decrease in surface cover. An estimated 338,600 acres of the Helena NF are currently susceptible to weed invasion based on acres of rangeland and forested areas with less than 35 percent tree canopy coverage, including 78,000 acres burned in 2000 and 2003. Future activities or events that reduce canopy cover could increase the acres susceptible to weed invasion.

PROJECT AREA

The Helena NF encompasses approximately 975,000 acres in central Montana within Lewis and Clark, Powell, Jefferson, Broadwater, and Meagher Counties. The project area consists of land within the boundaries of the Helena NF. Proposed treatments would occur throughout the Forest, on National Forest System lands.

PURPOSE AND NEED FOR ACTION

Damage from noxious weeds is increasing due to their expanding populations and distribution of weeds will continue to increase if action is not taken to control their spread. Noxious weeds can crowd out native plants and diminish the productivity, bio-diversity, and appearance of land.

Although only a small portion (approximately 23,000 acres) of the Helena NF is now infested with weeds, results of uncontrolled weed spread are well documented (Sheley *et al.* 1999). Infested acres continue to increase because all identified infestations cannot be effectively treated under the existing program.

Ongoing inventory and monitoring shows that there is a need to:

Control Noxious Weeds

- New weed species are coming into the Helena area from all directions with potential for new weed species to move in and spread. Adjacent states and other areas in Montana already have infestations of weeds that have not yet arrived on the Helena NF. New invaders need to be treated aggressively to limit establishment of new weed populations.

Treat Weeds on Rangeland

- A healthy rangeland provides high quality forage for native herbivores and domestic livestock as well as providing cover and foraging habitat for many small animals and birds. Establishment of weeds reduces forage production, which can result in reduced wildlife numbers (Duncan 1997). Rangeland with a good cover of native vegetation holds the soil, reducing erosion from runoff. Soil erosion from a weed-dominated site may contribute sediment to waterways (Lacey *et al.* 1989), which can decrease productivity of a stream by reducing availability of aquatic habitats.

Treat Weeds in Burned Areas

- Two large wildfires on the Helena NF in 2000 and one in 2003 burned about 78,000 acres including both rangeland and timber. Additional large fires are expected to occur in the future. Other previous fire areas such as the Scapegoat fire (1988), Warm Springs fire (1988), and the North Hills Fire (1984) have experienced weed spread. Susceptibility of burned areas to new weed invasion is increased due to decreased canopy cover and increased bare ground (Goodwin and Sheley 2001). Nearby weed infestations are poised to invade burned areas if management measures are not taken.

Treat Weeds in Remote Areas

- Large weed infestations continue to expand on the Helena NF because of arduous access for equipment and personnel, creating difficult and sometimes unsafe working conditions. As a result, about 6,800 acres of the total infested acres are not currently being treated. Weed infestations have doubled and in some cases tripled in inaccessible areas over the last decade; while weed populations in accessible areas, such as roads, have shown decreases due to consistent treatment measures. Cost-effective and safe methods are needed to control spread of weeds in these areas.

PROPOSED ACTION

The Helena NF proposes to implement an aggressive noxious weed control program, which includes aerial application of water-soluble herbicides, increased ground application of water-soluble herbicides, and increasing biological and mechanical control efforts through use of insects and grazing. All of these methods would become part of the Helena NF's integrated weed management program. Esther/fat-soluble herbicides will not be used.

The project would be implemented over a 12-year period. Not all acres would be treated in the first year, but some areas would be treated repeatedly on a 2 or 3-year rotation to ensure effective control, as part of a "maintenance mode of action." Follow-up maintenance treatments are expected to require reduced amounts of herbicide from initial application. Maintenance treatments may be ground based, but in some cases, a second or third aerial treatment may be required.

HERBICIDES

Chemical treatments would include both ground and aerial herbicide applications. Chemical applications would take place at the appropriate time of year for targeted weed species and environmental considerations such as proximity to water or residential areas. Equipment such as helicopters, trucks, all-terrain vehicles (ATVs), horse, and backpack sprayers would be used. New herbicides are being developed which are more species specific and less persistent or less mobile in soil. Newly registered water-soluble herbicides displaying toxicity, leaching, and persistence characteristics less than or equal to picloram may be used.

Ground applied herbicide treatments are proposed in Scapegoat and Gates of the Mountains Wilderness areas.

Surfactant adjuvant would be used in certain situations to increase efficacy, primarily on target species with a waxy cuticle (especially toadflax), or when temperature and humidity are not optimal (but still within label and more restrictive locally prescribed limits) yet other conditions (such as plant phenology) are ideal. Surfactants may be used during periods of drought. Surfactants used would be a silicone-blend type, (including silicone components mixed with non-silicone components such as modified seed oils) such as Phase II®, added to tank mixes. Surfactant adjuvant would be used in accordance with label requirements for both the herbicide and the surfactant products.

BIOLOGICAL CONTROLS

Biological controls (such as insects) would continue to be introduced where appropriate and newly approved agents would be considered for use.

GRAZING

Grazing of livestock such as sheep or goats would occur to control leafy spurge, Dalmatian toadflax and spotted knapweed. Grazing would be done on a contract basis, would be high-intensity and short duration, and would be done with animals specially conditioned to graze on target weeds.

MECHANICAL TREATMENT

Mechanical treatment such as hand pulling or grubbing would occur on sensitive areas or in very small infestations. Cultivation and/or seeding would occur where natural recovery of native species is inadequate to provide needed competition to prevent reinvasion by weeds.

ADAPTIVE MANAGEMENT

Weeds spread aggressively and the most effective time to treat new infestations or new species is when they are first discovered. An Adaptive Management Strategy was included to address new areas of infestation, new weed species discovered or listed, and new weed treatment methods becoming available (herbicides, biocontrols, and cost effective mechanical methods).

For analysis purposes, the adaptive management strategy in Alternatives A and B assumed up to 25 percent more acres may be identified as needing treatment within the 12-year time-frame of the EIS. It is possible that treatment success would offset new acres, resulting in little overall change in treatment acres.

Effective weed treatment would require a combination of tools to treat target species for a particular location. Reliance on one method or restricting use of one or more weed management tools may prove less effective. Effectiveness and applicability of each tool varies and depends on weed biology and ecology, location and size of infestation, environmental factors, management objectives, and costs.

SCOPE OF THE DECISION

Geographic Scope

Table 1-2 shows the geographic scope of the Proposed Action. Treatments would occur on NFS land within the Helena NF only, however, the number of acres treated would change with the Adaptive Management Strategy. For each resource, an analysis area was determined that could be used to adequately measure cumulative effects of the proposed alternatives. Unless otherwise stated, the cumulative effects area is the treatment area.

Temporal Scope

The timeframe for project implementation is 12 years. Direct, indirect, and cumulative effects, if any, would occur during that period. For cumulative effects analysis, an additional 10 years past the final implementation year is considered, unless otherwise described in the resource sections. In some cases, longer-term effects are discussed.

PUBLIC INVOLVEMENT PROCESS

A public scoping letter was sent to interested citizens on December 7, 2001 asking for comments on the Helena NF Noxious Weed Control proposal. A Notice of Intent to prepare an EIS on the proposal was published in the Federal Register on February 20, 2002. Publication of this notice initiated a public scoping period through June 1, 2002. In total, written comments were received from 11 individuals and 10 organizations or agencies during the scoping period.

A Draft Environmental Impact Statement (DEIS) was published in October, 2003. A Notice of Availability appeared in the Federal Register on October 17, 2003, initiating a 45-day comment period. The Comment Period closed on December 1, 2003. Details of public involvement during the DEIS comment period are provided at the beginning of Chapter 7. Written comments were received from 4 individuals and 5 organizations or agencies during the comment period. These letters, along with the agency's response to specific comments, are presented in Chapter 7.

In 2004, following the agency's review of comments to the DEIS, and preparation of Chapter 7, work on a Final Environmental Impact Statement (FEIS) was begun. Changes were incorporated to address public comments, correct typographic errors, and incorporate updated information. Release of a FEIS was put on hold pending completion of some other Forest priority work activities. Late in 2005, the Forest again began work on the FEIS. An interdisciplinary team reviewed the existing analysis and supporting documentation. They reviewed updated information, performed additional literature searches, and evaluated any changes in information or conditions since the DEIS. The FEIS content was updated based on further review of public comments, identified data gaps, and current literature. A more detailed discussion of the public involvement process can be found in Chapter 2.

SIGNIFICANT ISSUES

Comments from the public and Helena NF Interdisciplinary Team (IDT) members were used to determine issues of concern that could result from implementing the Proposed Action. One issue (see below) was considered by the IDT to be significant, because there is no way to resolve the conflict within the confines of the Proposed Action. Therefore, the best way to address it is through development of a new alternative. An "Issue Indicator" is specified which is a statement of how the effects will be measured in the "Summary Comparison of Alternatives" section at the end of this Chapter.

Potential effects on human health, non-target vegetation, and wildlife from aerial application

Comments during scoping indicate there is a perception that, regardless of the required Environmental Protection Measures (EPM) that were designed to minimize unintended herbicide exposure, aerial application may cause herbicides to be deposited in unintended locations and affect non-target species. This issue is addressed through development of Alternative B, which contains no aerial application of herbicides. Under Alternative B, all weed treatments would be conducted using ground application, biocontrol methods, or mechanical treatment. In some areas, due to worker safety and effectiveness of available control methods, no treatment would occur.

ISSUES AND ALTERNATIVES NOT STUDIED IN DETAIL

Comments were received suggesting that various mitigation measures or other plans of action be considered. Alternatives derived from these issues were either outside the scope of the analysis or did not meet the Purpose and Need. Some issues, such as actions to address the existence of noxious weeds on adjacent privately owned land, and their disposition can be found in the Project File (PF-*Scoping Issues*).

Aerial applications should not take place in areas anywhere near (at least ¼ of a mile away from) water or private land and should not include any restricted use herbicides.

Various buffer widths for herbicide application areas were considered. This alternative was not considered in detail because buffer areas proposed for aerial spraying have been determined to be effective through past monitoring to prevent drift to water and private land (PF-*Aquatics*). Not using restricted herbicides in aerial applications was not considered in detail because restricted herbicides would be used safely when applied carefully and in accordance with herbicide label instructions as described in the Proposed Action.

Develop an alternative that does not include chemical treatments

Some people believe herbicides may present a risk to people, animals, and native plants. Although herbicides proposed for weed control in the Proposed Action have gone through rigorous scientific testing and government approval, some people perceive use of these herbicides as unsafe. An alternative that did not use chemical treatments was not considered in detail because, for many of the most troublesome noxious weeds, other methods are not effective, or are not feasible. For example, because of its physical characteristics, pulling, digging, and mowing are not effective treatments for Dalmatian toadflax (Lajeunesse *et al.* n.d.), one of the most common weeds. The rhizomatous root systems cause re-sprouting after pulling or digging, requiring repeated treatments for up to 15 years. Mowing tends to spread the seed and reduces competition from native vegetation.

Another example is knapweed, where infestations are so large that pulling and digging could not reasonably be accomplished. Hand-pulling is labor intensive and only suitable for small infestations (Lacey *et al.* 1995). Given availability and cost of labor combined with slow rates of accomplishment, it is unlikely enough acres could be treated annually to address the Purpose and Need. Mowing is not physically possible in many areas. Knapweed and toadflax constitute 80 percent of the weed infestations proposed for treatment (PF-*Weed Database*). Also, effective biocontrol agents are not currently available to target some noxious weed species.

The Forest reviewed and considered several documents that fully analyzed a "no herbicide" alternative, including the Gallatin National Forest Noxious and Invasive Weed Control Final Environmental Impact Statement (FEIS) (USFS 2004) and Record of Decision (ROD) (USFS 2004), the Beaverhead-Deerlodge Noxious Weed Control Program Final EIS and ROD (USFS 2002a), the Lolo National Forest Big Game Winter Range and Burned Area Weed Management FEIS and ROD (USFS 2001a), and the Bureau of Land Management's 1991 Vegetation Treatment on BLM Lands in Thirteen Western States (USBLM 1991). In all cases, findings indicated that the alternative would only minimally meet the need for weed management and, therefore, would not meet federal and state laws and executive orders (EIS, pages 1-4 through 1-6). In the case of Forest Service decisions, the "no herbicide" alternative did not comply with the agency's Integrated Pest Management program and is not consistent with the policy that noxious weeds and their adverse effects be managed on National Forests. Decisions noted that such an alternative would allow the Forest to cooperate only to a very limited extent with county and state agencies and private landowners interested in managing invasive weeds. Based on interdisciplinary team (IDT) discussion and evaluation of these other analyses, it was determined that an alternative that does not include herbicide treatments would not be studied in detail.

Aerial spray weeds in wilderness areas

This alternative was suggested with rationale that aerial spraying would be considered a "minimum impact tool" for weed treatment in wilderness areas. This alternative was not considered in detail because at the present time, weed treatment areas in wilderness are in small, isolated patches; aerial treatment would not meet Forest Plan standards for wilderness (minimum low flight limit of 3,000 feet) ; and it would not comply with wilderness regulations pertaining to low flying aircraft.

Require lease/permit holders to eradicate noxious weeds on land they use

This alternative was considered at the suggestion of the public. This alternative was not considered in detail because of complications involved with ensuring permittees applying herbicides on National Forest System land are licensed to apply herbicide; that lessees would write and submit pesticide use plans for approval as required by Forest Service policy, and ensuring that the correct amount of herbicide, timing of application, and appropriate use of herbicides by permittees was occurring. Although requiring permittees/lease holders to hand pull weeds could be implemented, it would not effectively treat weed in those areas. See "Develop an alternative that does not include chemical treatments" above.

Do not treat weeds in wilderness areas

Some people indicated that weed management within wilderness contradicted the definition of wilderness and therefore weed treatment should not occur. An alternative that would eliminate wilderness area treatments was considered, but not studied in detail because management practices, such as weed treatment that maintains the natural ecosystem in wilderness areas, are allowed (see the effects on wilderness in Chapter 4). Only about 68 acres of weed treatment is proposed in wilderness areas and potential adverse effects on wilderness attributes are not expected.

Develop public volunteer program using schools, businesses, even prisoners, to pull weeds

This activity already occurs to some degree as part of the Helena NF's integrated weed management strategy. In addition, pulling weeds is not an effective treatment in most instances, but where it is, it is part of the Proposed Action. Another concern is safety of volunteers (allergic reactions, steep terrain, exposure to heat and cold).

Eradicate all weeds, not just new and existing ones

Eradication of all weeds is an impossible task at this time. Weed seeds last for years, even decades and there are thousands of acres in Montana where no effective weed treatments are planned. It is unlikely that weed establishment in new areas could be completely prevented, given the vectors for transportation and distribution of seeds (water, wind, animals, and humans).

Analyze a true "no action" alternative

The "No Action" Alternative (*Alternative C*) as described in this EIS is a continuation of the current weed treatment program. The "No Action Alternative" can be described as no change in action (as in this EIS) or no action at all (Council on Environmental Quality's "40 most asked question concerning CEQ's National Environmental Policy Act Regulations" question 3).

A "true" No Action Alternative (the second scenario as described in the previous statement) that has <u>no weed treatment activities and no prevention measures</u> was not studied in detail because it would require eliminating all previously approved treatment plans, would violate state and federal laws and policies, and would not meet the Purpose and Need.

Develop an alternative that includes only measures to prevent weeds

Based on review of other Environmental Impact Statements and associated public comments, there appears to be a question among a portion of the public of why we don't consider a "prevention only" alternative. A "prevention only" alternative was not considered in detail because it would only address the introduction of new weed species and spread of existing infestations into new areas. Without treatment, existing weed populations could not be reduced and weeds would continue to spread by natural dispersal mechanisms (seeds carried by wind, in the fur of animals and the digestive tracts of birds, spreading by creeping – for rhizomatous species). Prevention measures, in the form of education (for forest users and employees) and implementation of activity-specific prevention practices (as outlined in FSM 2081.2 Prevention and Control Measures), are already being used. Prevention is recognized as an important component of integrated pest management but when used alone it would be ineffective and inconsistent with Forest Plan direction and Forest Service policy to manage weeds and their adverse effects on National Forest System lands, and violates federal and state laws and executive orders.

ALTERNATIVES CONSIDERED IN DETAIL

ALTERNATIVE A – PROPOSED ACTION

This alternative is described by the Proposed Action (above) and is considered in detail in the EIS.

ALTERNATIVE B – NO AERIAL HERBICIDE APPLICATION

Under Alternative B, chemical weed treatments would include ground herbicide applications, in addition to the ongoing activities described under the No Action Alternative (*Alternative C*). Many acres proposed for aerial application would be treated through ground application, but some areas would not be treated at all due to remoteness, steepness of terrain, or cost. About 18,900 acres would have herbicide application. Mechanical, biological, and grazing treatments would occur as in Alternative A.

Activities described under *Features Common to All Alternatives* and under *Environmental Protection Measures* below apply to this alternative.

ALTERNATIVE C – NO ADDITIONAL WEED TREATMENT

This alternative is the No-Action Alternative. Current activities would continue as planned. Some measures under *Environmental Protection Measures* would also apply. Measures applicable to Alternative C are measures already incorporated into the current program.

SUMMARY COMPARISON OF ALTERNATIVES

The tables below provide a summary comparison of the three alternatives analyzed and their relationship to the Purpose and Need, the extent to which they address significant issues, and the extent to which they address public concerns.

Meeting the Purpose and Need

Purpose and Need Statement	Alt. A	Alt. B	Alt. C
Control Noxious Weeds (acres)	22,668	18,913	15,871
Treat new weeds and infestations?	Yes	Yes	No

Addressing Significant Issues

Issue	Alt. A	Alt. B	Alt. C
1. Potential effects on human health, non-target vegetation, and wildlife from aerial application.			
Issue Indicator: Acres of aerial herbicide application (total).	11,086	0	0

Addressing Public Concerns

Concern	Alt. A	Alt. B	Alt. C
Effects of weed treatment on water quality, groundwater, and fisheries			
	Low risk with environmental protection measures in place	Low risk with environmental protection measures in place.	Low risk with environmental protection measures in place.
Effects of weed treatment on native grasses, forbs, shrubs, and trees			
	1-3 year reduction in growth for individual plants from herbicides on 22,668 acres. More selective herbicides can be used.	1-3 year reduction in growth for individual plants from herbicides on 18,913 acres. More selective herbicides can be used.	1-3 year reduction in growth for individual plants from herbicides on 15,871 acres. Herbicide selection limited.
Effects of weed treatment on wildlife			
	Low risk of effects from herbicides. Short-term disturbance (between alternatives considered) from application, hand pulling.	Low risk of effects from herbicides. Short-term disturbance (highest of alternatives considered) from application, hand pulling.	Low risk of effects from herbicides. Short-term disturbance (lowest of alternatives considered) from application, hand pulling.

Addressing Public Concerns			
Concern	**Alt. A**	**Alt. B**	**Alt. C**
Cost of proposed treatments for the initial treatments*			
Per Acre Total	$44.23 to $48.84 $1,002,510 to $1,106,994	$66.51 to $68.52 $1,257,974 to $1,295,942	$62.00 $987,350
Effects on human health from herbicide use			
	No health effects or risks to worker or general public.	No health effects or risks to worker or general public.	No health effects or risks to worker or general public.
Effects of weed treatment on insects			
	No effect	No effect	No effect
Effects of weed treatment on recreationists and adjacent landowners			
	Short-term disturbance (middle)	Short-term disturbance (highest)	Short-term disturbance (lowest)
Effects of weed treatment on wilderness, inventoried roadless areas, research natural areas, and unroaded areas			
Acres Treated Wilderness IRA RNA	 68 2,399 5	 68 1,418 5	 <3 1,038 5
Effects on apparent naturalness and natural integrity	Improved through reduction of weed invasion.	Improved through reduction of weed invasion on 60% of infested acres. Long-term reduction as remaining weeds spread.	Improved through reduction of weed invasion on 43% of infested acres. Long-term reduction as remaining weeds spread.
Effects of weed treatment on sensitive areas and important ecological communities			
	No effect with environmental protection measures.	No effects with environmental protection measures.	No effect with environmental protection measures. .
Effects of herbicide use on soil			
	Slight temporary reduction in productivity, long-term improvement on 100% of infested area.	Slight, temporary reduction in productivity, long-term improvement on acres treated (84% of infested area). Decrease on areas not treated.	Slight, temporary reduction in productivity, long-term improvement on acres treated (70% of infested area). Decrease on areas not treated.
Potential Effectiveness of Weed Treatments			
	High on 100% of infested areas.	High on 84% of infested area, ineffective on 26%.	High on 70% of infested area, ineffective on 30%.
Effects of noxious weeds on other resources			
Noxious weeds have negative impacts on wildlife habitat, water quality, recreational values, soil productivity, wilderness and IRAs.	100% of infested areas treated with provisions for new infestations to be treated, reducing effects of noxious weeds.	84% of infested areas treated with provisions for new infestations to be treated in most areas, reducing effects of noxious weeds.	70% of infested areas treated with no provisions for new infestations to be treated without further NEPA decisions. Effects of noxious weeds likely to increase.

* Initial treatments include the first 3-4 years in Alternative A, and 4-5 years for Alternatives B and C.

TABLE OF CONTENTS

PAGE

APPENDICES

LIST OF TABLES PAGE

LIST OF FIGURES

CHAPTER 1 PURPOSE AND NEED

CHANGES BETWEEN THE DRAFT AND FINAL EIS

Main changes in Chapter 1 include:

- Added Table 1-2 "Acres of High Risk", which displays results of a weed risk assessment completed between the draft and final EIS.
- Updated the number of acres susceptible to weed infestation and updated the discussion to reflect the fires of 2003.
- Added Appendix G (which presents by category the range of past activities used in the cumulative effects analysis) to the document organization discussion.
- Dropped Figures 1-2 through 1-5, as they simply duplicated base information displayed on the Alternative and Resource maps found in Chapters 2 and 3.

INTRODUCTION

This Environmental Impact Statement (EIS) discloses potential effects of implementing a noxious weed treatment project and alternatives on the Helena National Forest (Helena NF). Currently, about 22,668 acres of the Helena NF and 198 miles of roads are infested with noxious weeds (Project File [PF] – Weed Database).

DOCUMENT ORGANIZATION

This document is organized into chapters that follow direction in the Forest Service National Environmental Policy Act (NEPA) handbook (FSH 1909.15), which includes:

Chapter 1 - Purpose and Need: This chapter discusses the regulatory direction, federal and state regulations, purpose of, and need for the Project, and scope of the analysis. A location map can be found at the end of the chapter.

Chapter 2 - Alternatives: This chapter provides a detailed discussion of issues identified from scoping comments received. It describes the issues that were used to develop alternatives. The alternatives are described in detail along with mitigation and design criteria. A comparison of alternatives and their potential effects on the environment as well as how they meet the purpose and need is presented. The agency preferred alternative is identified.

Alternative maps are located at the end of the chapter.

Chapter 3 - Affected Environment: This chapter explains the current condition of resources and issues that may be affected by the Proposed Action and alternatives. Regulations that apply to each resource are also explained. Maps displaying the existing condition of various resources can be found at the end of the chapter.

Chapter 4 - Environmental Consequences: This chapter summarizes the analysis conducted for each resource, describes potential effects that could result from implementation of the alternatives, and indicates whether the potential effects are consistent with regulatory direction.

Chapter 5 - Consultation, Coordination, and Preparation: Agencies, groups, and individuals involved or contacted during EIS preparation are identified.

Chapter 6 - References: This chapter contains the bibliographical information on the citations used throughout the EIS.

Chapter 7 – Response to Comments: This contains copies of the letters received as comments on the DEIS, with substantive comments identified, and responses to them.

Appendix A - Proposed Treatment Acreage by Watershed.

Appendix B - Scientific Names of Plant, Fish, and Wildlife Species used in the document.

Appendix C - Spill Plan and Procedures.

Appendix D - FSM 2080 R1 Supplement – Noxious Weed Management.

Appendix E - RAVE/Site Evaluation Form.

Appendix F - Procedures For Mixing, Loading, and Disposal of Pesticides.

Appendix G – Past Activities

BACKGROUND INFORMATION

Since the late 1800s, exotic plant species have been spreading across the Pacific Northwest. From these historic trends, this pattern of expansion is expected to continue due to transport of seeds from increasing travel and trade, and through continued disturbance of land (agricultural, residential, recreational, and commercial developments).

The main weed species of concern are spotted and diffuse knapweed, leafy spurge, Dalmatian and common (or yellow) toadflax, ox-eye daisy, and sulfur cinquefoil. Other weed species of concern include Russian knapweed, Canada and musk thistles, St. Johnswort, and houndstongue. The rate of spread of these weeds is expected to expand 14 percent per year (Asher 1998) and may increase due to large wildfires (recent and future). A shift from trees, shrubs, and bunchgrass vegetation to noxious weeds causes a decrease in wildlife forage, a reduction in species diversity, and an increase in soil erosion and overland flow due to a decrease in surface cover.

NOXIOUS WEEDS ON THE HELENA NF

An estimated 338,600 acres of the Helena NF are currently susceptible to weed invasion based on acres of rangeland and forested areas with less than 35 percent tree canopy coverage, including 78,000 acres burned in 2000 and 2003. Future activities or events that reduce canopy cover could increase the acres susceptible to weed invasion.

Field inventories for noxious weeds have been conducted. These surveys indicate that at least ten noxious weeds species are currently present on the Helena NF (spotted and diffuse knapweed, ox-eye daisy, Canada thistle, houndstongue, leafy spurge, common tansy, St. Johnswort, Dalmatian toadflax, and sulfur cinquefoil). In addition, one species (musk thistle) has been found, which is currently listed as "noxious" by several counties in the state. This species is also proposed for listing by the State of Montana. The most prevalent of existing weed species is spotted knapweed, which infests over 10,000 acres of the Helena NF (PF-Weed Database). Another species of particular concern, cheatgrass, exists in isolated patches throughout the forest. Weed infestations range from light (less than 10 percent cover) to dense (more than 70 percent cover).

Adjacent states and other areas in Montana have infestations of weeds that have not yet been found on the Helena NF. Weeds on the Montana State or county noxious weed lists known to occur in surrounding counties, but not yet found on the Helena NF, include absinth wormwood, field bindweed, purple loosestrife, hoary cress, perennial pepperweed, orange hawkweed, tall buttercup, and tamarix (Rice 2003).

ECOLOGICAL IMPACTS OF NOXIOUS WEEDS

Noxious weeds alter the structure, organization, and function of ecological systems (Olson 1999a), including soil, plant, and animal relationships (Randall 2000). Spotted knapweed dominance on many open timber and grassland communities may be affecting soil properties such as microbial activity, nutrients and moisture, as well as increasing soil erosion. Native plant composition, diversity, species richness, and litter production are also affected. Changes in plant communities from native to non-native species affect wildlife species that depend on open timber and grassland for forage, breeding, and nesting habitat. Other noxious weed species are expected to result in similar effects on ecosystem processes. Examples of ecological impacts from spotted knapweed will dominate the following discussion, but this does not preclude the impacts caused by the presence of other species.

SOILS

Noxious weeds affect the structure of ecosystems by altering soil properties. Soil in areas dominated by noxious weeds may have lower amounts of organic matter and available nitrogen than areas supporting native grasslands (Olson 1999a). Organic matter can be affected in various ways. For example spotted knapweed has a deep taproot, which tends to decompose more slowly than the fine roots of native grasses, reducing the annual input of organic matter into the soil (Olson 1999a). Biologically active organic matter occurs within the top one to four inches of soil and may be more prone to loss even during minor run-off events. A study conducted by Montana State University (Lacey *et al.* 1989) found runoff was 56 percent higher and sediment yield was 192 percent higher on spotted knapweed plots compared to sites dominated by native bunchgrass.

Soil nutrient levels may be affected by the presence of noxious weeds. For example, potassium, nitrogen, and phosphorous levels were 44 percent, 62 percent, and 88 percent lower on soils from a spotted knapweed-infested site than from adjacent soils with a grass overstory in a study conducted by Harvey and Nowierski (Olson 1999a). Plants that reduce soil nutrient availability to very low levels have a competitive advantage over neighboring plants (Olson 1999a).

Soil micro-organisms can either benefit or be adversely affected by the presence of secondary compounds produced by some weedy species. Most microbial populations adapt to secondary compounds by increasing their populations, thereby increasing the rate of breakdown of secondary compounds (Olson 1999a). Conversely, these secondary compounds may limit activity and growth of aerobic soil microbial populations, resulting in thick litter layers and slowed nutrient cycling (Olson 1999a).

Soil moisture can also be altered by the presence of taprooted weedy species. Taprooted forbs may reduce infiltration because they do not have the dense, fine root systems of grasses, which contribute organic matter and enhance soil structure (Olson 1999a). Infested sites may also have more extreme temperature changes because of lower soil water content, poorer soil aggregation, and greater exposure of soil to direct sunlight (Olson 1999a). Water has a very high capacity to store heat. By reducing soil water content in surface soils, greater evaporation enhances rapid heating and cooling of near-surface layers. This will increase runoff but lower infiltration, again reducing thermal conductivity and capacity of the soil, causing greater temperature extremes at the soil surface (Olson 1999a).

NATIVE PLANT COMMUNITIES

Noxious weeds have a variety of mechanisms giving them a competitive advantage over native species. Noxious weeds can contain compounds that suppress other plants, produce abundant seed, establish and spread in a wide range of habitats, have fast growth rates, grow before native species initiate growth, exploit water and nutrients, have no natural enemies, and are often avoided by large herbivores. Once established, non-native plants threaten biological diversity of native plant communities and can alter ecosystem processes.

As mentioned above spotted knapweed is the most widespread weed species on the Helena NF. Invasion of knapweed into disturbed and undisturbed native bunchgrass communities is well documented (Tyser and Key 1988). As spotted knapweed and other weedy species increase, cover of more desirable but less competitive grasses and forbs is significantly reduced, sometimes as much as 60 to 90 percent (Willard et al. 1988). A study conducted in Glacier National Park reported that spotted knapweed reduced the number and frequency of native species. In addition, seven species classified as "rare" and "uncommon" at the beginning of the study were not present three years later. These results suggested that spotted knapweed alters plant community composition (Tyser and Key 1988).

Cryptogamic ground crust may also be impacted by spotted knapweed. This crust, which is composed of small lichens and mosses and commonly covers undisturbed soil surfaces, is important for soil stabilization, moisture retention, and nitrogen fixation (Rychert and Skujins 1974). Tyser (1992) compared a native fescue grassland site to one invaded by spotted knapweed in Glacier National Park. Results of the study indicated that the cryptogamic ground cover within spotted knapweed infested sites was 96 percent less than the native fescue grassland site.

Cheatgrass is fast becoming a concern because of its reputation for altering fire regimes. Cheatgrass is commonly associated with disturbed areas, such as recently burned rangeland and wildlands, roadsides, and eroded areas. However, cheatgrass also invades communities in the absence of any type of disturbance. Cheatgrass seedlings usually germinate with fall moisture, and the root system continues to develop throughout the winter, producing an extensive root system by springtime. This well-developed root system is ready to exploit available spring moisture and nutrients before native species are able to germinate. Cheatgrass typically dries out and disperses seed by mid-June. The fine structure of the plant and its ability to dry completely, and accumulate litter, make it extremely flammable. Cheatgrass invasion has increased the frequency of fires from once every 60 to 110 years to once every 3 to 5 years on millions of acres of rangeland in the Great Basin (Whisenant 1990). The high frequency of fire has eliminated native shrub communities (Randall 2000). Rapid growth and vigorous reproduction assure cheatgrass dominance.

WILDLIFE HABITAT

The introduction of exotic plants influences wildlife by displacing forage species, modifying habitat structure (such as changing grassland to a forb-dominated community), or changing species interactions within the ecosystem (Asher 1998).

In general, use of spotted knapweed by wildlife and livestock is highest during the spring and early summer when plants are green and actively growing in the rosette and bolt stages (USFS 2002a). Spotted knapweed can have about 18 percent crude protein early in the season, but nutritional value decreases and fiber content increases later in the season (Kelsey and Mihalovich 1987).

Spotted knapweed is not considered good forage, even though the plants can contain high amounts of crude protein. The bitter-tasting sesquiterpene lactone, cnicin, found primarily in the leaves reduces palatability (USFS 2002a). Even though animals may ingest spotted knapweed, the secondary compounds in the forage may affect rumen microbial activity (Olson 1999a), thereby reducing forage intake, or may cause general malaise resulting in aversive post-ingestive feedback (Olson 1999a).

HUMANS

Spotted knapweed has direct and indirect effects on humans. Beekeepers value spotted knapweed because of the quality of honey produced from its flowers. However, the flowers are also pollen sources, which produce positive allergic skin tests and are a significant cause of allergic rhinitis (Olson 1999a). People residing in knapweed-infested areas are treated for a variety of knapweed allergies ranging from skin hives to knapweed-induced asthma attacks. Some individuals are required to carry artificial adrenaline kits and take weekly allergy shots (Olson 1999a).

CHOOSING MANAGEMENT TECHNIQUES

Table 1-1 compares the limitations and effectiveness of weed management methods. Selecting weed management tools is not a choice of one tool over another, but rather selection of a combination of tools that would be most effective on the target species for a particular location. Effectiveness and applicability of each tool depends on weed biology and ecology, location, and size of the infestation, environmental factors, management objectives, and costs.

PROJECT AREA

The Helena NF encompasses approximately 975,000 acres in central Montana within Lewis and Clark, Powell, Jefferson, Broadwater, and Meagher Counties. The project area consists of National Forest System land within the boundaries of the Helena NF (**Figure 1-1**). Proposed treatments would occur throughout the Forest, on National Forest System lands.

TABLE 1-1
Comparison of Weed Management Methods

Methods	Limitations	General Effectiveness[1]
Grazing animals	Treatment must occur during proper phonological stage; herding required; non-selective; can reduce forage available for big game; ground disturbance; may increase spread.	Low
Mowing	Limited to level and gently sloping smooth-surfaced terrain; must be conducted for several consecutive years; treatment timing critical; impact on non-target vegetation	Very low
Hand-pulling/ grubbing	Labor intensive; not effective on deep-rooted or rhizomatous perennials; causes ground disturbance which may increase susceptibility of site to reinvasion by weeds; effective on single plants or small, low-density infestation	High for small infestations of tap-rooted weeds; low for high-density infestation >1 acres or rhizomatous perennials
Parasites, predators and pathogens	Often too selective; does not achieve eradication; cannot be used on weeds closely related to beneficial plants; long-term results only; may be ineffective without being integrated with other strategies.	High to very low depending on management agent and weed species
Ground application of herbicide	Not cost effective on slopes greater than 40%; must have accessible sites; potential impacts to non-target vegetation; application timing limited based on plant phenology and weather conditions	High
Aerial application of herbicide	Potential impacts to non-target resources; application timing limited based on plant phenology and weather condition	High

[1] Percent of target species killed in a treatment area: High = 75-100%, Moderate = 46-75%, Low = 24-46%, Very Low = 0-24%

The Project Area has been divided into four "Landscape Areas" (LA) for display and discussion purposes. These include Belts/Dry Range, Elkhorns, Blackfoot, and Continental Divide.

REGULATORY DIRECTION

Activities on the Helena NF are governed by the Helena NF Forest Plan (Forest Plan)(USFS 1986). To implement the Forest Plan and meet more recent direction, the Helena NF must develop a weed treatment program that incorporates federal, state, and county direction and regulations. An aggressive and effective weed treatment program is directed by the Forest Plan and agency objectives for biodiversity, health, and human safety, responsibility to neighboring land, and consistency with Federal and state laws.

FOREST PLAN

The Forest Plan (FP) sets forest-wide standards for resource management. The following standards apply to weed and vegetation management:

NOXIOUS WEED CONTROL

- Implement an integrated weed control program in cooperation with the state of Montana and County Weed Boards to confine present infestations and prevent establishment of new areas of noxious weeds. Noxious weeds are listed in the Montana Weed Law and designated by County Weed Boards (FP page II/22);

- Integrated Pest Management, which uses chemical, biological, and mechanical methods, will be the principal control method. Spot herbicide treatment will be emphasized. Biological control methods will be considered as they become available (FP page II/22).

- Management Areas are included in the Forest Plan and contain specific management direction to achieve Forest-wide goals, objectives, and standards. The Proposed Action and alternatives would occur on all management area allocations identified in the Forest Plan. Some Management Areas limit noxious weed treatment methods as proposed, particularly when chemical control can be justified (for wildlife forage improvement), where grazing is allowed (some restricted areas), and use of motorized vehicles (some restricted areas).

WILDERNESS AREAS

Wilderness area direction in the Forest Plan (FP pages III/56 and III/66) states that a management goal of wilderness is to "maintain plants and animals indigenous to the area by protecting the natural dynamic equilibrium associated with natural, complete ecosystems."

INLAND NATIVE FISH STRATEGY

One of the riparian goals stated in the strategy (USFS 1995a) is to maintain or restore:

- Diversity and productivity of native and desired non-native plant communities in riparian zones;
- Riparian vegetation to help achieve rates of surface erosion, bank erosion, and channel migration characteristics of those under which the communities developed; and
- Habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities.

FOREST SERVICE MANUALS (FSM)

FSM 2259.03

This manual directs the Forest Service to control noxious weeds and cooperate fully with state, county, and Federal officials in implementing 36 CFR 222.8 (see below) and the Carlson-Foley Act. Noxious weed management should be directed where it will be most effective in preventing or reducing spread of noxious weeds considered to be the greatest threat to economic, environmental, social, and other values.

FSM - 2080 – NOXIOUS WEED MANAGEMENT

The Forest Service Manual states as its objective to use an integrated weed management approach to control and contain the spread of noxious weeds on NFS land and to adjacent land. It further states: where funds and other resources do not permit undertaking all desired measures, address and schedule noxious weed prevention and control:

1. First Priority: Prevent introduction of new invaders;
2. Second Priority: Conduct early treatment of new infestations; and
3. Third Priority: Contain and control established infestations.

OTHER STATE AND FEDERAL REGULATIONS

- Code of Federal Regulations - 36 CFR 222.8. This regulation directs the Forest Service to cooperate with local weed control districts to analyze and develop noxious weed control programs.
- Executive Order 13112. The purpose and need is directed by Executive Order 13112 (signed in 1999) to prevent introduction of invasive species and provide for their control and minimize economic, ecological, and human health impacts that invasive species cause. Specifically, it is ordered that Federal agencies "subject to the availability of appropriations, and within Administration budgetary limits...detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner..."
- The Federal Noxious Weed Act of 1974 (PL 93-629) authorizes the Secretary of Agriculture to cooperate with other agencies to control and prevent noxious weeds.
- Montana Weed Management Plan. The Montana Weed Management Plan was written to strengthen, support, and coordinate private, county, state, and Federal weed management efforts, and promote implementation of ecologically based integrated weed management programs (pg 1). It establishes the same priority for treatment as FSM 2080.

- Montana County Noxious Weed Control Act of 1948, amended in 1991 (MCA 7-22-2101). This act provides for designation of noxious weeds and directs control efforts. Provisions are made for registration of pesticides, licensing of distributors and applicators, and enforcement of State statutes. An enforcement responsibility for control of noxious weeds within Montana is delegated to county commissioners through district weed management boards.

PURPOSE AND NEED FOR ACTION

Damage from noxious weeds is increasing due to their expanding populations and distribution of weeds will continue to increase if action is not taken to control their spread. Noxious weeds can crowd out native plants and diminish the productivity, bio-diversity, and appearance of land.

Although only a small portion (approximately 23,000 acres) of the Helena NF is now infested with weeds, results of uncontrolled weed spread are well documented (Sheley *et al.* 1999). Infested acres continue to increase because all identified infestations cannot be effectively treated under the existing program. Acres on the Helena NF mapped as high risk for weed invasion are displayed in the **Table 1-2**. The information shows that relatively few acres at high risk for infestation are currently infested. An aggressive treatment program when weed infestations are small is most effective.

Ongoing inventory and monitoring shows that there is a need to:

- Control Noxious Weeds - New weed species are coming into the Helena area from all directions with potential for new weed species to move in and spread. Adjacent states and other areas in Montana already have infestations of weeds that have not yet arrived on the Helena NF. New invaders need to be treated aggressively to limit establishment of new weed populations.
- Treat Weeds on Rangeland - A healthy rangeland provides high quality forage for native herbivores and domestic livestock as well as providing cover and foraging habitat for many small animals and birds. Establishment of weeds reduces forage production, which can result in reduced wildlife numbers (Duncan 1997). Rangeland with a good cover of native vegetation holds the soil, reducing erosion from runoff. Soil erosion from a weed-dominated site may contribute sediment to waterways (Lacey *et al.* 1989), which can decrease productivity of a stream by reducing availability of aquatic habitats.
- Treat Weeds in Burned Areas - Large wildfires on the Helena NF thousands of acres including both rangeland and timber. Other previous fire areas such as the Scapegoat fire (1988), Warm Springs fire (1988), and the

TABLE 1-2
Acres of High Risk

Landscape/ Weed	Acres at High Risk	Infested Acres at High Risk	% Not Infested
Belts/Dry Range LA			
Spotted Knapweed	167734	1522	99.09%
Canada Thistle	1521	24	98.42%
Leafy Spurge	167742	584	99.65%
Dalmatian Toadflax	144344	2363	98.36%
Elkhorn LA			
Spotted Knapweed	50250	611	98.78%
Canada Thistle	917	34	96.31%
Leafy Spurge	50562	2	100.00 %
Dalmatian Toadflax	44277	342	99.23%
Sulfur Cinquefoil	41957	6	99.99%
Blackfoot LA			
Spotted Knapweed	26476	827	96.88%
Canada Thistle	276	2	99.28%
Leafy Spurge	27523	1	100.00 %
Dalmatian Toadflax	21098	12	99.94%
Continental Divide LA			
Spotted Knapweed	50824	977	98.08%
Canada Thistle	887	22	97.52%
Leafy Spurge	51621	222	99.57%
Dalmatian Toadflax	45748	834	98.18%
Sulfur Cinquefoil	45012	171	99.62%

Source: PF-Weed Risk Assessment.

North Hills Fire (1984) have experienced weed spread. Susceptibility of burned areas to new weed invasion is increased due to decreased canopy cover and increased bare ground (Goodwin and Sheley 2001). Nearby weed infestations are poised to invade burned areas if management measures are not taken.

- Treat Weeds in Remote Areas - Large weed infestations continue to expand on the Helena NF because of arduous access for equipment and personnel, creating difficult and sometimes unsafe working conditions. As a result, about 6,800 acres of the total infested acres are not currently being treated. Weed infestations have expanded in some inaccessible areas over the last decade; while weed populations in accessible areas, such as roads, have shown decreases due to consistent treatment measures. Cost-effective and safe methods are needed to control spread of weeds in these areas.

PROPOSED ACTION

The Helena NF proposes to implement an aggressive noxious weed control program, which includes aerial application of water-soluble herbicides, increased ground application of water-soluble herbicides, and increasing biological and mechanical control efforts through use of insects and grazing. All of these methods would become part of the Helena NF's integrated weed management program. Esther/fat soluble herbicides will not be used.

The project would be implemented over a 12-year period. Not all acres would be treated in the first year, but some areas would be treated repeatedly on a 2 or 3-year rotation to ensure effective control, as part of a "maintenance mode of action." Follow-up maintenance treatments are expected to require reduced amounts of herbicide from initial application. Maintenance treatments may be ground based, but in some cases, a second or third aerial treatment may be required. See description of *Alternative A* in Chapter 2 for more detail. Monitoring would identify areas that would need to be re-treated or if treatment areas can be reduced, based on effectiveness of previous treatments. **Table 1-3** shows proposed weed spray acres by Landscape Areas. Maps are located at the end of Chapter 2.

This project is part of the Helena NF's effort to implement integrated weed management. The purpose of the project is to implement the Forest Plan and expand implementation of the "managing weed infestation" portion of integrated weed management. Treatments are proposed for

TABLE 1-3
Alternative A Weed Treatment by Landscape Area

Treatment Acres	Weeds of Concern	Proposed treatments
Belts/Dry Range		
9,903 (5817 aerial) (1330 grazing*)	Spotted, diffuse and Russian knapweed, Dalmatian toadflax, leafy spurge, musk thistle and Canada thistle	Ground and aerial chemical treatment, biocontrols, grazing, mechanical
Elkhorns		
1,792 (710 aerial)	Spotted and diffuse knapweed, Dalmatian and common toadflax, leafy spurge, hounds tongue, musk thistle and Canada thistle	Ground and aerial chemical treatment, biocontrols, mechanical
Blackfoot		
5,328 (2,895 aerial)	Spotted knapweed, St Johnswort, musk thistle and Canada thistle	Ground and aerial chemical treatment, biocontrols, mechanical
Continental Divide		
5,645 (1664 aerial) (26 grazing*)	Spotted knapweed, musk thistle and Canada thistle, common toadflax, Dalmatian toadflax, and leafy spurge	Ground and aerial chemical treatment, biocontrols, grazing, mechanical

Note: *Grazing occurs on acres counted in "ground" application.

reducing growth or reproduction of existing noxious weed plants. Prevention methods are ongoing and those currently in use on the Helena NF are described in more detail in Chapter 2.

SCOPE OF THE DECISION

Geographic Scope

Figure 1-1 shows the geographic scope of the Proposed Action. Treatments would occur on NFS land within the Helena NF only, however, the number of acres treated would change with the Adaptive Management Strategy. For each resource, an analysis area was determined that could be used to adequately measure cumulative effects of the proposed alternatives.

Temporal Scope

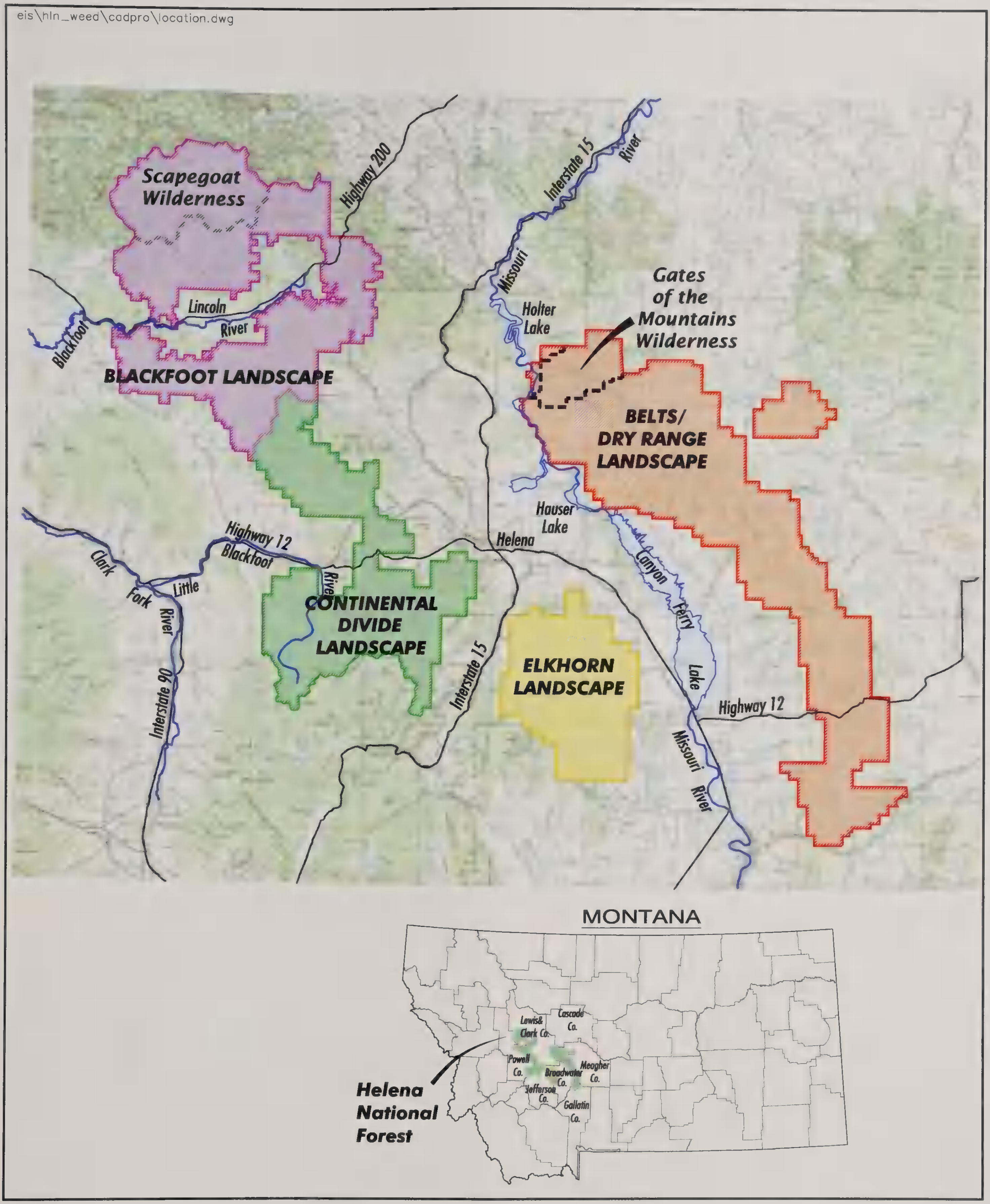
The timeframe for project implementation is 12 years. Direct, indirect, and cumulative effects, if any, would occur during that period. For cumulative effects analysis, an additional 10 years past the final implementation year is considered. In some cases, longer-term effects are discussed.

Decision Framework

Based on the environmental analysis and public comments, the Helena NF will decide:

- Where treatments would occur;
- Which treatment methods would be used;
- Which mitigation and monitoring measures (if any) would be required; and
- Whether to include an adaptive approach to address future spread of existing infestations.
- Whether to amend the Forest Plan.

The scope of the project is confined to issues and potential environmental consequences relevant to the decision being made. Reconsideration of other existing project level weed management decisions is beyond the scope of this document.



From USGS 250,000 Helena Quad

N

0 Miles 15

Project Area
Noxious Weed Treatment Project
Helena National Forest
FIGURE 1-1

CHAPTER 2 ALTERNATIVES

CHANGES BETWEEN THE DRAFT AND FINAL EIS

Main changes in Chapter 2 include:

- Under *Alternatives Not Studied in Detail*: updated discussion of the "No Chemical Treatment" alternative; clarified the "True" No Action alternative; Inter Disciplinary Team evaluated a "Prevention Only" alternative and made the determination to add it to the alternatives not studied in detail section of the EIS
- Reorganized the discussion of Alternative C and Features Common to All Alternatives for clarity.
- Discussion of the Forest Service Northern Region (R1) weed risk assessment was added for Alternatives A and B.
- Numbered the Environmental Protection Measures in Table 2-4 to allow clearer referencing and added a "Grazing" category.
- Environmental Protection Measures (EPMs) # 15 and #16 were added at the request of the Bureau of Reclamation, EPM #29 was added for protection of amphibians in riparian buffers, EPM #34 was added to address utilization standards for grazing animals used in weed control, language was added to EPM #44 to provide protection near wolf den or rendezvous sites, EPM #47 was added to restrict activities near peregrine falcon eyries.
- Expanded the water quality monitoring discussion to: list specific watersheds to be monitored; add monitoring of ground water at selected wells; clarify the timing and intensity of monitoring; and, add monitoring in the event of a spill.

INTRODUCTION

This chapter contains information, including management practices and mitigation measures, relative to the Action and No Action Alternatives. Chapter 2 also provides the documentation on how the alternatives were developed and the reasons for excluding some alternative from detailed analysis. A comparison of the alternatives can be found at the end of the chapter.

PUBLIC INVOLVEMENT PROCESS

A public scoping letter was sent to interested citizens on December 7, 2001 asking for comments on the Helena NF Noxious Weed Control proposal. A Notice of Intent to prepare an EIS on the proposal was published in the Federal Register on February 20, 2002. Publication of this notice initiated a public scoping period through June 1, 2002. In total, written comments were received from 11 individuals and 10 organizations or agencies during the scoping period.

Comments received during scoping were categorized by issue. The categories include Significant Issues, Concerns, and Issues and Alternatives Not Studied in Detail. Also included in the comment categories are those suggestions for mitigation and monitoring. Significant issues were used to develop alternatives to the Proposed Action. Concerns were used to help define the scope of analysis and to develop Environmental Protection Measures (EPMs). Issues and alternatives that were not studied in detail along with the rationale for dismissing them from detailed review are described. This section includes issues that were considered outside the scope of the EIS. Suggestions for mitigation and monitoring were included in at least one of the alternatives, unless impractical. A detailed analysis of the comments and how they were used is in the project file (PF - *Scoping Issues*).

A Draft Environmental Impact Statement (DEIS) was published in October, 2003. A Notice of Availability appeared in the Federal Register on October 17, 2003, initiating a 45-day comment period. The Comment Period closed on December 1, 2003. Details of public involvement during the DEIS comment period are provided at the beginning of Chapter 7. Written comments were received from 4 individuals and 5 organizations or agencies during the comment period. These letters, along with the agency's response to specific comments, are presented in Chapter 7.

In 2004, following the agency's review of comments to the DEIS, and preparation of Chapter 7, work on a Final Environmental Impact Statement (FEIS) was begun. Changes were incorporated to address public comments, correct typographic errors, and incorporate updated information. Release of a FEIS was put on hold pending completion of some other Forest priority work activities. Late in 2005, the Forest again began work on the FEIS. An interdisciplinary team reviewed the existing analysis and supporting documentation. They reviewed updated information, performed additional literature searches, and evaluated any changes in information or conditions since the DEIS. The FEIS content was updated based on further review of public comments, identified data gaps, and current literature.

SIGNIFICANT ISSUES

Comments from the public and Helena NF members were used to determine issues of concern that could result from implementing the Proposed Action. The following issue was considered to be significant, because there is no way to resolve the conflict within the confines of the Proposed Action. The best way to address it is through development of a new alternative. An "Issue Indicator" is specified which is a statement of how the effects will be measured in the "Summary Comparison of Alternatives" section at the end of this chapter.

POTENTIAL EFFECTS ON HUMAN HEALTH, NON-TARGET VEGETATION, AND WILDLIFE FROM AERIAL APPLICATION

Comments during scoping indicated there is a perception that, regardless of the required Environmental Protection Measures (EPM) designed to minimize unintended herbicide exposure, aerial application may cause herbicides to be deposited in unintended locations and affect non-target species. This issue is addressed through development of Alternative B, which contains no aerial application of herbicides. Under Alternative B, all weed treatments would be conducted using ground application of herbicides, biocontrol methods, livestock grazing, or mechanical treatment. In some areas, due to worker safety and effectiveness of available control methods, no treatment would occur.

Issue Indicator

Acres of aerial herbicide application (total) will be used to indicate differences between alternatives.

CONCERNS

Other concerns were expressed which were not used to develop alternatives (non-significant issues), because within the confines of the Proposed Action, EPMs were developed to reduce the perceived conflict. These concerns are analyzed in Chapter 4. These concerns include:

- Effects of weed treatment on water quality, groundwater, and fisheries;
- Effects of weed treatment on native grasses, forbs, shrubs, and trees;
- Effects of weed treatment on wildlife;
- Cost of proposed treatments for the initial treatments and retreatments;
- Effects on human health from herbicide use;
- Effects of weed treatment on insects;
- Effects of weed treatment on recreationists and adjacent landowners;

- Effects of weed treatment on wilderness, inventoried roadless areas, research natural areas, and unroaded areas;
- Effects of weed treatment on sensitive areas and important ecological communities;
- Effects of herbicide use on soil;
- Weed treatment effectiveness; and
- Effects of noxious weeds on other resources, such as vegetation, wildlife, fish, wilderness, and recreation.

ISSUES AND ALTERNATIVES NOT STUDIED IN DETAIL

Comments were received suggesting that other plans of action be considered. Alternatives derived from these issues were either outside the scope of the analysis or did not meet the Purpose and Need. Some issues, such as actions to address the existence of noxious weeds on adjacent privately owned land, and their disposition can be found in the project file (PF-*Scoping Issues*).

Aerial applications should not take place in areas anywhere near (at least ¼ of a mile away from) water or private land and should not include any restricted use herbicides

Various buffer widths for herbicide application areas were considered. This alternative was not considered in detail because buffer areas proposed for aerial spraying have already been determined to be effective through past monitoring to prevent drift to water and private land on the Lolo National Forest (PF-*Aquatics*). Not using restricted herbicides in aerial applications was not considered in detail because restricted herbicides would be used safely when applied carefully and in accordance with herbicide labels as proposed.

Develop an alternative that does not include chemical treatments

Some people believe herbicides may present a risk to people, animals, and native plants. Although herbicides proposed for weed control in the Proposed Action have gone through rigorous scientific testing and government approval, some people perceive use of these herbicides as unsafe. An alternative that did not use chemical treatments was not considered in detail because, for many of the most troublesome noxious weeds, other methods are not effective, or are not feasible. For example, because of its physical characteristics, pulling, digging, and mowing are not effective treatments for Dalmatian toadflax (Lajeunesse *et al.* n.d.), one of the most common weeds. The rhizomatous root systems cause re-sprouting after pulling or digging, requiring repeated treatments for up to 15 years. Mowing tends to spread the seed and reduces competition from native vegetation.

Another example is knapweed, where infestations are so large that pulling and digging could not reasonably be accomplished. Hand-pulling is labor intensive and only suitable for small infestations (Lacey *et al.* 1995). Given the availability and cost of labor combined with slow rates of accomplishment, not enough acres could be treated annually to address the Purpose and Need. Mowing is not physically possible in many areas. Knapweed and toadflax make up 80 percent of known weed infestations (PF-*Weed Database*). Also, effective biocontrol agents are not currently available to target some noxious weed species.

The Forest reviewed and considered several documents that fully analyzed a "no herbicide" alternative, including the Gallatin National Forest Noxious and Invasive Weed Control Environmental Impact Statement (EIS) (USFS 2005b) and Record of Decision (ROD) (USFS 2005b), the Beaverhead-Deerlodge Noxious Weed Control Program Final EIS and ROD (USFS 2002a), the Lolo National Forest Big Game Winter Range and Burned Area Weed Management FEIS and ROD (USFS 2001a), and the Bureau of Land Management's 1991 Vegetation Treatment on BLM Lands in Thirteen Western States (USBLM 1991). In all cases, findings indicated that the alternative would only minimally meet the need for weed management and, therefore, would not meet federal and state laws and executive orders (EIS, pages 1-4 through 1-6). In the case of Forest Service decisions, the "no herbicide" alternative did not comply with the agency's Integrated Pest

Management program and is not consistent with the policy that noxious weeds and their adverse effects be managed on National Forests. Decisions noted that such an alternative would allow the Forest to cooperate only to a very limited extent with county and state agencies and private landowners interested in managing invasive weeds. Based on interdisciplinary team (IDT) discussion and evaluation of these other analyses, it was determined that an alternative that does not include herbicide treatments would not be studied in detail.

Aerial spray weeds in wilderness areas

This alternative was suggested with the rationale that aerial spraying would be considered a "minimum impact tool" for weed treatment in wilderness areas. This alternative was not considered in detail because at the present time, weed treatment areas in wilderness are in small, isolated patches; aerial treatment would not meet Forest Plan standards for wilderness; and it would not comply with wilderness regulations pertaining to low flying aircraft.

Require lease/permit holders to eradicate noxious weeds on land they use.

This alternative was considered at the suggestion of the public. This alternative was not considered in detail because of complications involved with ensuring that permittees applying herbicides on National Forest System land are licensed to apply herbicide; that lessees would write and submit pesticide use plans for approval as required by Forest Service policy; and ensuring that the correct amount of herbicide, timing of application, and appropriate use of herbicides by permittees was occurring. Although requiring permittees/lease holders to hand pull weeds could be implemented, it would not effectively treat weed in those areas. See *"Develop an alternative that does not include chemical treatments"* above.

Do not treat weeds in wilderness areas.

Some people indicated that weed management within wilderness contradicted the definition of wilderness and therefore weed treatment should not occur. An alternative that would eliminate wilderness area treatments was considered, but not studied in detail because management practices, such as weed treatment that maintains the natural ecosystem in wilderness areas, are allowed (see the effects on wilderness in Chapter 4). Only about 80 acres of weed treatment is proposed in wilderness areas and potential adverse effects on wilderness attributes are not expected.

Develop public volunteer programs using schools, businesses, even prisons, to pull weeds.

This activity already occurs to some degree as part of the Helena NF's integrated weed management strategy. In addition, pulling weeds is not an effective treatment in most instances, but where it is, it is part of the Proposed Action. Another concern is safety of volunteers (allergic reactions, steep terrain, exposure to heat and cold).

Eradicate all weeds, not just new and existing ones.

Eradication of all weeds is an impossible task at this time. Weed seeds last for years, even decades and there are thousands of acres in Montana where no effective weed treatments are planned. It is unlikely that weed establishment in new areas could be completely prevented, given the vectors for transportation and distribution of seeds (water, wind, animals, and humans).

Analyze a "true" no action alternative.

The "No Action" Alternative (*Alternative C*) as described in this EIS is a continuation of the current weed treatment program. The "No Action Alternative" can be described as no change in action (as in this EIS) or no action at all (Council on Environmental Quality's "40 most asked question concerning CEQ's National Environmental Policy Act Regulations" question 3).

A "true" No Action Alternative (the second scenario as described in the previous statement) that has no weed treatment activities and no prevention measures was not studied in detail because it would require eliminating all previously approved treatment plans, would violate state and federal laws and policies, and would not meet the Purpose and Need.

Develop an alternative that includes only measures to prevent weeds

Based on review of other Environmental Impact Statements and associated public comments, there appears to be a question among a portion of the public of why we don't consider a "prevention only" alternative. A "prevention only" alternative was not considered in detail because it would only address the introduction of new weed species and spread of existing infestations into new areas. Without treatment, existing weed populations could not be reduced and weeds would continue to spread by natural dispersal mechanisms (seeds carried by wind, in the fur of animals and the digestive tracts of birds, spreading by creeping – for rhizomatous species). Prevention measures, in the form of education (for forest users and employees) and implementation of activity-specific prevention practices (as outlined in FSM 2081.2 Prevention and Control Measures), are already being used. Prevention is recognized as an important component of integrated pest management but when used alone it would be ineffective and inconsistent with Forest Plan direction and Forest Service policy to manage weeds and their adverse effects on National Forest System lands, and violates federal and state laws and executive orders.

Outside the Scope of the Decision

The following comments, suggestions, and concerns are outside the scope of the decision as described in Chapter 1 based on the Purpose and Need to treat existing and new infestations:

- Preventing weeds from establishing in new areas;
- Eliminating or minimizing human activities that spread weeds;
- Doing a Forest Plan amendment to address all causes of weed spread;
- Filing a complaint about adjacent private property infested with weeds;
- Seeking to establish licensing of off road vehicles (ORVs) and snowmobiles the same as required on full-sized vehicles;
- Limiting use of ORVs;
- Rerouting trails or roads around the infestation to reduce available vectors for spread;
- Considering road construction, closure, and obliteration on existing, ongoing, and planned roads/routes in the project area;
- Limiting snowmobile use to designated routes and play areas; and
- Researching consequences of spray techniques and compounds on wildlife.

A compete analysis of the public input is located in the project file.

ALTERNATIVES CONSIDERED IN DETAIL

ALTERNATIVE A – PROPOSED ACTION

The Helena NF's proposed weed control program includes treatment on four landscape areas totaling approximately 23,000 acres.

Implementation would occur over a 12-year period. Not all acres would be treated in the first year, but some areas would be treated repeatedly on a 2 or 3-year rotation to ensure effective control. Monitoring would be used to determine effectiveness and to identify areas that would need re-treated or if treatment areas could be reduced based on effectiveness of previous treatments. **Table 2-1** shows proposed weed spray and grazing acres by Landscape Area. Maps of these landscape and treatment areas are included at the end of this chapter (**Figure 2-1** through **Figure 2-4**).

Activities described under *Features Common to All Alternatives* and under *Environmental Protection Measures* apply to this alternative. These sections are included in this chapter. This project is part of the Helena NF's effort to implement the treatment portion of integrated weed management.

Weed Risk Assessment

The Forest Service (Northern Region) has developed an approach to evaluate and assess risk to native plant communities in Montana from exotic plant species. This approach involves the determination of a community's susceptibility to invasion, assigns a level of threat to susceptible areas, and evaluates the probability of exposure based on dispersal mechanisms of exotic plants. To date, 23 exotic plant species have been modeled using this regional approach.

The risk assessment will be used to effectively implement the proposed weed treatment program, and to assist with prioritization of existing and new infestations or disturbed area. Prioritization would be based on money available for treatment, infestation size, and level of risk. New invaders would be given highest priority, regardless of the level of risk and location. Prioritization would consider the needs of and effects on other resources. The risk assessment tool would address the level of protection necessary and potential funding sources.

Herbicides

Chemical treatments would include both ground and aerial herbicide applications, in addition to activities described under the No Action Alternative (Alternative C). Environmental Protection Measures (**Table 2-4**) have been designed and included to reduce drift and other potential impacts of aerial application. Chemical applications would take place at the appropriate time of year for targeted weed species and environmental considerations such as proximity to water or residential areas would be adhered to. Equipment such as helicopters, trucks, ATVs, horse, and backpack sprayers would be used. Herbicides proposed for use include: picloram, 2,4-D, clopyralid, dicamba, glyphosate, imazapyr, hexazinone, chlorsulfuron, imazapic, metsulfuron methyl, sulfometuron methyl, and triclopyr. Following the Adaptive Management Strategy, other herbicides permitted by EPA and registered for use by the Montana Department of Agriculture may be used when they become available, if the herbicide is water soluble and less environmentally persistent than Tordon® (picloram). This would occur after interdisciplinary review and line officer approval.

TABLE 2-1
Alternative A Weed Treatment by Landscape Area*

Treatment Acres	Weeds of Concern	Proposed treatments
	Belts/Dry Range	
9,903 (5,817 aerial) (1330 grazing**)	Spotted, diffuse and Russian knapweed, Dalmatian toadflax, leafy spurge, musk thistle and Canada thistle	Ground and aerial chemical treatment, biocontrols, grazing, mechanical
	Elkhorns	
1,792 (710 aerial)	Spotted and diffuse knapweed, Dalmatian and common toadflax, leafy spurge, hounds tongue, musk thistle and Canada thistle	Ground and aerial chemical treatment, biocontrols
	Blackfoot	
5,261 (2,883 aerial)	Spotted knapweed, St Johnswort, musk thistle and Canada thistle	Ground and aerial chemical treatment, biocontrols
	Continental Divide	
5,631 (1,664 aerial) (26 grazing**)	Spotted knapweed, musk thistle, Canada thistle, common toadflax, Dalmatian toadflax and leafy spurge	Ground and aerial chemical treatment, biocontrols, grazing
22,668	Total	

Notes:

* Includes ongoing activities and new treatment areas.

**Grazing occurs on acres counted in "ground" application.

Surfactant adjuvant would be used in certain situations to increase efficacy, primarily on target species with a waxy cuticle (especially toadflax), or when temperature and humidity are not optimal (but still within label and more restrictive locally-prescribed limits) yet other conditions (such as plant phenology) are ideal. Surfactants may be used during periods of drought. Surfactants used would be a silicone-blend type, (including silicone components mixed with non-silicone components such as modified seed oils) such as Phase II®, added to tank mixes. Phase II® would not be used in riparian areas, but other surfactants labeled for aquatic use might be. Surfactant adjuvant would be used following label requirements for both the herbicide and the surfactant products.

Initial treatment in aerial application areas would include ground application to treat areas that were avoided, such as buffers or areas that were skipped. These areas are estimated at 20 percent of the aerial treatment acres. Based on monitoring, follow-up treatments are expected to occur on one to ten percent of the treatment area, in both aerial and ground application areas.

By the third and forth year, portions of the seed that remained in the soil would have germinated, and a plan for treatment similar to the initial aerial or ground treatment, followed by follow-up treatment would be made. Based on monitoring, it is likely the treatment areas would then enter "maintenance mode" where spot treatments of infestations would occur.

Aerial application of herbicides would occur in high-risk fire areas dating back to 1984, big game winter and summer ranges, large infestations, and smaller (2 acres or less) or less dense infestations in remote/rough terrain. These targeted infestations are areas that have received limited or no treatment due to access, terrain, or safety. Environmental Protection Measures (**Table 2-4**) would be required to reduce impacts from aerial application.

Ground applied herbicide treatments would occur in areas where aerial spraying is not practical due to size of infestations, locations, or site conditions. Herbicides would only be applied by ground spraying in designated wilderness, research natural areas, and sensitive areas (such as sensitive plants).

Biological Controls

Existing and newly approved biological controls would be introduced where appropriate.

Grazing

Livestock grazing such as with sheep or goats would occur. Grazing treatments would have herbicide treatments around the perimeter with livestock grazing in the interior. Noxious weeds targeted with grazing include leafy spurge, Dalmatian toadflax, and spotted knapweed.

Grazing for weed control would be done on a contract basis (government pays for the service). Grazing would be high-intensity, short-duration with animals specially conditioned to graze on target weed species. Grazing animals would be intensively herded.

Mechanical Treatment

Mechanical treatment such as hand pulling, mowing, or cultivation would occur on particularly sensitive areas or areas of small or new infestations.

Forest Plan Amendment

As indicated in the February 20, 2002 Notice of Intent to prepare an Environmental Impact Statement (Federal Register, Vol. 67, No. 34 pg 7666) an amendment to the Forest Plan would be included. Appendix X of the Forest Plan currently states, "all weed treatment will be performed by back pack sprayers, use of granules and ground rigs with hand held sprayers" (FP pg X/1). Methods of chemical application would be expanded to include aerial application. Appendix X would be amended to read:

"Emphasis for control of noxious weeds on the Helena National Forest will be under cooperative weed control agreements with the County Weed Boards. As part of the control program, the Forest expects to annually treat weeds where there is a danger of noxious weed infestation. The noxious weed inventory indicates where these areas are located. (Helena Forest noxious weed inventory is available at the Supervisor's Office, file 2240). Weed species to be treated are identified in the Montana State, County Weed Boards', or North American noxious weed lists. According to Integrated Pest Management principles, weed treatment could include mechanical, biological, cultural, or chemical control including aerial (e.g. helicopter or airplane) or ground (e.g. boom truck, ATV, or backpack or handheld sprayer or granule) application."

This amendment is considered non-significant. It is not anticipated to result in changes to the six types of Forest Plan decisions (goals, objectives, management areas and prescriptions, standards and guidelines, monitoring and evaluation, and "lands not suitable" determination) and is consistent with changes deemed not significant as described at FSM 1922.51 and Forest Service Handbook 1909.12, 5.32.

ALTERNATIVE B – NO AERIAL HERBICIDE APPLICATION

Under Alternative B (**Table 2-2**), chemical weed treatments would include ground herbicide applications, in addition to the ongoing activities described under the No Action Alternative (*Alternative C*). Approximately 19,000 acres would be treated under Alternative B. Many acres proposed for aerial application would be treated through ground application, but some acres would not be treated at all due to remoteness, steepness of terrain, cost, or safety. Mechanical, biological, and grazing treatments would occur as described in Alternative A. **Figures 2-5** through **2-8** are maps of proposed treatment areas under Alternative B.

Activities described under *Features Common to All Alternatives*, under *Environmental Protection Measures* (**Table 2-4**), in the *Adaptive Management Strategy* (except no aerial treatment) and *Monitoring* below apply to this alternative.

Weed Risk Assessment

The weed risk assessment described under Alternative A would apply to this alternatve.

Forest Plan Amendment

Alternative B would not require an amendment to the Forest Plan.

ALTERNATIVE C – NO ADDITIONAL WEED TREATMENT

This alternative is the No-Action Alternative (**Table 2-3**). Current activities would continue as planned (see *Ongoing Weed Treatment, Prevention, and Education Program* below) with approximately 16,000 acres treated. Some measures under

TABLE 2-2
Alternative B Weed Treatment by Landscape Area*

Treatment Acres	Weeds of Concern	Proposed treatments
	Belts/Dry Range LA	
7,917 (1330 grazing**)	Spotted, diffuse and Russian knapweed, Dalmatian toadflax, leafy spurge, musk thistle and Canada thistle	Ground chemical treatment, biocontrols, grazing, mechanical
	Elkhorns LA	
1,756	Spotted and diffuse knapweed, Dalmatian and common toadflax, leafy spurge, hounds tongue, musk thistle and Canada thistle	Ground chemical treatment, biocontrols
	Blackfoot LA	
3,938	Spotted knapweed, St Johnswort, musk thistle and Canada thistle	Ground chemical treatment, biocontrols
	Continental Divide LA	
5,302 (26 grazing**)	Spotted knapweed, musk thistle, Canada thistle, common toadflax, Dalmatian toadflax and leafy spurge	Ground chemical treatment, biocontrols, grazing
18,913	**Total**	

Notes:

* Includes ongoing activities and new treatment areas.
**Grazing occurs on acres counted in "ground" application.

TABLE 2-3 Alternative C - Weed Treatment by Landscape Area		
Treatment Acres	**Weeds of Concern**	**Current Planned Treatments**
Belts/Dry Range LA		
7,240	Spotted, diffuse and Russian knapweed, Dalmatian toadflax, leafy spurge, musk thistle and Canada thistle	Ground chemical treatment, biocontrols, mechanical
Elkhorns LA		
1,473	Spotted and diffuse knapweed, Dalmatian and common toadflax, leafy spurge, hounds tongue, musk thistle and Canada thistle	Ground chemical treatment, bio controls, mechanical
Blackfoot LA		
2,918	Spotted knapweed, St. Johnswort, musk thistle and Canada thistle	Ground chemical treatment, biocontrols, mechanical
Continental Divide LA		
4,240	Spotted knapweed, musk thistle and Canada thistle, common toadflax, Dalmatian toadflax and leafy spurge	Ground chemical treatment, biocontrols, mechanical
15,871	**Total**	

Environmental Protection Measures (**Table 2-4**) are part of the current program and would also apply to Alternative C. No additional herbicide treatments would occur in wilderness areas. Maps of the landscape and treatment areas are attached (**Figure 2-9** through **Figure 2-12**).

Forest Plan Amendment

This alternative would not require a Forest Plan amendment.

ONGOING WEED TREATMENT PROGRAM

CONTROL

Over the last six years, the Helena NF noxious weed control program has focused on reducing weed populations within major travel corridors. As a result, Forest Service personnel, external agencies, and the public have noticed a decrease in weeds along travel routes and elsewhere.

The existing Helena NF weed control program consists of a Forest-wide approach with emphasis placed on Fire Restoration areas of 2000. The elevated concern about existing weed spread and new invaders becoming established has resulted in an intensified effort in the Integrated Pest Management Program consisting of: prevention, education, biological control, herbicide control, mechanical control, and monitoring. Since the fires of 2000, increases in program accomplishments have been made, particularly in prevention, education, biological control, herbicide control, and monitoring. Weed treatments (biological and herbicide) have occurred on approximately 10,000 acres annually, while inventory and monitoring efforts have occurred on all blackened area within fire perimeters.

Typically, the Helena NF noxious weed appropriations average around $270,000 annually, while fire restoration budgets and grant money available in the Elkhorn Mountains has increased the weed program to nearly $1.8 million. Funding comes from Forest Service appropriated funds and fire restoration funds, along with several grants and agreements with Montana State Trust Funds, Rocky Mountain Elk Foundation, Sikes Act, Mule Deer Foundation, and the Foundation for North American Wild Sheep. Restoration money is used to control existing weed populations, inventory blackened areas, and treat new invaders and new populations. Current restoration planning encompassed a five-year program (beginning in 2000); however, future revenue for restoration work is unlikely. When developing a weed control project, cost and efficiency, along with likely available funding, and the amount of area needing treatment must be considered.

Recent specialized equipment purchases have allowed the Helena NF to expand treatment into more difficult terrain. The public has become more aware of this expansion of herbicide application as a result of seeing equipment tracks visible on steep open hillsides.

This program has generated a greater need for posting signs in response to public comments.

The Helena NF has established a goal of reducing weed population densities by 70 percent Forest-wide between 2000 and 2015. Achieving this goal is dependent on the availability of funding and providing available tools are used. Monitoring plots established in areas treated with the latest equipment indicate at least 70 percent reduction in density with herbicide treatments.

Herbicide Control

The Helena NF strategy has changed from a few years ago, when all roads were high priority for treatment. Aggressive treatment of all roads and trailheads (consisting of approximately 371 miles of infested roads and trailheads, totaling about 3,600 acres) over the past five years has decreased weed populations in these areas (PF-*Weed Database*). This success required a shift in strategy to continue with a maintenance level program that consists of spot treatments along roads and trailheads, while expanding treatment onto rangeland and timber harvest units outside road corridors.

This expansion of treatment required purchase of equipment that can access difficult terrain. Currently, land located off of road corridors with slopes less than 35 percent is targeted for treatment, which has enabled treating approximately 2,500 to 3,500 additional acres with herbicides each year using water-soluble formulations of picloram, 2,4-D, glyphosate and dicamba.

The fires of 2000 and completion of the Burned Area Emergency Rehabilitation Project allowed treatment to expand to approximately 5,000 acres in 2001, 2002, and 2003. This program incorporated use of chlorsulfuron, metsulfuron methyl and clopyralid herbicides. Chlorsulfuron has proven to be very effective in control of Dalmatian toadflax, while being more selective and not harming desirable native vegetation.

Three sites within the Scapegoat Wilderness infested with spotted knapweed and Canada thistle have been periodically treated with 2,4-D and picloram. Trailheads and wilderness boundaries are focus points for treatment; however, locations such as the Big Log area that burned in 1984 (North Hills Fire) have experienced spread of leafy spurge and Dalmatian toadflax toward the Gates of the Mountains Wilderness. Trees blown down in this area prevents access with ground-based spray equipment and makes these areas unsafe for backpack or horsepack operations.

Biocontrol

The Helena NF biological control program has expanded over the past three years. Leafy spurge, Dalmatian toadflax, spotted knapweed, and musk thistle are the primary species selected for biological insect releases. All insect release sites are mapped using a Global Positioning System (GPS). Selection of these species is based on accessibility and treatment effectiveness. Due to the success with the *Apthonia ssp.* flea beetle on leafy spurge, efforts have been concentrated on a large-scale release program targeting large or remote infestations of leafy spurge. Over two million *Apthonia* insects have been released over the last three years (PF-*Weed Database*). Insectary monitoring indicates that if site conditions favor survival of the insect, reduced weed populations can be observed within five years. To date, 104 releases have occurred on approximately 3,734 acres of leafy spurge, Dalmatian toadflax, spotted knapweed, and musk thistle.

Mechanical Control

In the past, hand-pulling has been implemented in conjunction with light applications of herbicide to control spotted knapweed and common burdock within the Gates of the Mountains picnic areas and along isolated sections of selected riparian areas. Hand-pulling as the sole method of eradicating weeds appears to be ineffective due to long-term viability of seed in the soil, some of which remain for 10 years; however, combining hand-pulling with light applications of herbicides has reduced spotted knapweed and common burdock infestations to a maintenance level requiring only annual spot treatments (PF-*Monitoring*). Hand-pulling weeds has been coordinated with volunteers and high school students for the past three years.

FEATURES COMMON TO ALL ALTERNATIVES

Prevention and Education

Prevention and education work together to reduce the spread and introduction of noxious weeds.

The current prevention program places emphasis on limiting introduction, establishment, and spread of noxious weeds by implementing many techniques. Techniques include:

- Limiting weed seed dispersal from major routes;
- Attempting to contain neighboring weed infestations;
- Minimizing soil disturbance;
- Signing trailheads and requiring weed seed free forage for backcountry users;
- Properly managing forage based on condition class of the vegetative community; and
- Implementing Best Management Practices (BMPs) that include washing of all vehicles when moving into a new area.

Region 1 of the Forest Service has prepared a comprehensive guide to Noxious Weed Prevention Practices (see **Appendix E**) for use in planning forest and wildland resource management activities and operations. This guide assists managers and cooperators in identifying weed prevention practices that mitigate identified risks associated with weed introduction and spread.

Public education and weed prevention programs are used to deter establishment of "new invader" species. Public education programs on noxious weeds have been active since 1990, and noxious weed awareness information is readily available to visitors. Several noxious weed programs are presented annually throughout the Helena valley for educational purposes. Programs include staffing public information booths at fairs in cooperation with local counties and BLM representatives, giving presentations at local schools and local community group meetings, and organizing public spray days with community residences adjacent to the Helena NF. These programs have helped raise public awareness about noxious weeds, which in turn, is believed to have reduced the establishment of new weeds, and limited spread of existing weed infestations on private and Helena NF land.

Monitoring

The weed monitoring program has expanded over the past three years. All known weed infestations are currently mapped through use of a Geographic Information System (GIS). The current monitoring program has identified and mapped approximately 70 permanent plots where the following are measured: 1) density and rate of spread of Dalmatian toadflax; 2) effects of aggressive plant species on natural resources; 3) effects of herbicides on noxious weeds and non-target vegetation; 4) coverage application of herbicides; and 5) effectiveness of biological control agents.

Cooperative monitoring is ongoing with Rocky Mountain Research Station (RMRS) in Missoula and Bozeman, as well as, with Montana State University, University of Montana, and several federal and state agencies.

Four ongoing studies in place include: 1) Fire Weed Monitoring by Steve Sutherland, Research Ecologist, Fire Sciences Laboratory, RMRS; 2) The Efficacy and Non-target Impact of Post Burn Herbicide Applications by Sharlene Sing, RMRS in Bozeman; 3) The Evaluation of *Mecinus janthinus* On The Control of Dalmation Toadflax; and 4) Herbicide Effectiveness on Dalmatian toadflax following Prescribed Fire by Helena Ranger District, Helena National Forest. Preliminary findings can be found in the project file.

The Forest is currently utilizing the preliminary findings from these studies, and cross referencing these positive results with studies researched in the Fire Effects Information System (FEIS) to stay current with monitoring research findings abroad. The Forest has recently reviewed the study titled, Stabilization of Plant Communities After Integrated Picloram and Fire Treatments, by Peter Rice and Michael Harrington from the Rocky Mountain

Research Station (RMRS), Fire Science Laboratory. The Forest agrees with much of their findings; however, we have chosen to utilize information that is more specific to our conditions. For additional information, see the Project File and the Fire Effects Information System (http://www.fs.fed.us/database/feis/). The Forest would continue to incorporate future study results under our adaptive management strategy under alternatives A and B.

Other Features Common to All Alternatives

The following would also apply to all the alternatives:

- People would be encouraged to notify the Helena NF of weed populations.
- Best Management Practices (BMPs) would be included and followed (Forest Service Manual 2081 – Management of Noxious Weeds, see Appendix E).
- Revegetation (reseeding with native grass mix) would be used on any site where the vegetation density is low enough to allow reinfestation, introduction of the noxious weeds, or erosion.
- The Administrative Travel Policy would be enforced. The policy conforms to the letter written by (then) Regional Forester Dale Bosworth in the Off-Highway Vehicle FEIS for Montana, North Dakota and Portions of South Dakota, Appendix D (USBLM 2001) regarding administrative off-road travel. The Helena NF policy states: motorized access on National Forest roads, trails and areas closed to the public will be authorized when it is determined that such motorized use results in efficiencies and cost savings and resource concerns are considered. Examples of types of appropriate motorized access include, but are not limited to, noxious weed spraying, fuel reduction projects, transport of fish and game species, timber management activities, resource monitoring, and administration of permits.

ENVIRONMENTAL PROTECTION MEASURES

Table 2-4 shows the environmental protection measures that would be implemented for each alternative. Measures applicable to Alternative C are measures already incorporated into the current program. Aerial Herbicide Application for Noxious Weed Control in the Northern Region: Observations, Recommendations and Considerations by Andy Kulla (USFS 2003a) has many suggestions for making aerial herbicide as effective and low-impact a possible based on past experience. These observations, recommendations, and considerations would be used in the Helena National Forest Weed Treatment Project whenever possible.

Table 2-5 describes the treatment acre thresholds that would be used to limit picloram use in sensitive watersheds.

TABLE 2-4
Environmental Protection Measures

No.	Measure	Applies to Alternative(s)
	Aerial Application	
1	On each side of streams, a 300-ft buffer would be established where aerial application would initially not be allowed. Through site-specific drift monitoring at time of application, this buffer may be reduced by 50-foot increments as long as monitoring results are favorable. In no case would aerial application buffers be less than 100 feet.	A
2	Aerial spray would not occur over areas with over 30% live tree canopy.	A
3	Aerial spray over areas with 10-30% live tree canopy would be reviewed and an on-site decision as to whether or not to aerial spray would be based on factors such as climate, drought, target species, and non-target species present.	A
4	Aerial spray units would be ground-checked, flagged, and marked using GPS prior to spraying to ensure only appropriate portions of the unit are aerially treated. A GPS system would be used in spray helicopters and each treatment unit mapped before the flight to ensure that only areas marked for treatment are treated.	A
5	Cost efficiency of treating smaller infestations would be evaluated based on proximity to larger spray units proposed for aerial treatment.	A
6	Helicopters would avoid, by ¼ mile (except for one mile around known peregrine falcon eyries, USFWS 1984),known raptor nesting territories when flying to and from treatment sites, and would not spray a known nest site during the following periods: ➢ northern goshawks - from April 1 through August, ➢ bald eagles - February 1 through August 15, (Montana Bald Eagle Working Group 1994) ➢ red-tailed hawks - March 1 through August 15, ➢ peregrine falcons - April 1 through August 31, and ➢ golden eagles - March 1 through July.	A
7	Most aerial applications would occur in the late summer or early fall depending on availability of the helicopter/ contractor. Certain combinations of target species and non-target species, chemicals, and site-specific weather dependant conditions may warrant aerial spraying in the spring.	A
8	Aerial applications would be excluded from Research Natural Areas, candidate RNAs, and designated Wilderness.	A
9	Press releases would be submitted to local newspapers indicating potential windows of treatment for specific areas. Signing and on site layout would be performed one to two weeks prior to actual aerial treatment.	A
10	To reduce risk of chronic effects on aquatic species, aerial spray operations would be closely monitored, and site characterizations near streams made to ensure a reduced risk of groundwater/surface water contamination.	A
11	Constant communications would be maintained between the helicopter and the project leader during spraying operations. Ground observers would have communication with the project leader. Observers would be located at various locations adjacent to the treatment area to monitor wind direction and speed as well as to visually monitor drift and deposition of herbicide.	A
12	Plastic spray cards would be placed out to 350 feet from and perpendicular to perennial creeks to monitor herbicide presence. Non-toxic dye would be added to make herbicide visible on spray cards. Dye would allow observers to see herbicide as it is sprayed and to visually monitor drift or vortices from boom and rotor tips.	A
13	If needed, aerial treatment areas would be treated repeatedly on a 2 or 3-year rotation to ensure effective control. Monitoring would show which areas would need to be re-treated or if treatment areas can be reduced based on effectiveness of previous treatments.	A
14	Temporary area and road closures would be used to ensure public safety during aerial spray operations.	A
15	For all aerial treatments that would be planned for the southern third of Township 11 North, Range 1 West, the Bureau of Reclamation and the Lewis and Clark County Sheriff's Department would be notified one day prior to treatment application.	A
16	A radius of ½ mile around Canyon Ferry Dam would be avoided while administering aerial applications.	A
	Drift Reduction	

TABLE 2-4 Environmental Protection Measures		
No.	Measure	Applies to Alternative(s)
17	Drift reduction agents, nozzles that create large droplets, and special boom and nozzle placement, are all techniques that may be used to reduce drift during aerial spraying. Drift control agents may be used in aerial spraying during low humidity to reduce drift into non-target areas. Products that reduce volatility, have been shown to keep droplet sizes larger, and are appropriate adjuvant for the herbicide (as specified by labeling of both the herbicide and the drift agent, in consultation with the herbicide manufacturer) would be used.	A
18	Aerial application of herbicides would occur when wind speeds are less than 6 mph and blowing away from sensitive areas.	A
19	Weather conditions would be monitored on-site (temperature, humidity, wind speed/direction), and spot forecasts would be reviewed for adverse weather conditions.	A
	Herbicide Use	
20	Aerial or ground spraying in mule deer fawning areas, elk calving areas, and bighorn sheep lambing areas during May and June would be avoided.	A, B
21	Picloram would not be used within 50 feet of streams or subirrigated land, regardless of the application method. Relative Aquifer Vulnerability Evaluation (RAVE)/site characteristic evaluation may indicate more restrictive distances than 50 feet.	A, B, C
22	Treatment sites would be evaluated for sensitive plant habitat suitability; suitable habitats would be surveyed as necessary before treatment. A 100-foot buffer would be placed around occurrences of threatened or sensitive plant species within ground and aerial spraying treatment areas. Herbicide use within this buffer is allowed if herbicides that do not affect the specific plant species are available and effective, or if they can be applied so as to avoid detrimental impacts to individual threatened or sensitive plants, as determined by the Forest botanist. If these methods are not available or effective, site-specific mechanical or biological controls are permissible. Livestock grazing for weed control would not occur in areas where threatened or sensitive plants occur.	A, B
23	Designated Wilderness Areas (Gates of the Mountains and Scapegoat Wildernesses), RNAs (Cabin Gulch, Red Mountain, and Indian Meadows) and the candidate RNA (Granite Butte) would only be treated by horse pack or backpack spraying equipment. Motor vehicles would not be used in Wilderness Areas, RNAs or candidate RNAs.	A, B, C
24	Herbicides would be used in accordance with USEPA label instructions and restrictions. Application would be done or supervised by licensed applicators, as required by law.	A, B, C
25	Use of herbicides would be consistent with the Generic Management Plan and future pesticide Specific Management Plans. This activity would be coordinated with the Montana Department of Agriculture.	A, B, C
26	Notification of weed spraying operations would be published in the "Outdoor" section of the Helena Independent Record. At trailheads and other entry points, signs would be posted before spraying occurs or when motorized vehicles would be used to spray in areas normally closed to motorized use (on or off road).	A, B
27	Procedures for mixing, loading, and disposal of pesticides and a spill plan would be followed. These procedures are outlined in Appendix F.	A, B
28	Glyphosate, picloram, imazapyr, hexazinone, triclopyr, 2,4-D, and dicamba would not be directly sprayed on aspens due to their habitat importance for wildlife.	A, B
29	For amphibians, use only aquatic formulations for glyphosate adjacent to riparian areas per the aerial and aquatic buffers identified above.	A, B
	Surfactants	

TABLE 2-4
Environmental Protection Measures

No.	Measure	Applies to Alternative(s)
30	Silicone-base surfactants (including silicone components mixed with non-silicone components such as modified seed oils) would be used outside of riparian areas or other high-runoff sites. They would be tank-mixed and used according to labeling for both the herbicide and surfactant. They would be used primarily on target weeds having a waxy cuticle (especially toadflax and leafy spurge), but other target species in the area may be sprayed from the same tank mix. Surfactants may be used in treatment of a wider variety of target species during periods of drought, or to extend treatment windows when temperatures are acceptable but on the upper end of desired range AND combined with low humidity. Products would be selected that contain only active components and inerts recognized as generally safe by USEPA, or which are a low priority for testing by USEPA. Site characteristic evaluation procedures (RAVE scores) would be used to determine where the application of herbicides mixed with surfactants is suitable.	A, B, C
	Dyes	
31	Water-soluble colorants, such as Hi-Light® blue dye, would be used in some situations to enable applicators and inspectors to better see where herbicide has been applied.	A, B, C
	Biocontrols	
32	Biological agents would not be released until screened for host specificity and approved by the USDA Animal Plant Health Inspection Service. A list of currently available biological controls can be found in **Table 2-8**.	A, B
33	Biological controls would not be released in designated or recommended wilderness.	A, B, C
	Grazing	
34	Utilization by grazing animals for weed treatment will not exceed 20 to 40 percent by weight on native species, depending upon the condition of the range (e.g. in dry years, when range conditions are less favorable, a stricter utilization standards would be applied.	A, B
	Cultural Treatments	
35	Seeding with native seed would only occur if desirable competitive plants do not reemerge and dominate the vegetation community after the weed species is controlled. This need is predicted to occur on very shallow (poor) soil or areas with soil effects from past management activities.	A, B
	Adjacent Land	
36	In cooperation with federal, state, and county agencies, Helena NF boundary land within 1/4-mile to intermingled ownership would be selectively treated to coincide with active weed management on adjacent land. Decisions regarding treatment methods and buffer width on land adjacent to privately owned land or land managed by other agencies would be negotiated between the Forest Service and the other owner/agency.	A, B
	Historical Resources	
37	Historical sites that are eligible for the NRHP or sites with unknown or unresolved eligibility for NRHP, including historic mining resources that have not yet been recorded and evaluated, should not be subjected to handpulling, livestock grazing, and mechanical treatments such as cultivation.	A, B, C
38	Fragile ruins or other significant cultural sites that could be damaged by off-road travel would be indicated on maps by the Forest archeologist and provided to weed treatment project coordinators. Multiple-trip traffic across these sites would be avoided; all traffic with wheeled vehicles would be avoided if deemed necessary by the archeologist.	A, B, C
	Aquatic	
39	In watersheds where picloram delivery modeling indicated possible exceedances for fall treatments (**Table 2-5**), one or more of the following strategies would be used to eliminate the possibility of an exceedance: ➢ Treat some infestations with another appropriate herbicide, if available; ➢ Postpone treatment of some infestations for at least 10 to 12 months; and/or ➢ Use biological control as appropriate.	A, B, C
40	Perennial seeps, springs, and wetlands would be marked on the ground and on maps before herbicide is applied. Only aquatic-label herbicides may be used in these areas.	A, B

TABLE 2-4
Environmental Protection Measures

No.	Measure	Applies to Alternative(s)
41	INFISH standard FA-4 prohibits storage of fuels and other toxicants within Riparian Habitat Conservation Areas and refueling within Riparian Habitat Conservation Areas unless there are no other alternatives.	A, B
42	Within 300 to 100-foot aerial spray buffers, spot ground-application of herbicides may occur. Herbicide selection would be based on product label restriction and site characteristic evaluation. Providing site characteristics are favorable, persistent chemicals (i.e. picloram) could be used to within 50 feet of live water. Less persistent herbicides would be used within 50 feet, again, based on site characteristic evaluation and in accordance with herbicide label restrictions.	A
	Wildlife	
43	Grazing of sheep/goats for primary purposes of controlling noxious weeds would not occur within the Northern Continental Divide Ecosystem or newly occupied areas identified on distribution maps.	A, B
44	HNF would coordinate with USFWS and Montana Fish, Wildlife and Parks to identify wolf pack locations and determine if a short-duration, high-intensity grazing program for control of noxious weeds is appropriate at that time. If wolf sightings occur within or immediately adjacent to the area, or if predation occurs, grazing animals would be removed immediately; there would be no action taken to jeopardize wolf population. Weed treatments will not occur within 1 mile of den or rendezvous sites from April through July should any be identified during project implementation.	A, B
45	Weed treatment operations on ungulate winter ranges would be during summer months. In addition, treatments on summer ranges would be in spring or fall when these ungulate populations are migrating to or from their winter range and are unlikely to have a sizeable presence.	A, B
46	Grazing by sheep for weed control would not occur in big horn sheep range to avoid the spread of disease.	A, B
47	Human activities in excess of those which have historically occurred at the known peregrine falcon eyries will be restricted within one mile of active eyries from February 1 through August 31 (USFWS 1984).	
	"Other" Habitats (See Vegetation section of Chapter 3 for definition of "Other" Habitats)	
48	Ground treatment with selective herbicide to minimize adverse effect may be used under the direction of the appropriate resource specialist.	A, B

HERBICIDE SELECTION

Herbicide selection would be based on environmental conditions such as depth to groundwater, soil type, associated non-target vegetation, and management objectives. The Site Evaluation Form (**Appendix D**) would be used to assess the site. **Table 2-6** displays examples of herbicides proposed for use and a range of application rates. **Table 2-7** indicates the weeds on which various herbicides are used. Herbicide selection considers the following criteria:

Herbicide label considerations;

- Herbicide effectiveness on target weed species;
- Proximity to water, or other sensitive areas;
- Soil characteristics;
- Burned area;
- Potential unintended impacts to non-target species such as conifers or shrubs;
- Application method (aerial, ground);
- Other weed species present at the site, and effectiveness of herbicides on those species (for example spotted knapweed infestations with inclusions of sulfur cinquefoil);
- Adjacent treatments (private land due to cumulative effects);
- Timing of treatment (spring, fall); and,
- Priority weed—new invaders vs. existing.

Chemical label information can be found at www.epa.gov/pesticides/pestlabels/. Material Safety Data Sheets (MSDS) can be found at http://msds.ehs.cornell.edu/msdssrch.asp.

TABLE 2-5
Picloram Treatment Acre Thresholds* in Sensitive Watersheds – Fall Treatments

Watershed	6th HUC**	Maximum Acres Within 300 Feet of Stream	Maximum Acres Outside 300 Feet of Stream
Cave Gulch and Others	10030101110050	37.9	303.3
Chicken Creek Area	17010203040110	47.8	382.1
Favorite Gulch	10030101160060	26.6	212.9
Grizzly-Orofino Gulch	10030101150030	42.6	341.0
Lower Beaver Creek	10030101170050	58.2	465.4
Lower Crow Creek	10030101090050	11.1	88.6
Lower Trout Creek	10030101160030	100.0	799.8
McClellan Creek	10030101120070	143.1	1,144.7
Middle Beaver Creek	10030101170030	14.6	117.0
Middle Crow Creek Tributary	10030101080040	35.8	286.6
Missouri River area	10030101160070	9.4	75.5
Moose Creek area	17010203030100	77.0	615.9
Ophir Creek	17010201070060	51.4	411.2
Oregon Gulch	10030101160040	31.0	248.0
Spokane Creek	10030101160050	28.8	230.2
Spotted Dog Creek East	17010201080020	53.2	425.6
U. Little Blackfoot River North	17010201060050	103.2	826.0
White Gulch	10030101110010	110.7	885.5

Notes:

* Delivery rates for acres within 300 feet of a stream are higher and faster than those for acres outside of 300 feet. The "threshold acreage" is based on use in one area or the other; however, it is most likely that treatment would be a combination of both. The actual threshold is a picloram concentration in the stream of less than .075 parts per million. The Helena NF has developed a spreadsheet to calculate the concentration that considers a combination of treatment areas.

** HUC = Hydrologic Unit Code.

TABLE 2-6
Herbicide Application Rates and Timing

Weed Species	Plant biology	Herbicide	Herbicide Rate	Herbicide Application Timing
Spotted knapweed Diffuse knapweed Yellow starthistle	Tap-rooted	Tordon 22K®	1 pint/ac	Active growth Bolt to early bud; fall
		Curtail®	2 quarts/ac	
		Transline®	2/3 pint/ac	
		2,4-D	1 quarts/ac	Rosette to early bolt
Sulfur cinquefoil	Tap-rooted	Tordon 22K®	1 pint/ac	Active growth
		2,4-D	1 quarts/ac	Rosette to bolt
St. Johnswort	Perennial/Deep-rooted Rhizominous	Tordon 22K®	1 pint/ac	Pre-bloom
		2,4-D	1 quarts/ac	Seedling/pre-bloom
Canada thistle	Perennial/Deep-rooted Rhizominous	Tordon 22K®	1 pint/ac	Late bolt to pre-bud
		Curtail®	2 quarts/ac	Bolt-early bud
		Transline®	2/3 pint/ac	Bolt to pre-bud
		2,4-D	1 quarts/ac	Bolt
Musk thistle	Tap-rooted	Tordon 22K®	1 pint/ac	Rosette to early bolt, fall rosettes
		Curtail®	2 quarts/ac	
		Transline®	2/3 pint/ac	
		2,4-D	1 quarts/ac	Rosette to early bolt
Leafy spurge	Perennial/Deep-rooted Rhizominous	Tordon 22K®	1 quart/ac	Full flower/fall
		Plateau®	8-12 oz/ac	Fall/ prior to first frost
		2,4-D	1 quart/ac	Full flower
Dalmatian toadflax Yellow toadflax	Perennial/ Rhizominous	Tordon 22K®	1to 2 pint/ac	Flower or fall
		Plateau®	8-10 oz/ac	fall
		Telar®	1.5 oz/ac	spring/fall
		2,4-D	1to 2 quarts/ac	flower
Houndstongue	Perennial/ Rhizominous	Escort®	0.25-0.5 oz/ac	Rosette to bolt
		Telar®	1 oz/ac	fall
		2,4-D	1 quarts/ac	Rosette
Common tansy	Perennial/Deep-rooted Rhizominous	Escort®	0.3 to 1.0 oz/ac	Full flower/fall
		2,4-D	1 quarts/ac	Full flower
Oxeye Daisy	Perennial/Shallow-rooted/ Rhizominous	Tordon 22K®	1 pint/ac	Late bud/early bloom
		Escort®	0.5 oz/ac	
		2,4-D	1 quart/ac	
Russian knapweed	Perennial/Deep-rooted Rhizominous	Tordon 22K®	1 pint/ac	Fall, early bud
		Curtail®	2 quarts/ac	Early bud
		Transline®	1 pint/ac	Early bud
		2,4-D	1 quarts/ac	Early bud
Hawkweeds	Perennial/Shallow-rooted/ Rhizominous	Curtail®	2 quarts/ac	Rosette to early bolt
Tansy ragwort	Perennial/ fibrous root	Transline®	1 pints/ac	Rosette to bud; fall
Whitetop	Perennial/ Rhizominous	Escort®	0.3-0.5 oz/ac	Rosette to pre-bud
		2,4-D	1 quarts/ac	Rosette
Cheatgrass	Annual/ fibrous root	Glyphosate	2-4 oz/ac	Early - pre root development
Tall buttercup	Fibrous/Tap-rooted	2,4-D	2 quarts/ac	Rosette to early bolt
		Clarity®	1 quart/acre	

Note: These are the most commonly used herbicides and rates are examples. In all cases, application rates would be those indicated on herbicide labels or less. Ongoing testing may result in new instructions on rate and target species.

TABLE 2-7 Herbicide and Target Weed Species		
Chemical Name	**Trade Name(s)* for pasture & rangeland herbicides (examples)**	**Target Weed Species (general)**
Chlorsulfuron	Telar®	Dyer's woad, thistles, common tansy, houndstongue, whitetop, tall buttercup,
Clopyralid	Stinger®, Transline®, Curtail®,	Thistles, yellow starthistle, orange hawkweed, yellow hawkweed, diffuse knapweed, Russian knapweed, rush skeletonweed, spotted knapweed, oxeye daisy
Dicamba	Clarity®, Banvel®, others	Houndstongue, yellow starthistle, common crupina, orange hawkweed, yellow hawkweed, diffuse knapweed, spotted knapweed, oxeye daisy, tall buttercup, Canada thistle, blueweed, leafy spurge, tansy ragwort
Glyphosate	Round-up Ultra RT®, Round-up Original®, Rodeo®, Accord®, others	Purple loosestrife, field bindweed, yellow starthistle, Canada thistle, cheatgrass, common crupina, yellow toadflax,
Hexazinone	Velpar®, Velpar L®	Cheatgrass, oxeye daisy, yellow starthistle, Canada thistle
Imazapic	Plateau®	Cheatgrass, leafy spurge
Imazapyr	Arsenal®, Chopper®	Dyers woad, field bindweed
Metsulfuron	Ally®, Escort®	Houndstongue, thistles, sulfur cinquefoil, common crupina, dyers woad, purple loosestrife, common tansy, whitetop, blueweed
Picloram	Tordon 22K®, Tordon RTU®	Houndstongue, thistles, yellow starthistle, sulfur cinquefoil, common crupina, orange hawkweed, yellow hawkweed, diffuse knapweed, Russian knapweed, spotted knapweed, rush skeletonweed, common tansy, Dalmatian toadflax, yellow toadflax, leafy spurge
Sulfometuron	Oust®	Cheatgrass, whitetop, oxeye daisy, tansy ragwort, musk thistle
Triclopyr	Garlon 3A®, Garlon 4®, Redeem®, Remedy®	Yellow hawkweed, orange hawkweed, sulfur cinquefoil, purple loosestrife, diffuse knapweed, spotted knapweed, oxeye daisy, thistles, Russian knapweed
2,4-D	numerous	Musk thistle, sulfur cinquefoil, common crupina, dyers woad, Russian knapweed, purple loosestrife, tall buttercup, whitetop, spotted knapweed

* Use of tradenames does not imply promotion of the use of this product or state that this is the exact product that would be used.

TABLE 2-8
Biological Control Agents

Target Weed	Agent	General Mode of Action
Knapweeds	*Agapeta zoegana* (moth)	Root miner
	Bangasternus fausti (weevil)	Seed head feeder
	Chaetorellia acrolophi (fly)	Seed head feeder
	Cyphocleonus achates (weevil)	Root miner
	Larinus minutus (weevil)	Seed head feeder
	Larinus obtusus (weevil)	Seed head feeder
	Metzneria paucipunctella (moth)	Seed head feeder
	Pelochrista medullana (moth)	Root miner
	Pterolonche inspera (moth)	Root miner
	Sphenoptera jugoslavica (beetle)	Defoliator, root miner
	Terellia virens (fly)	Seed head feeder
	Urophora affinis (fly)	Seed head feeder
	Urophora quadrifasciata (fly)	Seed head feeder
Yellow starthistle	*Bangasternus orientalis* (weevil)	Seed head feeder
	Chaetorellia austalis (fly)	Seed head feeder
	Eustenopus villosus (weevil)	Seed head feeder
	Larinus curtus (weevil)	Seed head feeder
	Urophora sirunaseva (fly)	Seed head feeder
Purple loosestrife	*Galerucella calmariensis* (beetle)	Defoliator
	Galerucella pusilla (beetle)	Defoliator
	Hylobius transversovittatus (weevil)	Root miner, defoliator
	Nanophyes brevis (weevil)	Seed head feeder
	Nanophytes marmoratus (weevil)	Seed head feeder
Rush skeletonweed	*Cystiphora schmidti* (gall midge)	Galls leaves/stem
	Eriophytes chondrillae (gall mite)	Galls terminal buds
	Puccinia chondrillina (rust fungus)	Rusts foliage/flowers
Leafy spurge	*Apthona abdominalis* (flea beetle)	Defoliator, root miner
	A.cyparissiae (flea beetle)	Defoliator, root miner
	A.czwalinae (flea beetle)	Defoliator, root miner
	A.flava (flea beetle)	Defoliator, root miner
	A.lacertosa (flea beetle)	Defoliator, root miner
	A nigriscutis (flea beetle)	Defoliator, root miner
	Chamaesphecia empiformis (moth)	Root miner
	C.hungarica (moth)	Root miner
	C.tenthrediniformis (moth)	Root miner
	Dasineura sp. nr. Capsulae (gall midge)	Galls growing tips
	Hyles euphorbiae (hawkmoth)	Defoliator
	Oberea erythrocephala (beetle)	Feeds on crown/root
	Spurgia esula (gall midge)	Galls growing points
St. Johnswort	*Agrilus hyperici* (beetle)	Feeds on stem/roots
	Aplocera plagiata (moth)	Feeds on foliage
	Chrysolina hyperici (beetle)	Feeds on leaves/flowers
	C.quadrigemina (beetle)	Feeds on leaves/flowers
	Zeuxidiplosis giardi (gall midge)	Galls leaves
Tansy ragwort	*Longitarsus jacobaeae* (flea beetle)	Root miner
	Pegohylemyia seneciella (fly)	Feeds on flower
	Tyria jacobaeae (tiger moth)	Feeds on terminal buds
Canada thistle	*Ceutorrhynchus litura* (weevil)	Defoliator
	Larinus planus (weevil)	Seed head feeder
	Urophora cardui (fly)	Creates galls in stem
Dalmatian toadflax Yellow toadflax	*Brachypterolus pulicarius* (beetle)	Flower feeder
	Calophasia lunula (moth)	Foliage feeder
	Gymnetron antirrhini (weevil)	Seed head feeder

MONITORING

Monitoring is part of the *Alternatives Considered in Detail*. The monitoring described below applies to Alternatives A and B unless otherwise noted.

WEEDS

The current monitoring effort (see *Ongoing Weed Treatment, Prevention, and Education Program*) would be expanded by placing greater emphasis on leafy spurge, spotted knapweed, Canada thistle, and musk thistle. Monitoring of these species would be in addition to species already monitored.

- Density and rate of spread of invasive exotic plant species and the effect these aggressive plants have on natural resources;
- Effects of treatment on non-target plants;
- Effectiveness of biological control agents; and
- Effects of cultural weed management activities.

WATER

Water quality monitoring of herbicide would focus on representative watersheds. These watersheds represent various geo-climatic conditions throughout the Helena NF and burned areas. Watersheds were also selected because they had the most acres of weed treatment, or are used for municipal water. Watersheds to be monitored include: Lower Trout Creek, Cave Gulch, Upper Little Blackfoot, Moose Creek, Poorman Creek, Ten-Mile Creek, McClellan Creek, Avalanche Creek, Magpie Creek, White Gulch, Copper Creek, Nevada Creek, Ophir Creek, Spotted Dog Creek, and Telegraph Creek. The exact location of monitoring sites would be determined prior to herbicide application to assure treatments are being effectely monitored.

Monitoring would include groundwater monitoring in selected wells in close proximity to application sites. Potential herbicide movement that coincides with infiltration and runoff from designated areas within the watersheds would be measured.

Effects on surface water quality from ground and aerial application of herbicide would be monitored. Samples would be taken immediately before and after treatment, then once a week for the next three weeks, and, if possible, after rain storms during the first month following treatment.

Up to three steams would be monitored each year, with monitoring rotated among the selected streams over the course of three to four years until each has been covered. Streams to be monitored would be determined annually, and would occur in treatment emphasis areas. Monitoring after that will be less intensive, and will be determined by the results of the previous monitoring. The parameters to be measured will be the particular herbicide(s) being sprayed or applied. The unit of measure will be concentration of the particular herbicide being applied in micrograms per liter.

Monitoring would also occur in the case of an accidental spill, or if more than 5% of the drift cards used during aerial applications show that drift has occurred within 50 feet of a stream.

SOIL

Monitoring potential weed treatment effects on soil quality parameters would be accomplished through an integrated resource-monitoring program. This program would include periodic sampling and evaluation of the resultant plant community following weed control as an indicator of overall soil production and quality. If the response of native vegetation to weed treatments is less than desired on a particular site, soil chemical and physical properties may be evaluated to determine needs for restoration. This may also include monitoring of soil microbial populations on the site by performing microbiologic assays on soil samples collected from various depths throughout the soil profile.

ADAPTIVE MANAGEMENT STRATEGY

The adaptive management strategy applies to Alternatives A and B. The strategy is made up of two principle components:

1. To quickly and effectively treat newly discovered weed infestations, a decision tree based on site characteristics, weed species, and location would be used to select treatment methods.

While initial treatments of noxious weeds are expected to be effective in reducing existing weed infestations, all infestations cannot be treated immediately due to budgetary and logistical constraints. Seven years may be required to accomplish initial treatments. The data used in this EIS includes all weeds inventoried up to 2002, although every acre of the Helena NF has not been inventoried for noxious weeds. Existing infestations will expand before they can be initially treated, and new areas would be identified, possibly including locating weed species that were previously not known to occur on the Forest. New species may be added to the Montana state and county and the North American weed lists. Some of these weeds may currently exist on the Forest.

For analysis purposes, the adaptive management strategy in Alternatives A and B assumed up to 25 percent more acres may be identified as needing treatment within the 12-year time frame of the EIS. It is possible that treatment success would offset new acres, resulting in little overall change in treatment acres. The strategy includes:

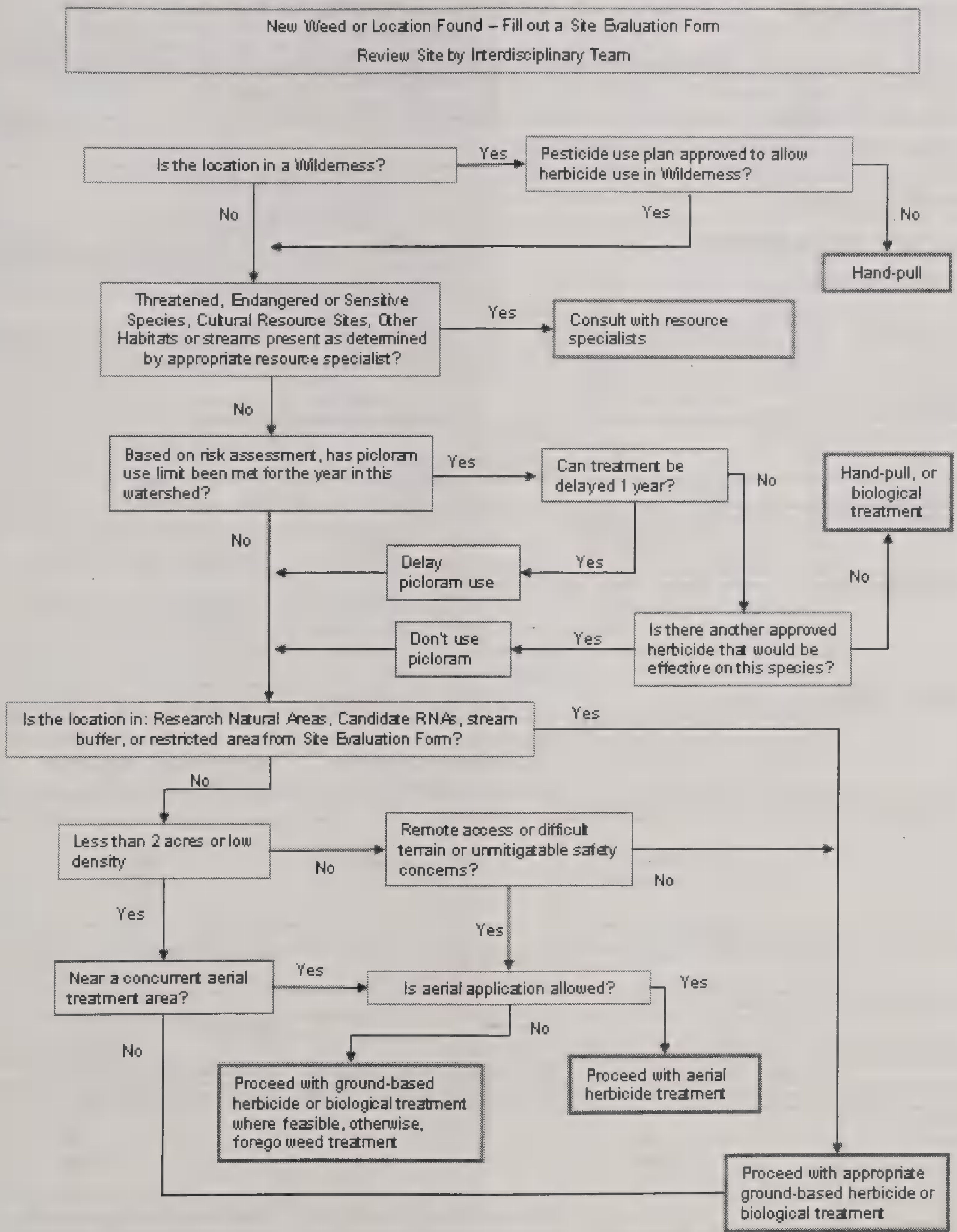
- The decision (if and how) to treat newly discovered infestations would be driven by a site characteristic evaluation. The Site Evaluation Form (Appendix D) would be used in the decision tree (Diagram 2-1).
- New invaders, as identified by local and state agencies, would be given high priority for eradication, if feasible.
- New infestations may be treated with herbicide as long as the acres treated remain within the limits described above. If new infestations evaluated considering site specific information such as burned area result in treatment beyond identified acres, further NEPA analysis would be required.
- Appropriate methods and Environmental Protection Measures described above would be used.

2. To improve effectiveness and reduce impacts, new technologies, biocontrols, or herbicides would be evaluated for use.

New technology, biocontrols, herbicide formulations, and supplemental labels are likely to be developed within the next 12 years. These new treatments would be considered when there are indications that they would be more weed-specific than methods analyzed here, less toxic to non-target vegetation, or less persistent and less mobile in the soil. Newly registered, water-soluble herbicides that display toxicity, leaching, and persistence characteristics less than or equal to picloram (which is considered in the effects analysis in Chapter 4) may be used. The Adaptive Management Strategy would allow incorporation of these new treatment methods:

- New herbicides or formulations registered and approved by the USEPA would be applied according to label specifications;
- Application methods and environmental protection measures described above would be used;
- The decision by the line officer to use a new treatment method would be driven by effectiveness monitoring, water quality monitoring, an interdisciplinary review to confirm that the new treatment is within the scope of the analysis in this EIS, and a site characteristic evaluation (see Diagram 2-1);
- Monitoring would be implemented to evaluate if desirable plant species are thriving in weed treatment areas. If observations show desirable plants species aren't successfully recolonizing, then these sites could be targeted for additional evaluation to determine need for further soil or site restoration measures;
- New biocontrols are approved and certified by the Animal Plant Health Inspection Service; and
- Cost effective mechanical methods of treatment are developed. These methods would be reviewed before use to determine if soil and water quality standards can be maintained.

Diagram 2-1 Decision Tree for New Weed Locations



SUMMARY COMPARISON OF ALTERNATIVES

Tables 2-9 through **2-11** provide a summary comparison of the three alternatives analyzed in relation to their relationship to the Purpose and Need, the extent to which they address significant issues, and the extent to which they address public concerns.

AGENCY'S PREFERRED ALTERNATIVE

After reviewing the environmental effects, Alternative A – Proposed Action is the preferred alternative.

TABLE 2-9
Meeting the Purpose and Need

Purpose and Need Statement	Alt. A	Alt. B	Alt. C
Control Noxious Weeds (acres)	22,668	18,913	15,871

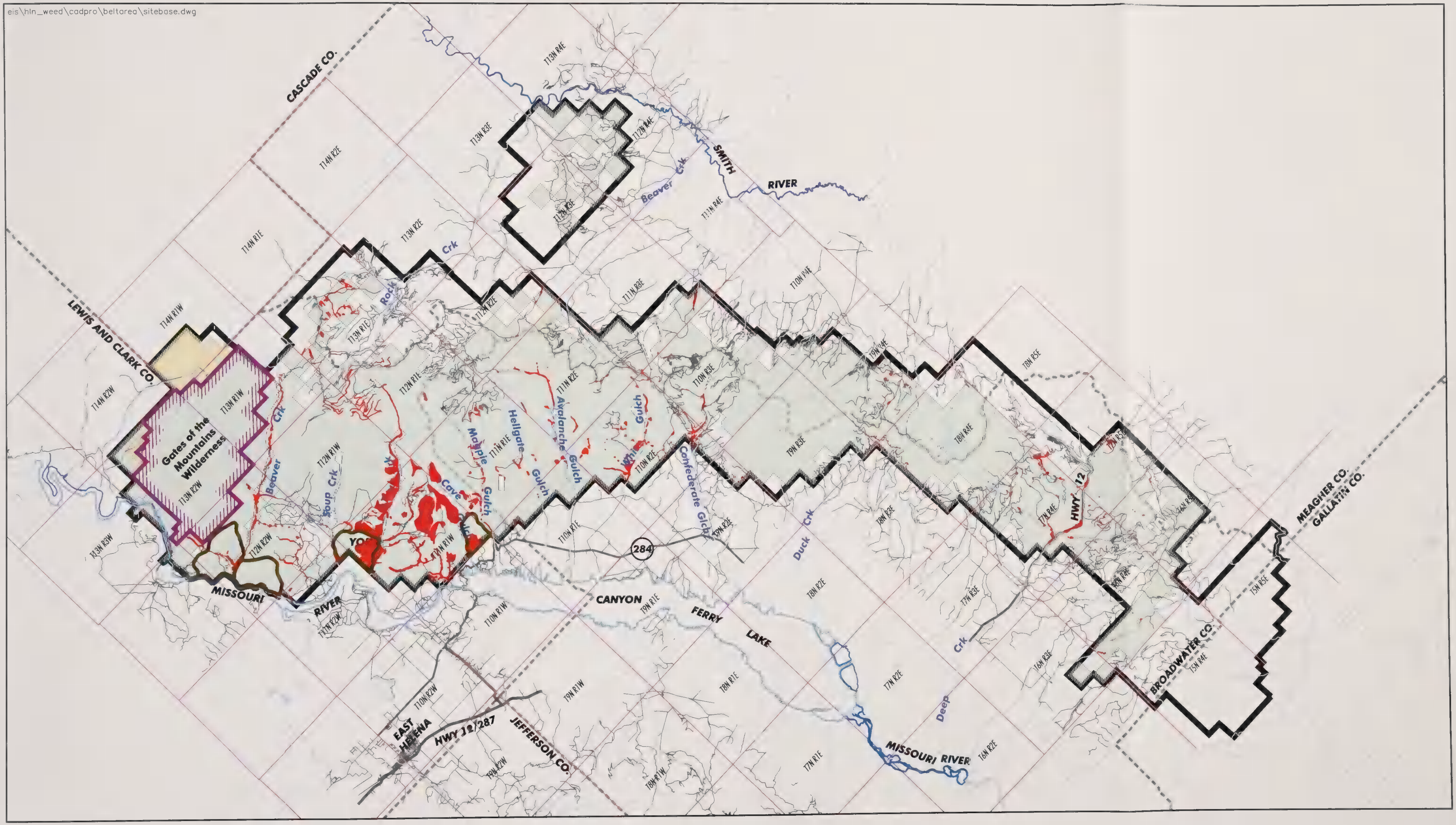
TABLE 2-10
Addressing Significant Issues

Issue	Alt. A	Alt. B	Alt. C
1. Potential effects on human health, non-target vegetation, and wildlife from aerial application.			
Issue Indicator: Acres of **aerial** herbicide application (total).	11,086	0	0

TABLE 2-11
Addressing Public Concerns

Concern	Alt. A	Alt. B	Alt. C
Effects of weed treatment on water quality, groundwater, and fisheries			
	Low risk with environmental protection measures in place	Low risk with environmental protection measures in place.	Low risk with environmental protection measures in place.
Effects of weed treatment on native grasses, forbs, shrubs, and trees			
	1-3 year reduction in growth for individual plants from herbicides on 22,668 acres. More selective herbicides can be used.	1-3 year reduction in growth for individual plants from herbicides on 18,913 acres. More selective herbicides can be used.	1-3 year reduction in growth for individual plants from herbicides on 15,871 acres. Herbicide selection limited.
Effects of weed treatment on wildlife			
	Low risk of effects from herbicides. Short-term disturbance (between alternatives considered) from application, handpulling.	Low risk of effects from herbicides. Short-term disturbance (highest of alternatives considered) from application, handpulling.	Low risk of effects from herbicides. Short-term disturbance (lowest of alternatives considered) from application, handpulling.
Cost of proposed treatments for the initial treatments			
Per Acre Total	\$44.23 to \$48.84 \$1,002,510 to \$1,106,994	\$66.51 to \$68.52 \$1,257,974 to 1,295,942	\$62.00 \$987,350
Effects on human health from herbicide use			
	No health effects or risks to worker or general public.	No health effects or risks to worker or general public.	No health effects or risks to worker or general public.
Effects of weed treatment on insects			
	No effect	No effect	No effect
Effects of weed treatment on recreationists and adjacent landowners			
	Short-term disturbance (middle)	Short-term disturbance (highest)	Short-term disturbance (lowest)
Effects of weed treatment on wilderness, inventoried roadless areas, research natural areas, unroaded areas			
Acres Treated Wilderness IRA RNA	 68 2,399 5	 68 1,418 5	 <3 1,038 5
Effects on apparent naturalness and natural integrity	Improved through reduction of weed invasion.	Improved through reduction of weed invasion on 60% of infested acres. Long-term reduction as remaining weeds spread.	Improved through reduction of weed invasion on 43% of infested acres. Long-term reduction as remaining weeds spread.

TABLE 2-11 Addressing Public Concerns			
Concern	**Alt. A**	**Alt. B**	**Alt. C**
Effects of weed treatment on sensitive areas and important ecological communities			
	No effects with environmental protection measures.	No effects with environmental protection measures.	No effects with environmental protection measures.
Effects of herbicide use on soil			
	Slight, temporary reduction in productivity, long-term improvement on 100% of infested area.	Slight, temporary reduction in productivity, long-term improvement on acres treated (83% of infested area). Decrease on areas not treated.	Slight, temporary reduction in productivity, long-term improvement on acres treated (70% of infested area). Decrease on areas not treated.
Weed treatment effectiveness			
	High on 100% of infested areas.	High on 83% of infested area, ineffective on 17%.	High on 70% of infested area, ineffective on 30%.
Effects of noxious weeds			
Noxious weeds have negative impacts on wildlife habitat, water quality, recreational values, soil productivity, wilderness and IRAs.	100% of infested areas treated with provisions for new infestations to be treated, reducing effects of noxious weeds.	83% of infested areas treated with provisions for new infestations to be treated in most areas, reducing effects of noxious weeds.	70% of infested areas treated with no provisions for new infestations to be treated without further NEPA decisions. Effects of noxious weeds likely to increase.



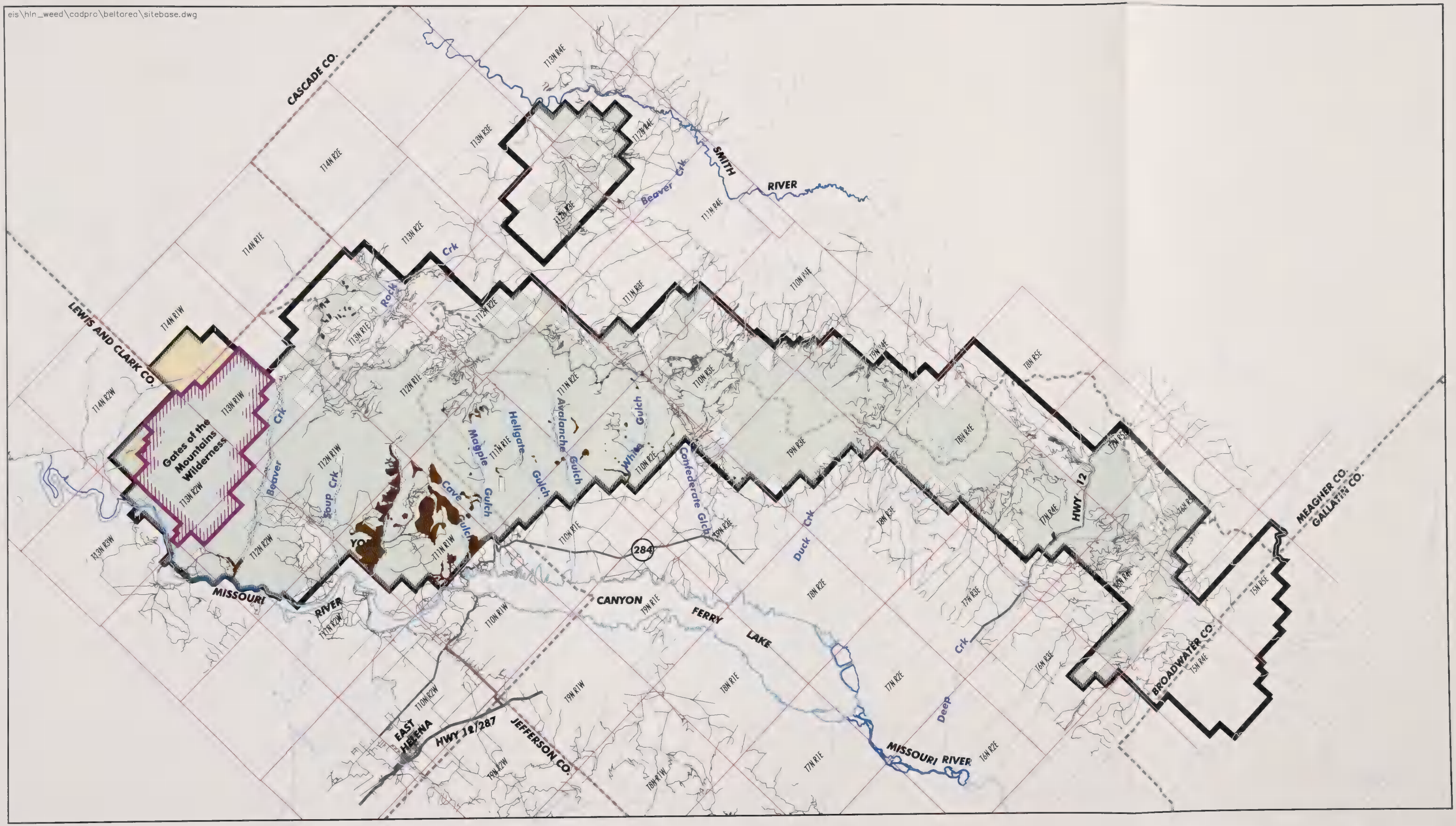
0 Miles 5

Note: Basemap data from Helena National Forest GIS database.

LEGEND

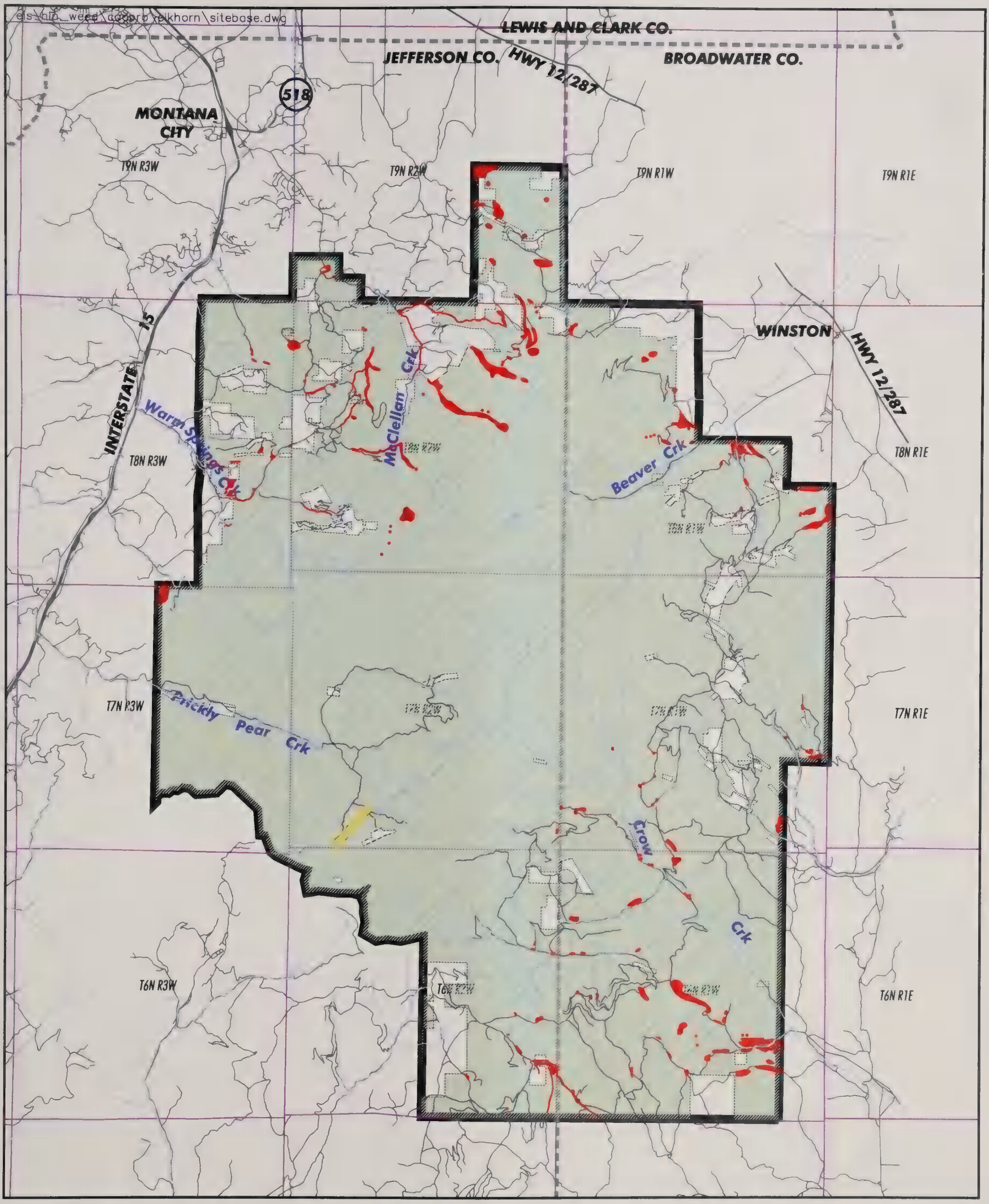
- Helena Forest Boundary
- Helena National Forest
- State
- Wilderness Boundary
- County
- Township/Range
- Perennial Streams
- Roads
- Weed Treatment Areas (Ground and Aerial Application)
- Grazing Areas

Alternative A - Belts/Dry Range Landscape Area
Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-1



Note: Basemap data from Helena National Forest GIS database.

Alternative A - Belts/Dry Range Landscape Area
Aerial Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-1a

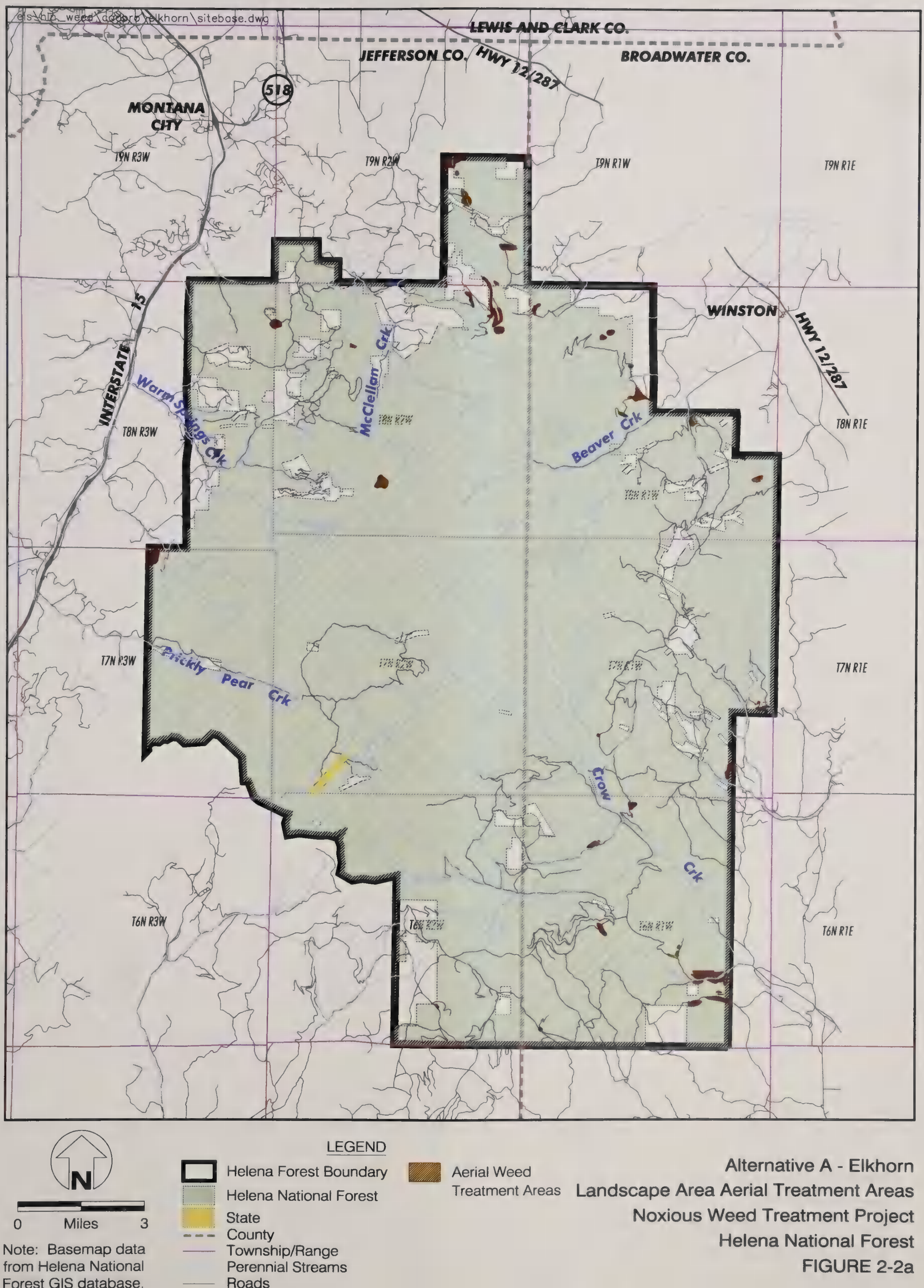


Note: Basemap data from Helena National Forest GIS database.

LEGEND

- Helena Forest Boundary
- Helena National Forest
- State
- County
- Township/Range
- Perennial Streams
- Roads
- Weed Treatment Areas (Ground and Aerial Application)

Alternative A - Elkhorn
Landscape Area Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-2



Note: Basemap data from Helena National Forest GIS database.

Alternative A - Elkhorn Landscape Area Aerial Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-2a

N

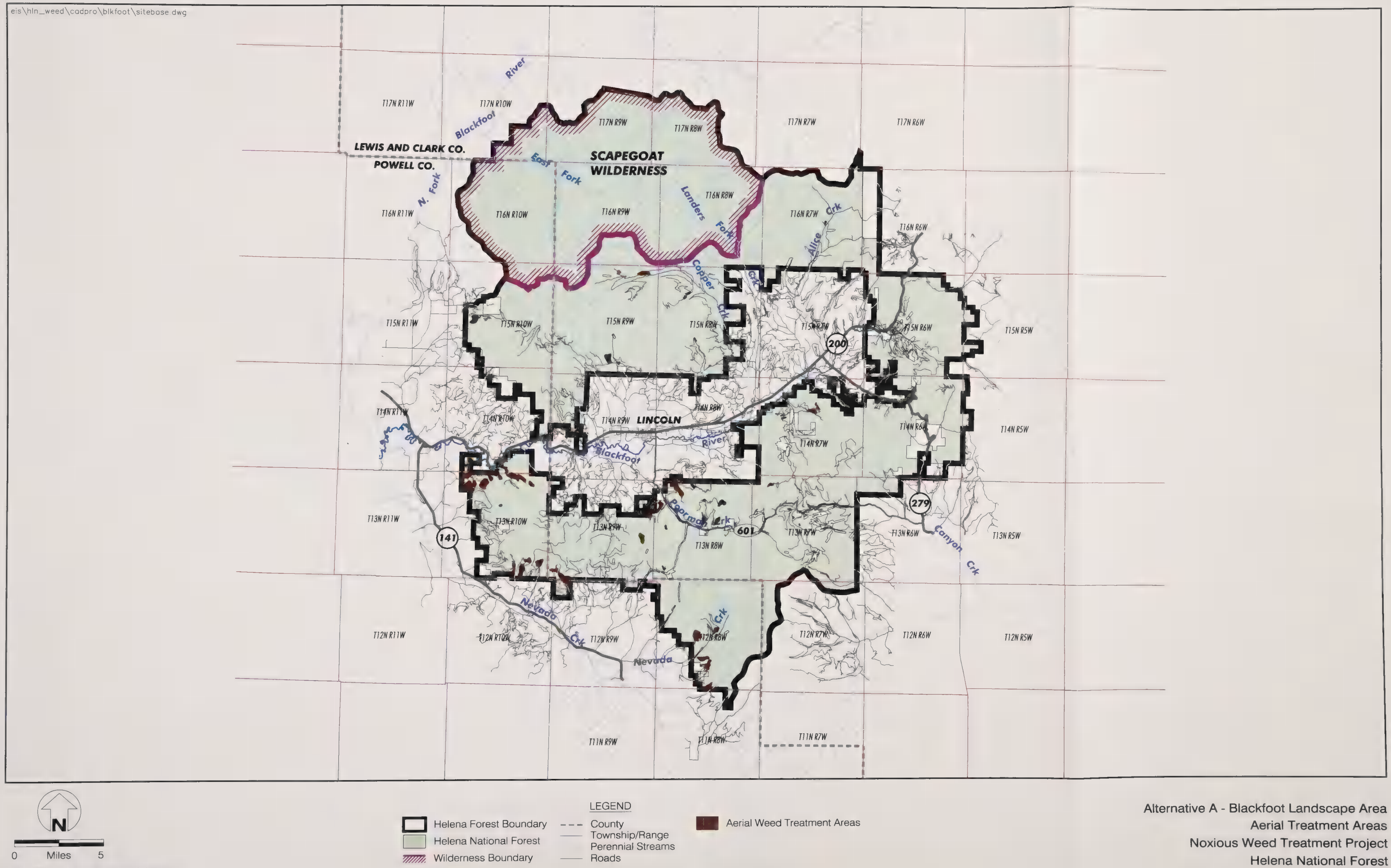
0 Miles 5

Note: Basemap data from Helena National Forest GIS database.

LEGEND

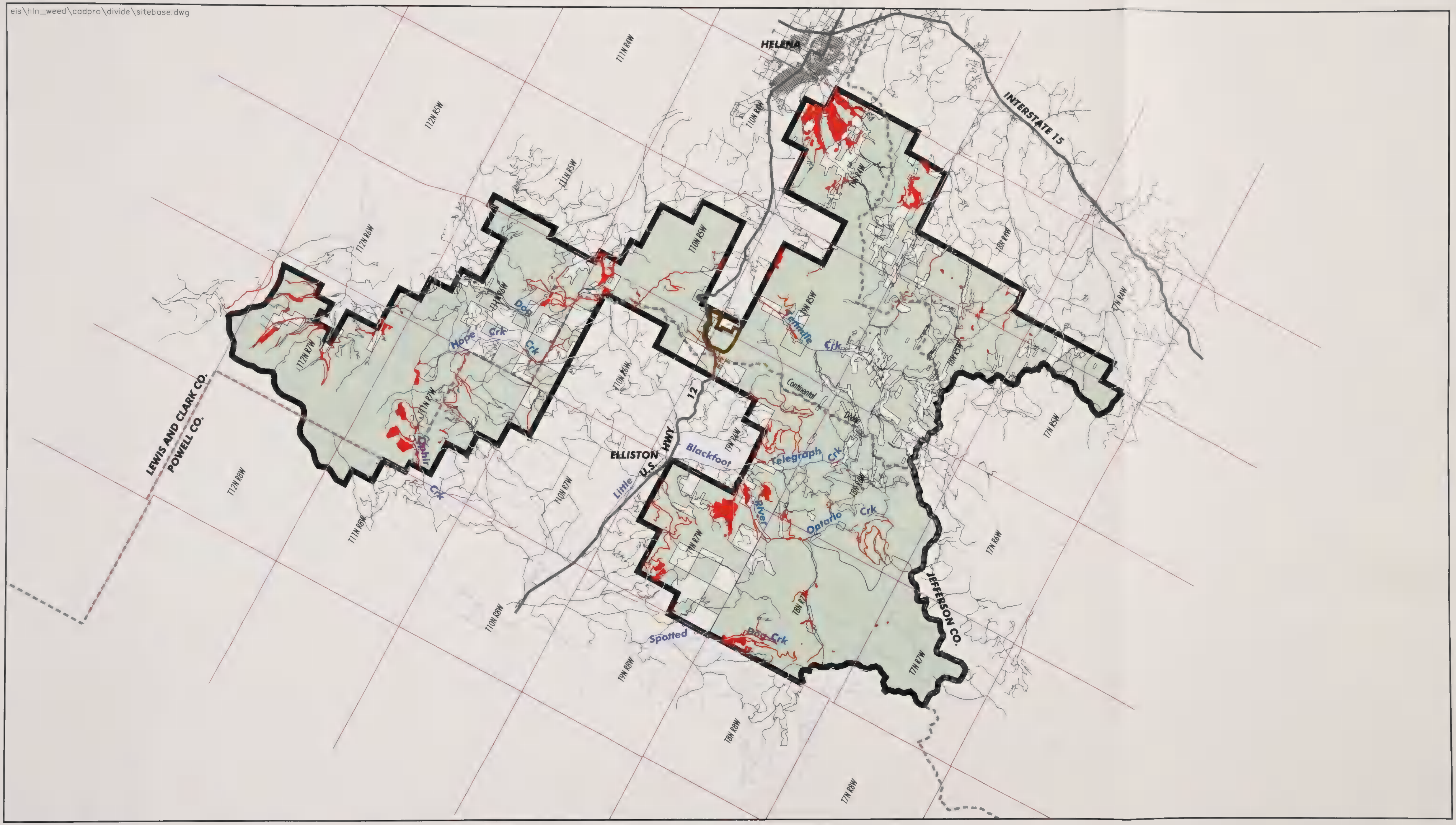
- Helena Forest Boundary
- Helena National Forest
- Wilderness Boundary
- County
- Township/Range
- Perennial Streams
- Roads
- Weed Treatment Areas (Ground and Aerial Application)

Alternative A - Blackfoot Landscape Area
Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-3

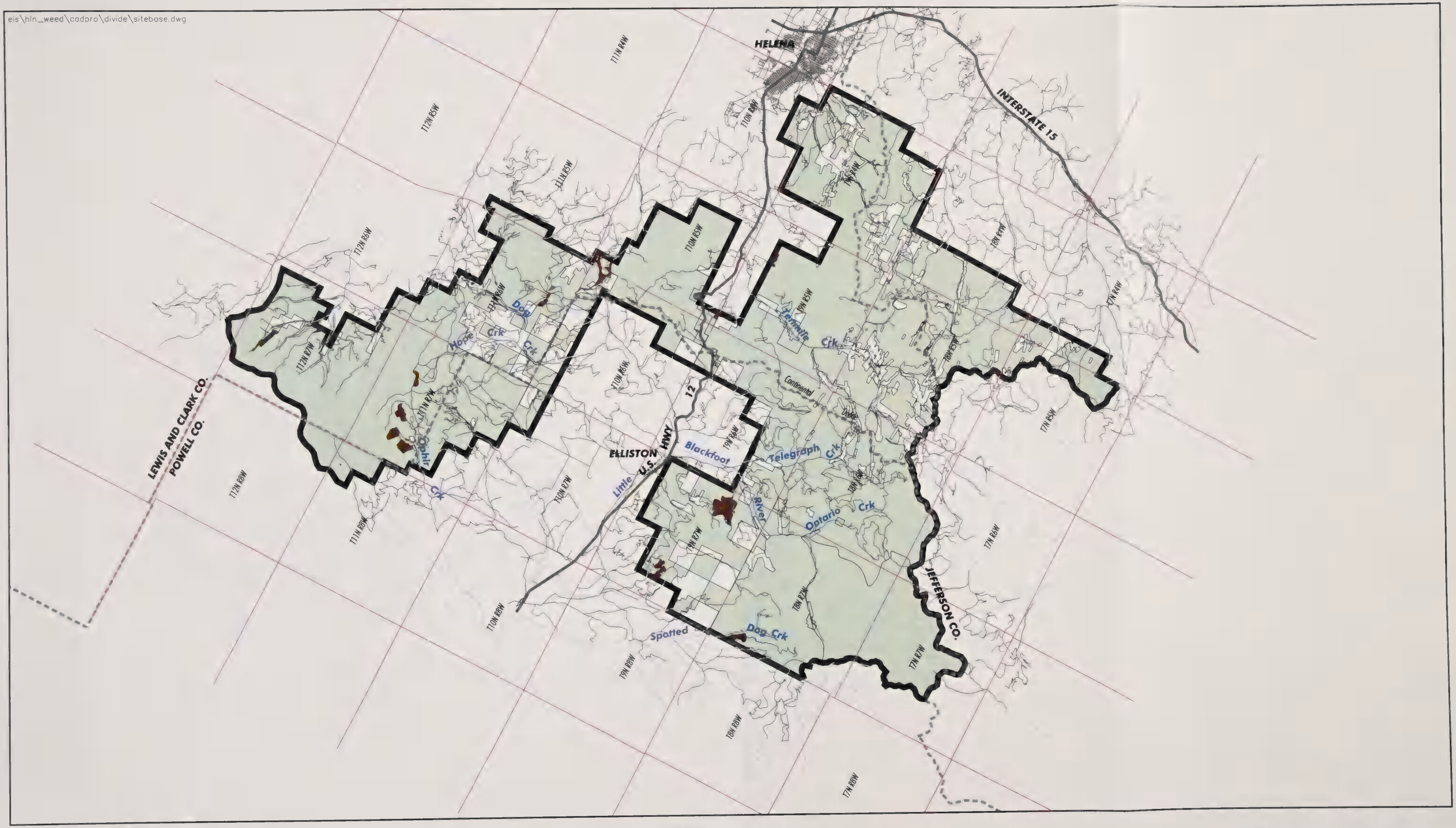


Note: Basemap data from Helena National Forest GIS database.

Alternative A - Blackfoot Landscape Area
Aerial Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-3a



Alternative A - Continental Divide
Landscape Area Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-4



N

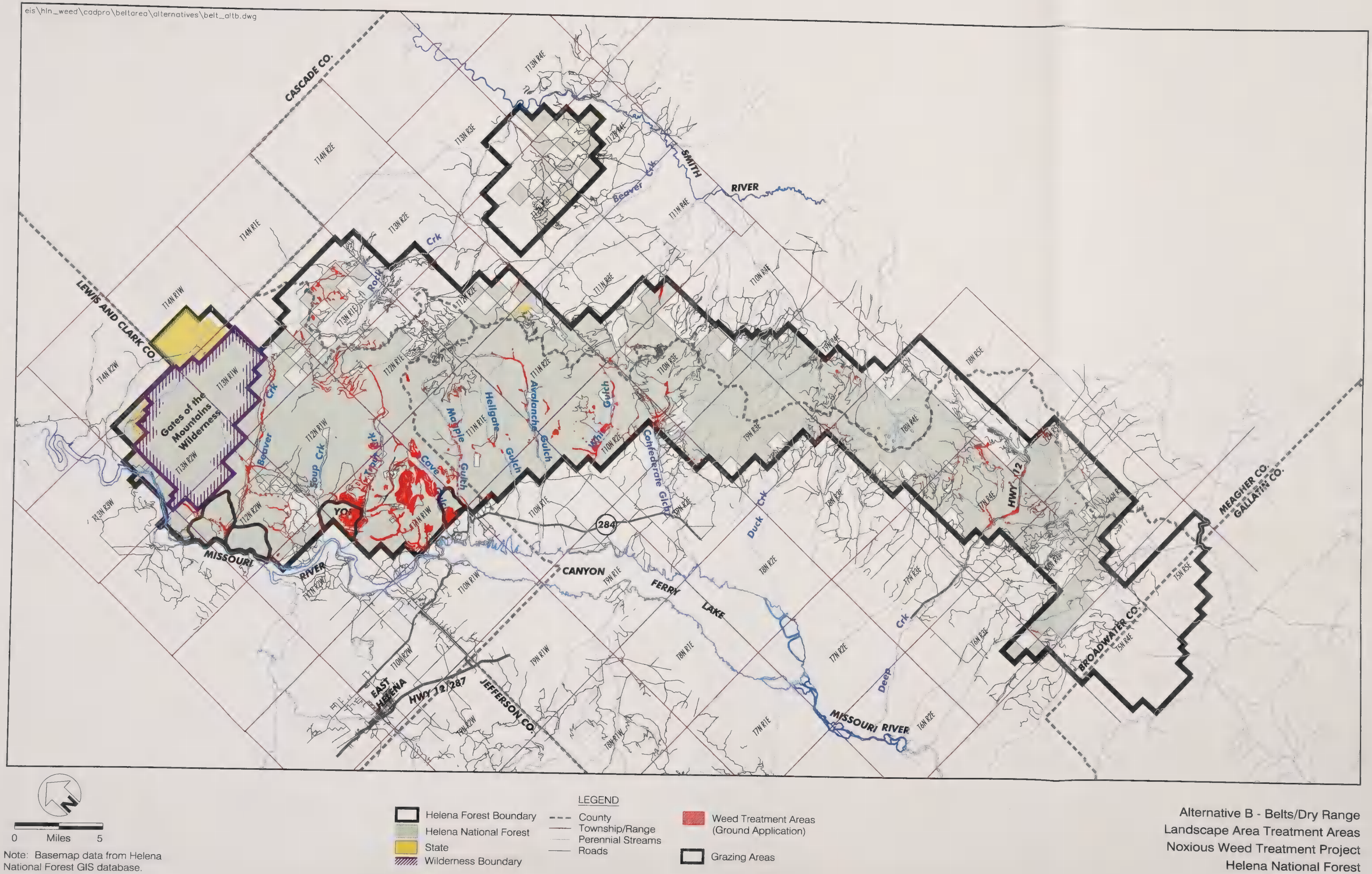
0 Miles 4

Note: Basemap data from Helena National Forest GIS database.

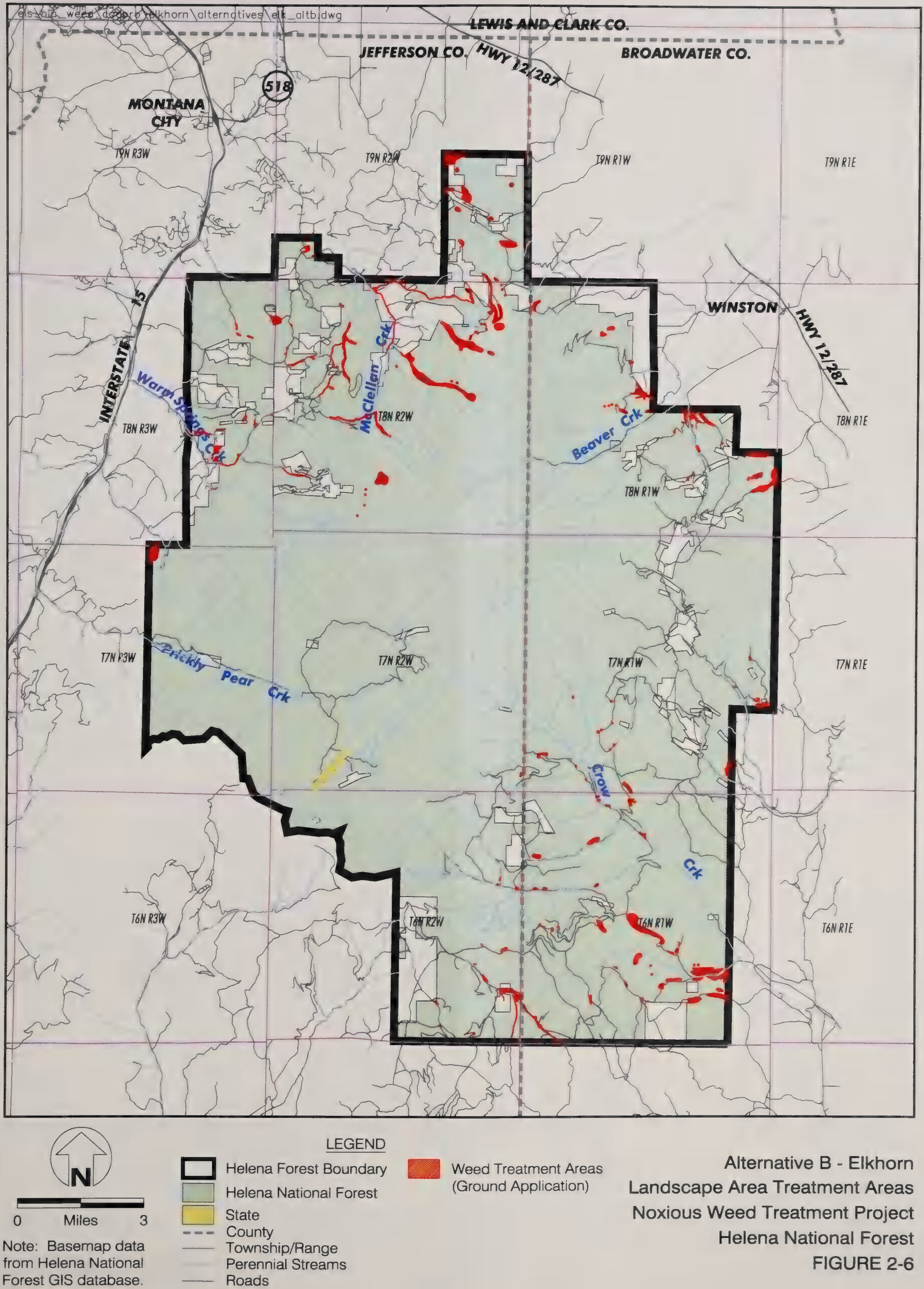
LEGEND

- Helena Forest Boundary
- Helena National Forest
- County
- Township/Range
- Perennial Streams
- Roads
- Aerial Weed Treatment Areas

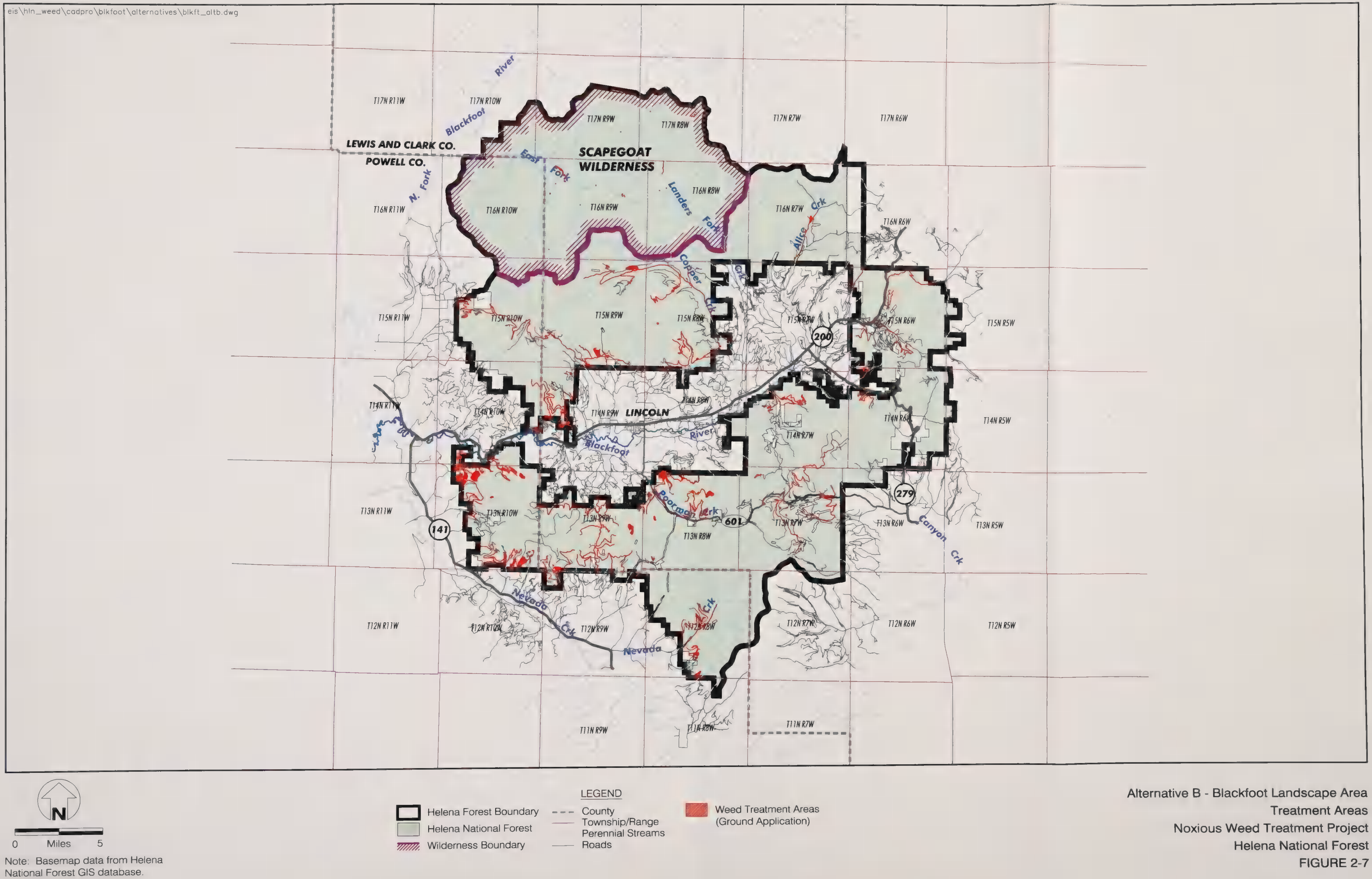
Alternative A - Continental Divide
Landscape Area Aerial Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-4a



Alternative B - Belts/Dry Range
Landscape Area Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-5

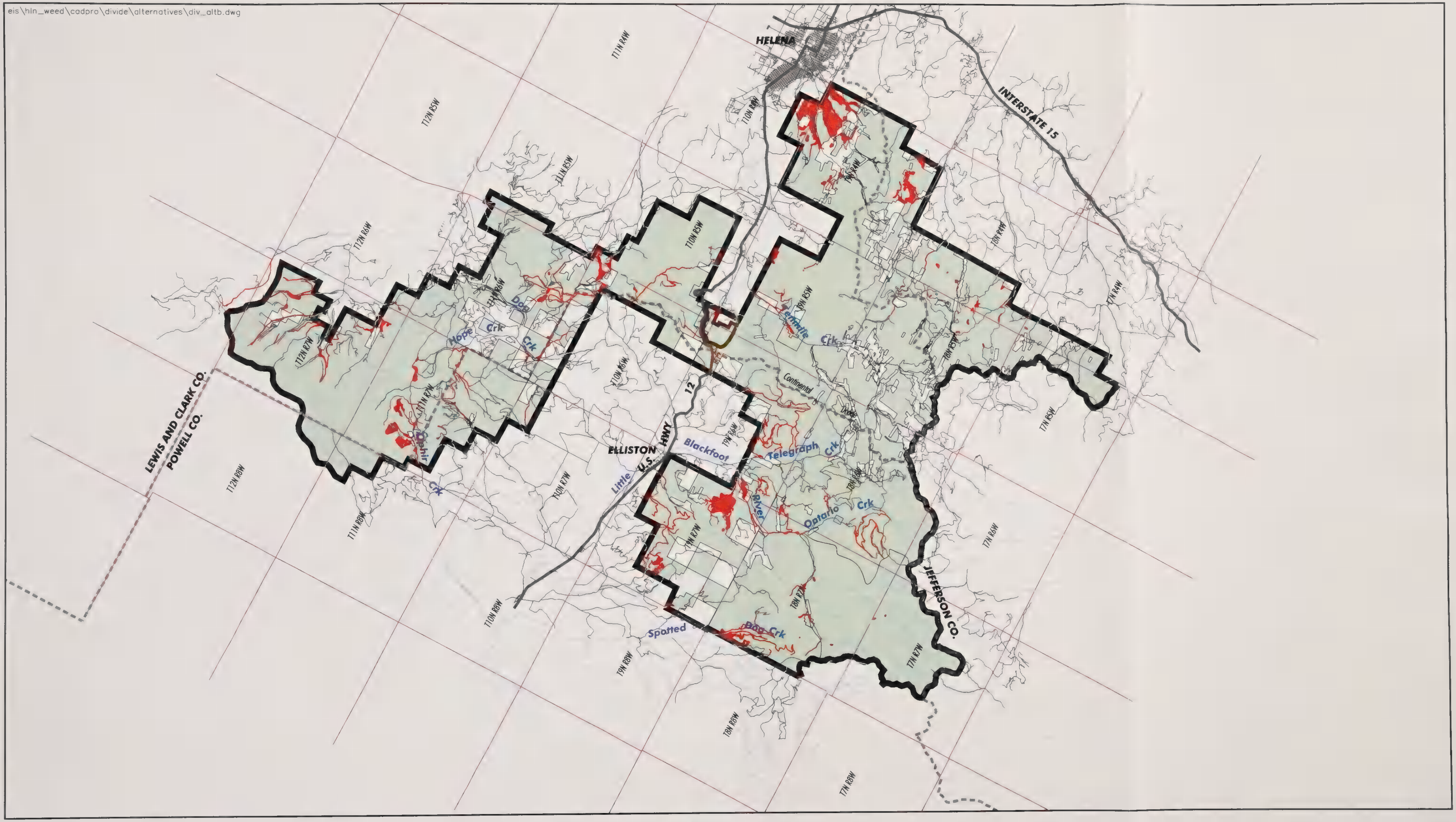


Alternative B - Elkhorn
Landscape Area Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-6



Note: Basemap data from Helena National Forest GIS database.

Alternative B - Blackfoot Landscape Area Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-7



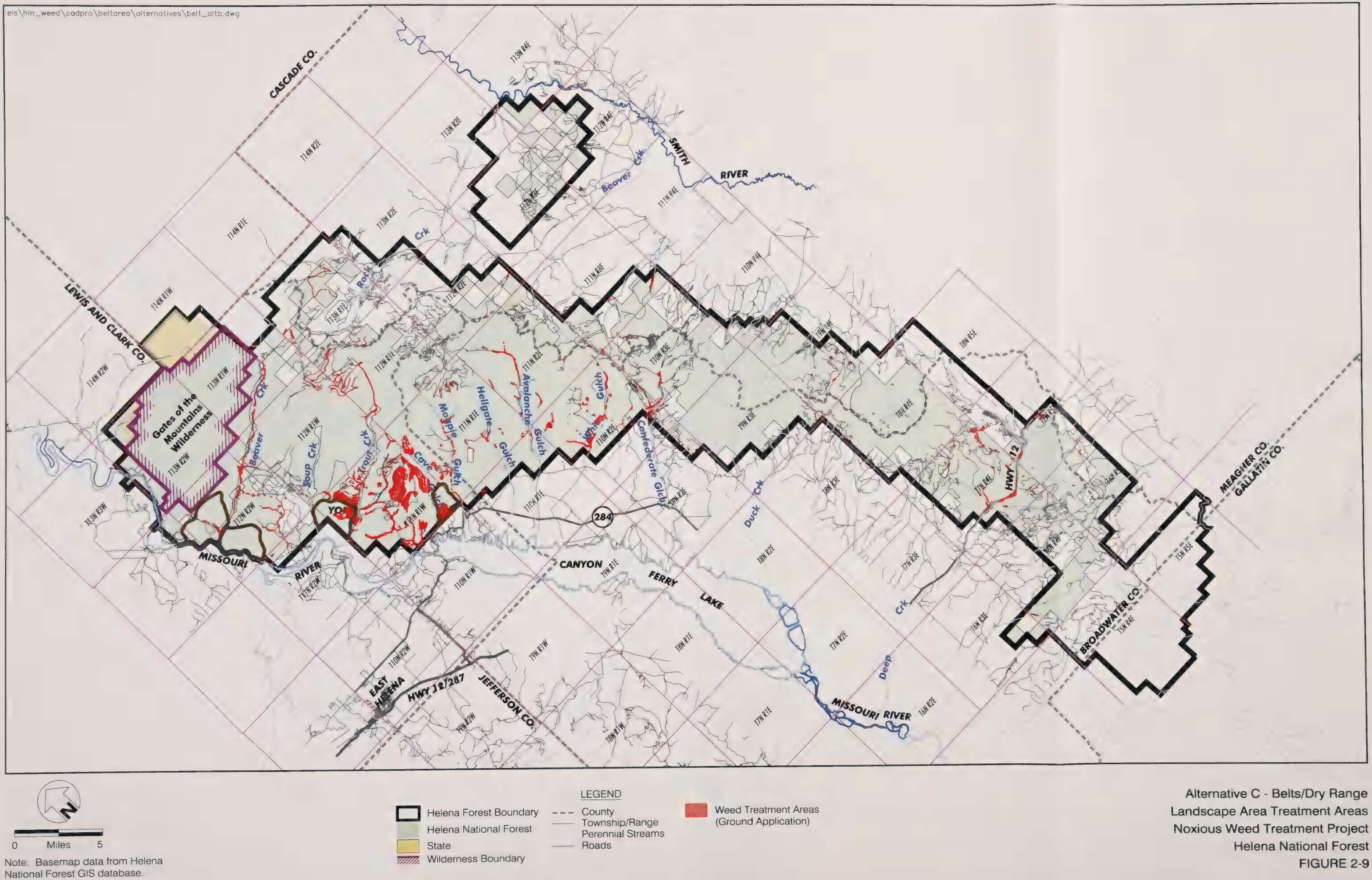
0 Miles 4

Note: Basemap data from Helena National Forest GIS database.

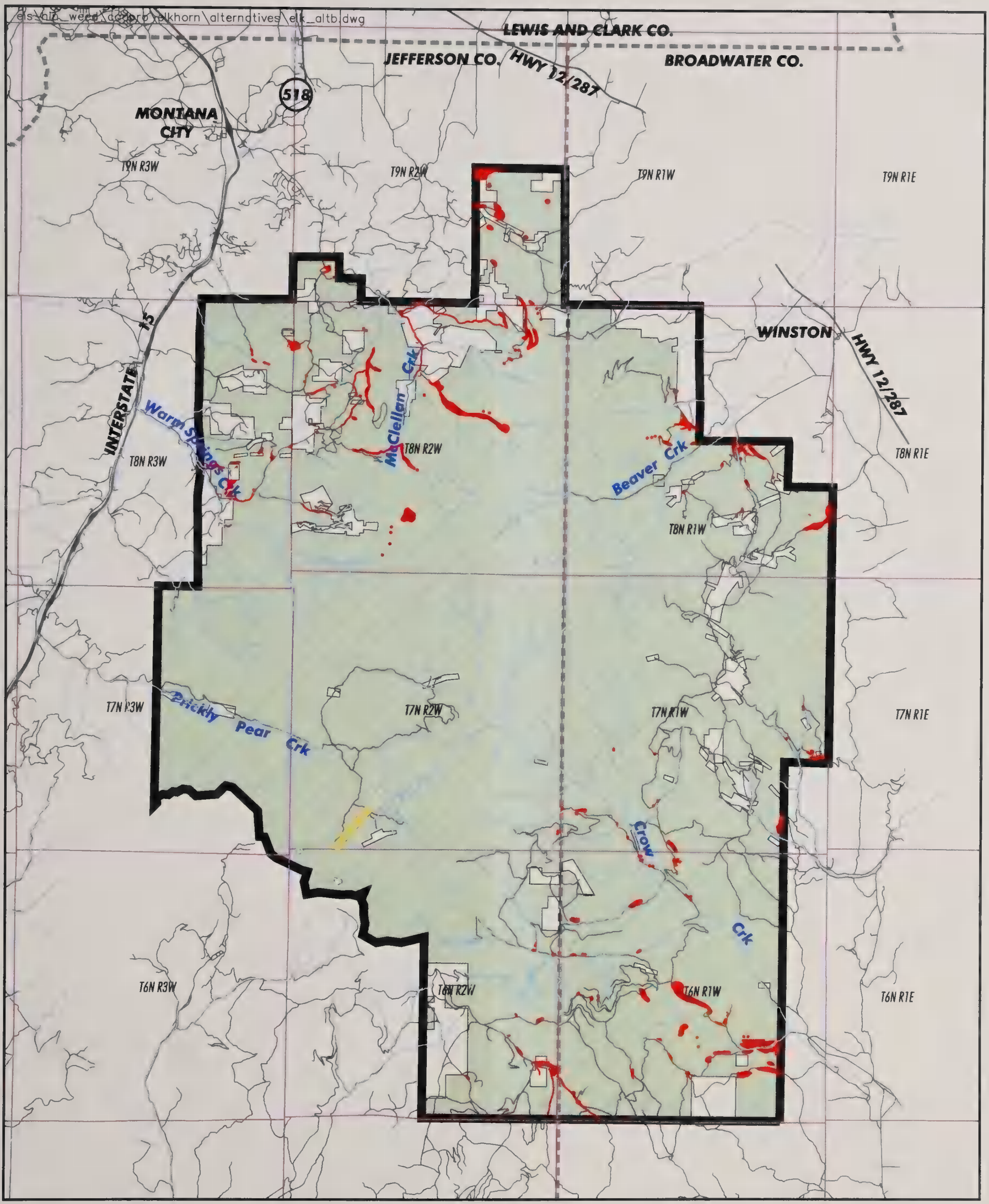
LEGEND

- Helena Forest Boundary
- Helena National Forest
- County
- Township/Range
- Perennial Streams
- Roads
- Weed Treatment Areas (Ground Application)
- Grazing Areas

Alternative B - Continental Divide Landscape Area Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-8



Alternative C - Belts/Dry Range
Landscape Area Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-9

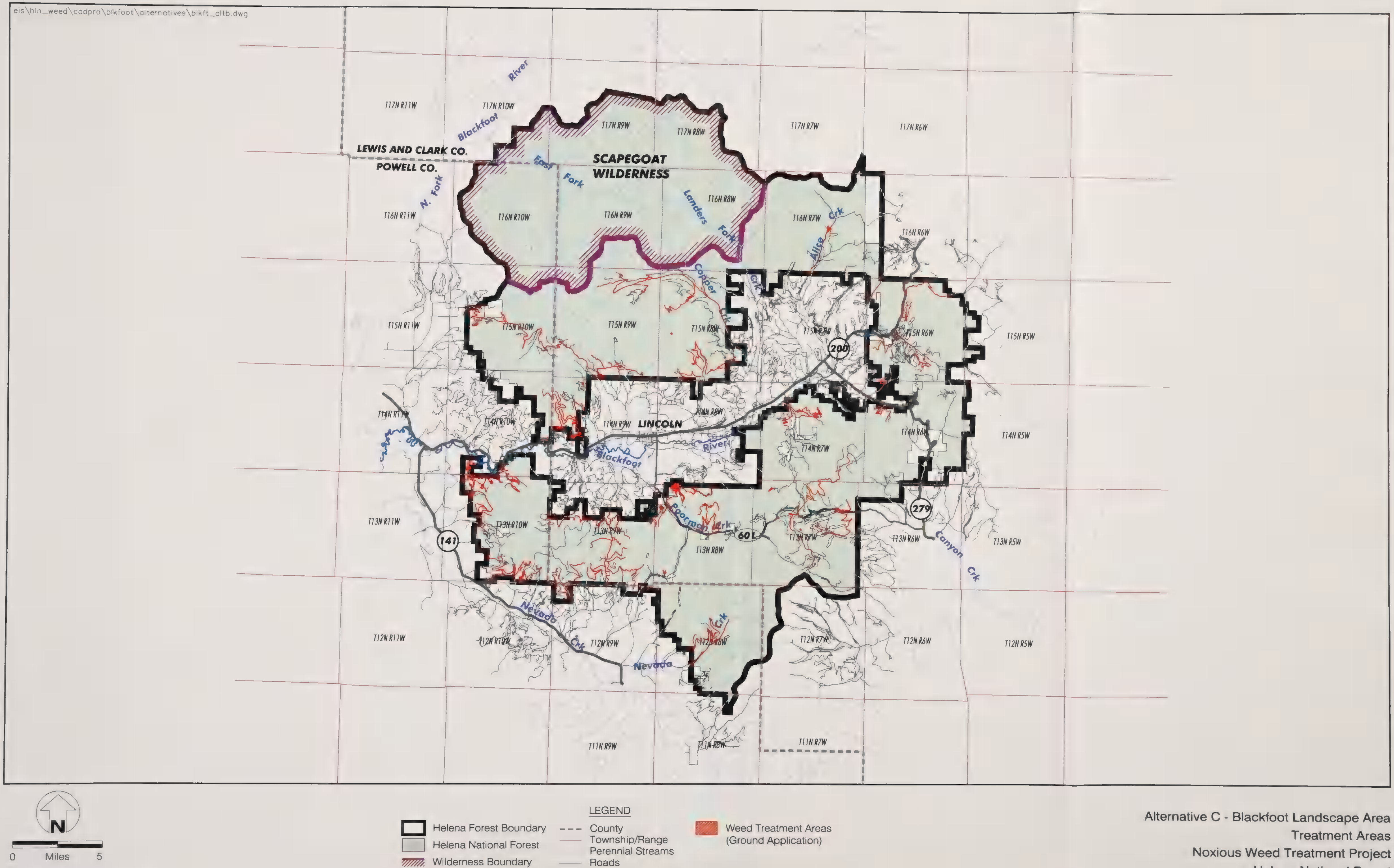


Note: Basemap data from Helena National Forest GIS database.

LEGEND

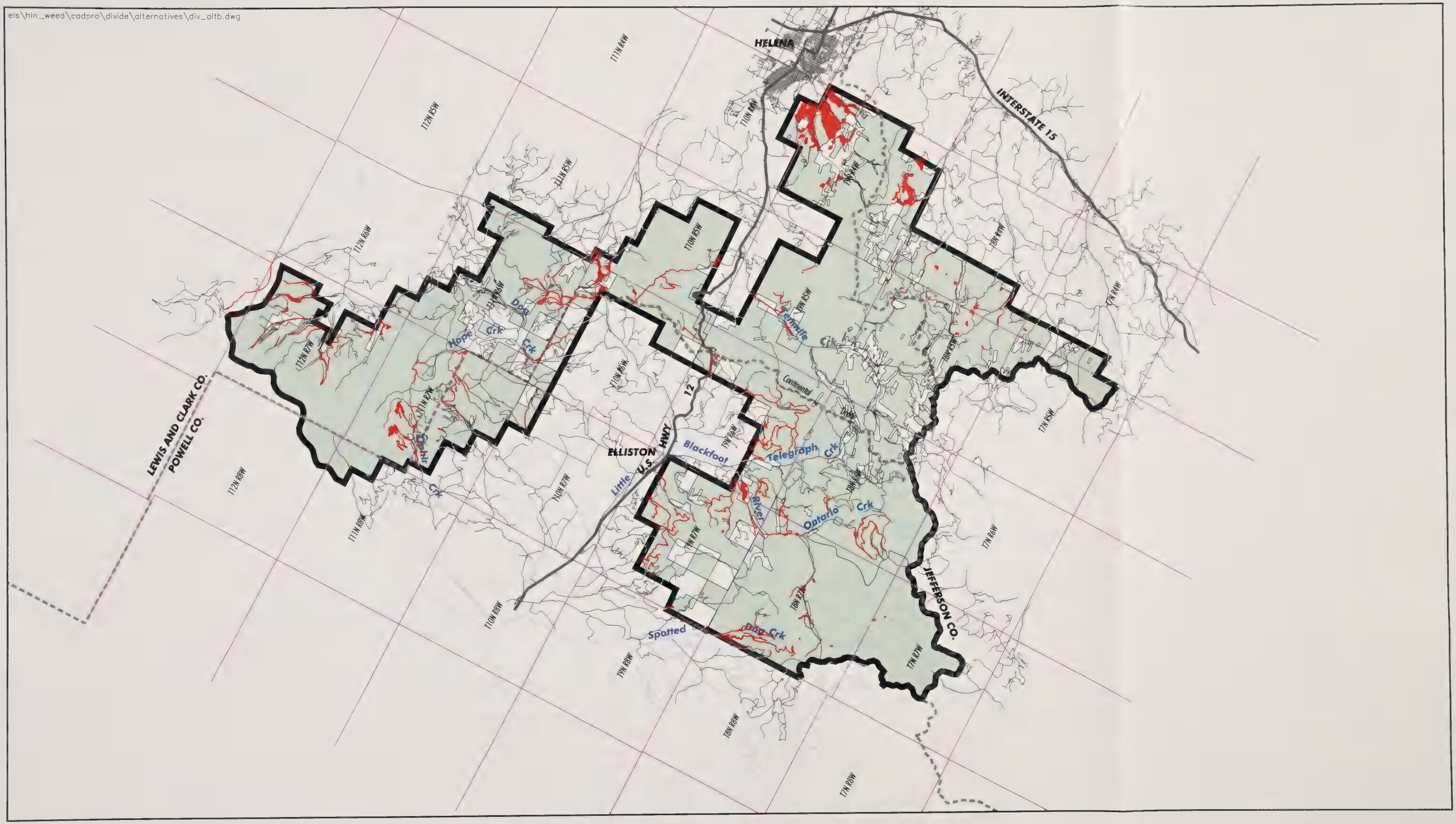
- Helena Forest Boundary
- Helena National Forest
- State
- County
- Township/Range
- Perennial Streams
- Roads
- Weed Treatment Areas (Ground Application)

Alternative C - Elkhorn
Landscape Area Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-10



Note: Basemap data from Helena National Forest GIS database.

Alternative C - Blackfoot Landscape Area
Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-11



LEGEND

- Helena Forest Boundary
- Helena National Forest
- County
- Township/Range
- Perennial Streams
- Roads
- Weed Treatment Areas (Ground Application)

Note: Basemap data from Helena National Forest GIS database.

Alternative C - Continental Divide
Landscape Area Treatment Areas
Noxious Weed Treatment Project
Helena National Forest
FIGURE 2-12

CHAPTER 3 AFFECTED ENVIRONMENT

CHANGES BETWEEN THE DRAFT AND FINAL EIS

Main changes in Chapter 3 include:

- Added discussions of Yellowstone cutthroat trout, burbot and arctic grayling.
- Updated Vegetation discussion with current references. Tables 3-10 and 3-11 were adjusted to reflect current plant sensitive species list. The sensitive plant species Austin knotweed was omitted from table 3-11 in the DEIS; this was corrected in the FEIS. Long-styled thistle and pale sedge have been dropped from the Table and from the final EIS discussion as they are not currently on the R1 sensitive species list.
- Corrected discussion of Affected Environment for Research Natural Areas to reflect the presence of about 5 acres of Canada thistle in the Granite Butte proposed RNA (rather than in Cabin Gulch RNA as identified in the DEIS) and to correctly describe the occurrence of weeds in Cabin Gulch as described in the establishment record.
- Information for Lewis and Clark County was added to Table 3-16, "Population by County, 2000".
- Updated wildlife discussions to reflect current modeling procedures and current vegetation information. Noted in the wildlife discussion that under the existing condition, USFWS is currently consulting on grizzly bear baseline conditions in the grizzly bear recovery area and the expanded grizzly bear distribution zone.
- The plains spadefoot toad has been added to the R1 sensitive species list and is now included in the EIS in the wildlife analysis and discussion.
- Updated fisheries discussion to reflect current status of critical habitat for bull trout, current conservation strategies for westslope cutthroat trout, and to incorporate watershed baseline conditions and references for the Blackfoot and Little Blackfoot drainages.
- Updated Water Resources discussion to incorporate current (2006) Montana water quality standards for herbicides; added discussion of a minor change in the human health standards for Dicamba as displayed in Table 3-1 (value went from 210 ppm in the draft EIS to 200 ppm in the final EIS for both groundwater and surface water).

INTRODUCTION

This chapter describes the existing condition of the physical, biological, and social resources within the Project Area that may be affected by the Proposed Action. The descriptions are based on the geographic scope of the project described in Chapter 1. The Analysis Methods section under each resource contains an explanation of the methods and sources of information used in the analysis. More detailed information on each resource can be found in the resource specialist's reports in the project file (PF).

This chapter also contains the regulatory requirements that management activities must meet or move towards meeting (primarily Forest Plan standards and other Federal and state laws and policies).

SOIL RESOURCES

REGULATORY FRAMEWORK

The Helena NF Plan has the objective of maintaining soil productivity and minimizing sedimentation by applying soil and water conservation practices.

The National Forest Management Act requires that lands be managed to ensure the maintenance of long-term soil productivity, soil hydrologic function, and ecosystem health. Soil resource management will be consistent with these goals.

The Forest Service Manual (FSM) 2550 - Soil Management has a goal to optimize sustained yields of goods and services without impairing the productivity of the land, and it is the policy of the Forest Service to manage forest and rangelands in a manner that will improve soil productivity.

Other laws and guidance include the Soil Conservation and Domestic Allotment Act (16 U.S.C. 590) that states soil erosion is a menace to national welfare and provides for the prevention of erosion on lands owned or controlled by the United States through a variety of means including the establishment of vegetative cover. In addition, Congress declares that unsatisfactory conditions on public lands present a high risk of soil loss, subsequent loss of productivity, and unacceptable levels of siltation that can be mediated by increased rangeland management (43 C.F.R. § 1901).

The Montana legislature encourages the use of best management practices in order to prevent soil erosion on forest lands (MCA 76-13-101). Standards for Forest Practices in Streamside Management Zones (MCA 77-5-303) prohibit the application of any hazardous material in a manner that may damage or cause injury to the land within a streamside management zone as defined in MCA 77-5-302.

ANALYSIS AREA

The analysis area for soil resources is the proximity of the proposed treatment areas.

ANALYSIS METHODS

Impacts on soil quality resulting from weed infestation and weed control measures associated with treatment alternatives are discussed below. Effects were determined through a review of scientific literature (PF-*Soils*). Many of the effects discussed are common for all herbicides on all soils within the Project Area.

AFFECTED ENVIRONMENT

The Helena NF soil survey (USFS 1988) describes soil characteristics in association with specific, detailed map units or land types located on the Helena NF. Locations and acres of weed infestations included in the following landscape area discussions are based on information provided by the Helena NF.

- **Belts/Dry Range Landscape Area** - Weed infestations occur on 529 sites. Affected soil occurs in a variety of topographic positions ranging from floodplains and terraces in lower elevations to higher elevation mountain ridges. Soil ranges from fine-textured clays to medium-textured sandy loams. Approximately 1,340 acres have surfaces subject to moderate erosion hazard while approximately 1,515 acres are subject to severe erosion hazard. Approximately 915 acres include areas such as wet meadows, floodplains, and draws where the water table fluctuates and can be at or within 30 inches of the soil surface, especially in the spring or early summer.
- **Blackfoot Landscape Area** - Weed infestations occur on 213 sites. Affected soil occurs in a variety of topographic positions ranging from floodplains and terraces in lower elevations to higher elevation mountain ridges. Soil ranges from moderately fine-textured silty clays to moderately coarse-textured sands. Approximately 3,215 acres have surfaces subject to moderate erosion hazard while approximately 790 acres are subject to severe erosion hazard. Approximately 135 acres include floodplains where the water table fluctuates and can be at or within 30 inches of the soil surface during spring months.
- **Continental Divide Landscape Area** - Weed infestations occur on 336 sites. Affected soil occurs in a variety of topographic positions ranging from floodplains and terraces in lower elevations to higher elevation mountain ridges. Soil ranges from medium-textured clay loams to moderately coarse-textured sandy loams.

Approximately 2,000 acres have surfaces subject to moderate erosion hazard while approximately 1,100 acres are subject to severe erosion hazard. Approximately 225 acres include areas such as wet meadows, floodplains, and draws where the water table fluctuates and can be at or within 30 inches of the soil surface, especially in the spring or early summer.

- **Elkhorn Landscape Area** - Weed infestations occur on 213 sites. Affected soil occurs in a variety of topographic positions ranging from floodplains and terraces in lower elevations to higher elevation mountain ridges. Soil ranges from medium-textured clay loams to moderately coarse-textured sandy loams. Approximately 780 acres have surfaces subject to moderate erosion hazard while approximately 610 acres are subject to severe erosion hazard. Approximately 35 acres include areas such as wet meadows, floodplains, and draws where the water table fluctuates and can be at or within 30 inches of the soil surface, especially in the spring or early summer.

Noxious weed infestations affect soil quality by out-competing native species for water and nutrient resources in the soil (Olson 1999a). Broadleaved weeds often produce deeper taproot systems and less canopy cover compared to the native species that they displace (DiTomaso 1999). Due to these physiologic and morphologic differences, weed infestations can have direct and indirect effects on soil properties resulting in negative changes in overall soil quality. The following information is related to weed species that occur on the Helena NF and can be assumed to be occurring where weed infestations are dense.

- Soil Organic Matter Content - Organic matter may be reduced or redistributed in weed-infested soil. Noxious weeds may decay more slowly than native species (Olson 1999a; Olson and Kelsey 1997). Slower decay rates result in less annual input of organic matter to the soil. Since noxious weeds also tend to have deeper roots and less foliage than native species, decay of these plants would contribute less litter and organic matter near the soil surface.

- Soil Water Interactions - Water infiltration can be reduced on weed-infested sites due to reduced cover (DiTomaso 1999; Olson 1999a). Lacey *et al.* (1989) measured significantly greater surface water runoff, indicating less infiltration, from spotted knapweed dominated sites compared to adjacent native grass dominated sites. Decreased soil organic matter can reduce the amount of water held in the soil (especially near the surface) (Brady and Weil 1999; Tisdall and Oades 1982).

- Reduced cover on weed infested sites can result in higher evaporation from the exposed soil surface (Lauenroth *et al.* 1994, Olson 1999a). On sites where weeds are dense, the high transpiration rate may deplete soil water stored deeper in the profile (Olson 1999a).

- Soil Erodibility - Weed infested soil has been shown to be more erodible than soil supporting native grass species (Lacey *et al.* 1989). With less cover than native species, weeds are less able to dissipate the kinetic energy of rainfall, overland flow, and wind that cause soil erosion (Torri and Borselli 2000; Fryrear 2000).

- Soil Biota - Since abundance of soil microbial biomass is generally related to the organic matter content of soils (Brady and Weil 1999), it is possible that weed infested soils may support smaller populations of microorganisms than non-infested soils. Considering the deeper root distribution and reduced litter production of weeds compared to native grasses it is possible that infestation would result in a change of the size and/or distribution of the soil microbial population.

- Soil Nutrient Availability - Noxious weeds directly limit nutrient availability through their ability to out compete native species for limited soil resources. Weeds have high nutrient uptake rates and can deplete soil nutrients to very low levels (Olson 1999a).

Potassium, nitrogen, and phosphorous levels were 44 percent, 62 percent, and 88 percent lower in spotted knapweed infested soil than in adjacent grass covered soil (Olson 1999a). In addition, some weed species germinate prior to native species and exploit nutrient (and water) resources before native species are actively growing (Olson 1999a). In instances where weed decomposition occurs slowly, nutrients remain immobilized in the plant tissue and unavailable for uptake by other species.

- Weeds indirectly limit nutrient availability due to increased soil erosion that can occur in infested areas. Erosion selectively removes organic matter and the finer sized soil particles that store nutrients for plant use, leaving behind soil with a reduced capacity to supply nutrients (Brady and Weil 1999).

WATER RESOURCES

REGULATORY FRAMEWORK

The Helena NF Plan (Forest Plan) includes management objectives for water resources, some of which are applicable to the proposed weed treatment project (USFS 1986). According to the Forest Plan, "The water currently meeting water quality standards would be maintained, by applying soil and water conservation practices that have been developed cooperatively by the State Water Quality agency and the Forest Service, and displayed in the Watershed Conservation Handbook (FSH 2509.25). To help identify the minimum requirements for projects that could degrade water quality, the effectiveness of state and local BMPs (best management practices) will be identified." In addition, "Soil productivity will be maintained and sediment will be minimized by applying soil and water conservation practices." A statement regarding herbicide in the Forest Plan is, "Use of chemicals within the riparian area will be minimized to the extent feasible, and will be coordinated with wildlife, watershed, and fisheries personnel, and a certified pesticide applicator."

Surface water is classified by the Montana Department of Environmental Quality (DEQ) (Administrative Rules of Montana [ARM] 17.30.607 & 610).

The beneficial uses of surface water in the Helena NF (except McClellan, Tenmile, and Prickly Pear Creeks) are drinking; culinary and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, furbearers; and agricultural and industrial water supply (ARM 17.30.623). Water in McClellan Creek (Elkhorn Landscape) and Tenmile Creek (Upper Missouri River Landscape) is to be maintained suitable for drinking, culinary, and food processing purposes after conventional treatment for removal of naturally present impurities (ARM 17.30.622). Water in Prickly Pear Creek (Upper Missouri River Landscape), which is impaired, has a goal of fully supporting beneficial uses after implementation of measures to improve water quality (ARM 17.30.628). Ephemeral streams and seasonal lakes/ponds are to be maintained suitable for agricultural purposes, secondary contact recreation, and wildlife (ARM 17.30.652 & 654).

Applicable standards for streams and rivers (except McClellan, Tenmile, and Prickly Pear Creeks) include: maximum allowable increase above naturally occurring turbidity of five nephelometric turbidity units (NTU), and no increases are allowed above naturally occurring concentrations of sediment or suspended sediment, settleable solids, oils, or floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife (ARM 17.30.623).

Specific prohibitions for pesticide use in Montana are described in ARM 17.30.637(8): Application of pesticides in or adjacent to state surface waters must be in compliance with the labeled direction, and in accordance with provisions of the Montana Pesticides Act (Title 80, chapter 8, Montana Code Annotated) and the Federal Environmental Pesticides Control Act (7 USC 136, et seq., [Supp. 1973] as amended). Excess pesticides and pesticide containers must not be disposed of in a manner or in a location where they are likely to pollute state waters.

In Montana, numeric water quality standards are specified in Circular DEQ-7, Montana Numeric Water Quality Standards (Montana DEQ 2006) as human health and/or aquatic life criteria (also refer to ARM 17.30. subchapter 6). **Table 3-1** shows Montana's human health water quality standards for herbicides that are proposed for use on the Forest. No numeric aquatic life standards have been established for these herbicides. Montana's water quality standards, however, do require surface waters to be free from substances that "will create concentrations or combinations of materials which are toxic or harmful to human, animal, or aquatic life" (ARM 17.30.637(l)(d)). Additionally, lethal concentrations, risk quotients, and expected environmental concentrations of the proposed herbicides are discussed in the Chapter 4 section of Fisheries and Aquatic Resources. Montana also has a "nondegradation" policy with associated rules (ARM 17.30.701-717; Montana Code Annotated [MCA] 75-5-301,303,306) that are intended to protect pristine surface water and groundwater.

Portions of the Federal Clean Water Act (CWA) also direct watershed management activities. Section 303(d) of the CWA directs states to list water quality impaired streams and develop total maximum daily loads (TMDLs) for the affected stream segments. Several streams and rivers in the Helena NF are on one or more of Montana's 303(d) lists of impaired water bodies. Section 319 of the CWA directs states to develop programs to control non-point source pollution. There are Section 319 projects currently underway in the Helena NF for the Blackfoot River headwaters area, the Lake Helena Planning Area, the Middle Blackfoot, and for Deep Creek.

ANALYSIS AREA

Watershed characteristics are described within hydrologic unit code (HUC) locations. The Project area is divided into four landscapes (**Figure 1-1**) that generally coincide with separate mountain regions: Belts/Dry Range, Elkhorn, Continental Divide, and Blackfoot. The four landscape areas are located within the following major watersheds at the 4th HUC level: Upper Missouri River, Smith River, Upper Clark Fork River, Boulder River, and Blackfoot River. Watersheds are generally discussed at the 6th HUC level, which is a further

TABLE 3-1
Montana's Water Quality Standards for Herbicides

Herbicide	Category	Human Health Standard micrograms per liter (µg/l)	
		Groundwater	Surface Water
Chlorsulfuron	Toxin	1,750	1,750
Clopyralid	Toxin	3,500	3,500
Dicamba	Toxin	200	200
2,4-Dichlorophenoxyacetic Acid (2,4-D)	Toxin	70	70
Glyphosate	Toxin	700	700
Hexazinone	Toxin	400	400
Imazapyr	Carcinogen	21,000	21,000
Imazapic*	NA	NA	NA
Metsulfuron Methyl	Toxin	1,750	1,750
Picloram	Toxin	500	500
Sulfometuron Methyl	Toxin	1,750	1,750
Triclopyr	Toxin	350	350

* No standard included.

Source: Montana DEQ 2006.

division of the 4th HUC level into smaller watersheds. A hydrologic unit is defined as an area of land upstream from a specific point on a stream (i.e., mouth) that defines a hydrologic boundary and includes all of the source areas that could contribute surface water runoff directly and indirectly to the designated outlet point.

All 149 6th HUC watersheds for the Helena NF are considered. The four Landscape Areas have the following number of 6th HUC watersheds: Belts/Dry Range Landscape = 59 watersheds; Elkhorns Landscape = 17 watersheds; Continental Divide Landscape = 32 watersheds; and Blackfoot Landscape = 41 watersheds.

For purposes of describing general watershed characteristics, nine of the 149 6th HUC watersheds in the project area will be used to represent the various geo-climatic conditions throughout the potential treatment areas. Proposed weed treatments would occur in 105 watersheds (**Figures 3-1** through **3-4**), including the nine representative drainages. The nine 6th HUC watersheds selected by the Helena NF as representative of project area conditions are listed below. The physical settings within these nine watersheds are displayed in **Table 3-2**.

Belts/Dry Range Landscape

Avalanche Creek – Upper Missouri River Basin

Magpie Creek – Upper Missouri River Basin

White Gulch – Upper Missouri River Basin

Elkhorn Landscape

McClellan Creek – Upper Missouri River Basin

Blackfoot Landscape

Copper Creek – Blackfoot River Basin

Nevada Creek – Blackfoot River Basin

Continental Divide Landscape

Ophir Creek – Upper Clark Fork Basin

Spotted Dog Creek – Upper Clark Fork Basin

Telegraph Creek – Upper Clark Fork Basin

ANALYSIS METHODS

Information for watersheds on the Helena NF was obtained from state and Federal agencies, including Montana Department of Environmental Quality (DEQ), Montana Natural Resource Information System (NRIS), Helena NF, U.S. Environmental Protection Agency (USEPA), and U.S. Geological Survey (USGS).

Drainage areas were determined using geographic information systems (GIS) methods. Flow characteristics of streams were obtained from a database maintained by the Helena NF. A few streams have actual flow measurements however, most flow information, including mean monthly flow and peak runoff values for storm events, were calculated using regression equations developed by USGS for ungaged sites.

TABLE 3-2
Physical Setting of Representative Watersheds

Watershed/ Stream	Receiving Water for Stream	Geographic Area	Dominant Geology
Belts/Dry Range Landscape			
Avalanche Creek	Canyon Ferry Reservoir & Missouri River	S-facing basin on S-side of Big Belt Mountains	Metasedimentary rock with limestone; unburned
Magpie Creek	Canyon Ferry Reservoir & Missouri River	S-facing basin on S-side of Big Belt Mountains	Metasedimentary rock with limestone; burned
White Gulch	Canyon Ferry Reservoir & Missouri River	S-facing basin on S-side of Big Belt Mountains	Metasedimentary rock; thinly bedded; unburned
Elkhorn Landscape			
McClellan Creek	Prickly Pear Creek	N-facing basin on N-side of Elkhorn Mountains	Granitic rock
Continental Divide Landscape			
Ophir Creek	Little Blackfoot River	S-facing basin on W-side of Continental Divide	Limestone
Spotted Dog Creek	Little Blackfoot River	N-facing basin on W-side of Continental Divide	Volcanic rock; glaciated and non-glaciated
Telegraph Creek	Little Blackfoot River	N-facing basin on W-side of Continental Divide	Granitic & volcanic rock; glaciated
Blackfoot Landscape			
Copper Creek	Landers Fork of Blackfoot River	SE-facing basin south of Scapegoat Wilderness	Metasedimentary rock; glaciated
Nevada Creek	Blackfoot River	SW-facing basin on W-side of Continental Divide	Metasedimentary rock

The analysis uses stream flow rates for two time periods – spring high flow (June) and fall low flow (September) – to provide realistic dilution factors for herbicide runoff in the primary stream channels of each watershed. These two time periods approximate each end of the general season of herbicide application in the Helena NF. For June, the flood magnitude for a two-year recurrence interval (Q_2) was used to simulate dilution of herbicide in each stream during that time of year. For September, the mean monthly streamflow exceeded 20 percent of the years ($Q_{.20}$) was used to simulate lower flow conditions during that time of year. These flows were then used as input values to model resultant herbicide concentrations after mixing and diluting in the streams for each watershed (see Aquatic Resources Report in the project file for results of these calculations).

Sediment impacts are discussed qualitatively, as are point-source impacts from herbicide leaks and spills, and impacts on surface water and groundwater, because of attenuation and degradation mechanisms for herbicide in the environment, and the lack of water supply wells.

AFFECTED ENVIRONMENT

Watershed Characteristics

The Belts/Dry Range Landscape is located primarily within the Upper Missouri River drainage basin, with a small part in the Smith River drainage basin. The Elkhorn Landscape is also primarily located within the Upper Missouri River basin, with a minor portion in the Boulder River basin. The Continental Divide Landscape is located within the Upper Missouri River and Upper Clark Fork River drainage basins. The Blackfoot Landscape is located primarily in the upper Blackfoot River drainage basin, with a minor part in another part of the Upper Missouri River basin.

Physiography

Average annual precipitation at Helena, Townsend, and Lincoln are 11.3, 10.7, and 18.8 inches, respectively, for the period 1971-2000 (National Weather Service 2002); however, considerably more precipitation (30 to 60+ inches annually) occurs at higher elevations in the surrounding mountains. Highest monthly precipitation typically occurs in May/June, with some higher elevations also receiving high monthly totals in December and January due to snowfall. Information from seven snow monitoring stations (Snowtel) in the Helena NF (Copper Bottom, Nevada Ridge, Frohner Meadow, Rocker Peak, Tizer Basin, Boulder Mountain, and Pickfoot Creek) for a 30-year period shows that average maximum monthly snowpack ranges from 8 to 22 inches water equivalent, occurring in the months of April and May (MDNRC 2003). These stations range in elevation from 5,200 to 8,000 feet.

Drainage areas (total and Helena NF area) for the nine representative watersheds are presented in **Table 3-3**. Approximately 3,000 miles of streams are present in the Helena NF. The watersheds are snowmelt and rainstorm runoff dominated. Precipitation in the form of snow causes peak flows in the spring during snowmelt runoff. Streamflows increase as snowmelt occurs, usually beginning in April or May, and reach peak levels typically in May or June, depending on weather conditions and temperature fluctuations. After the peak, flows decrease through July and August. In September and October, when air temperatures decrease, streamflows increase slightly, after which they remain fairly consistent until spring runoff. Occasional brief intense storm events in spring/summer can cause sudden increases in runoff, sometimes causing flooding.

Many drainages are ephemeral or intermittent – flowing primarily in response to storms and/or snowmelt runoff. **Table 3-4** shows stream miles (intermittent and perennial) for the nine representative watersheds. Widespread forest fires have changed the natural flow pattern (i.e., greater runoff and sedimentation) in some areas that had significant burning (see "Effects from Fires" section below).

At lower elevations, where valley bottoms widen and gradients become less steep, the streams generally are less confined and have well-developed floodplains. Wider, valley bottom streams typically are stable because they can dissipate energy on the floodplain. These streams usually carry sediment during high flow and deposit it during lower flow periods. The finer-grained alluvial deposits on bed and banks of wider valley bottom streams can be easily eroded each year during high flow. In these stream systems, stream bank vegetation is important in maintenance of channel stability. Depending on condition of stream banks, bank erosion and channel migration may occur during periods of high flow.

Effects from Fires

The Cave Gulch fire in 2000 burned approximately 29,300 acres across portions of four watersheds in the central part of the Belts/Dry Range Landscape (USFS 2000a). The primary watershed affected was Magpie Creek. The Maudlow-Toston Fire in 2000 burned approximately 10,678 acres of National Forest System land across portions of several watersheds in the southern part of the

TABLE 3-3
Areas for Representative Watersheds

Watershed/ Stream	Total Drainage Acres	Helena NF Drainage Acres
Belts/Dry Range Landscape		
Avalanche Creek	25,018	22,456
Magpie Creek	16,249	15,600
White Gulch	20,450	12,436
Elkhorn Landscape		
McClellan Creek	23,144	14,096
Continental Divide Landscape		
Ophir Creek	16,786	5,748
Spotted Dog Creek	8,801	5,094
Telegraph Creek	12,205	10,254
Blackfoot Landscape		
Copper Creek	30,309	25,165
Nevada Creek	25,180	17,852

TABLE 3-4
Stream Distance for Representative Watersheds

Watershed	Total Stream Miles[1]	Intermittent Stream Miles[1]	Perennial Stream Miles[1]	Stream Density[2]
Belts/Dry Range Landscape				
Avalanche Creek	75.9	63.2	12.7	2.19
Magpie Creek	60.3	47.9	12.4	2.51
White Gulch	40.2	30.6	9.6	2.16
Elkhorn Landscape				
McClellan Creek	26.1	5.5	20.6	1.32
Continental Divide Landscape				
Ophir Creek	6.3	3.6	2.7	0.85
Spotted Dog Creek	8.6	0.0	8.6	1.26
Telegraph Creek	21.0	8.6	12.4	1.68
Blackfoot Landscape				
Copper Creek	68.8	32.2	36.6	1.77
Nevada Creek	40.7	22.3	18.4	1.83

Notes:

1 All distances are based on Helena NF land only.

2 Stream Density = Total Stream Miles divided by watershed area (in square miles).

Source: USFS 2002b.

Belts/Dry Range Landscape, including Sulphur Bar, Cedar Bar, Blacktail, Black Butte, Deep, and Dry Creeks (USFS 2001d). Fires burned with low to high severity over 10 to 90 percent of these watersheds. In 2003, the Snow-Talon Fire burned approximately 35,000 acres of National Forest System land across portions of several watersheds north of Lincoln in the Blackfoot Landscape, including Copper Creek and Landers Fork. An estimated 50-55% of those acres were mapped as high burn severity (USFS 2005). There have been several small fires on the Forest since the DEIS for this project, including the Jimtown Fire in the Belts/Dry Range Landscape and the Moose-Wasson Fire in the Blackfoot Landscape. Additional fires are expected to occur in the future.

Watershed and stream channel conditions are adjusting to changes in water and sediment yield resulting from the fires. Wildfire removes large amounts of forest canopy, resulting in increasing stream temperatures, runoff response to precipitation, and erosion. As an example, the Maudlow-Toston fire burned about 2,900 acres (37 percent) of the Sulphur Bar Creek watershed. Based on predictions of pre-fire sediment production, the fire increased sediment yield by over 1,000 percent, with a total sediment production rate of 1,650 tons/year (USFS 2001d). Estimated increase in water yield for this watershed after the 2000 fires is about seven percent (USFS 2001d).

Surface Water Quality

Generally, surface water quality is good. Sediment (suspended and bedload) is the water quality parameter that is often most affected by land management. Activities that disturb vegetation or soil surface have potential to produce sediment from increased erosion. Sediment in streams and rivers is naturally a highly variable parameter, with higher loads usually in the spring runoff period. Roads, logging, and grazing activities are sources of increased sediment and nutrients in streams. Some areas of historic mining disturbance have resulted in increased metal and sediment loads to streams.

Water samples were collected from several streams in the project area (USFS 2002b). Of the nine representative watersheds, water quality data are available for Avalanche Creek (1984-93), upper and lower McClellan Creek (1979-93), upper and lower Telegraph Creek (1989-95), and Copper Creek (1988-98). Parameters typically measured for the surface water samples include: water temperature, pH, specific conductance, suspended sediment, turbidity, bedload, alkalinity, and hardness. These data show the following general quality conditions: neutral pH (6.0 – 8.5); specific conductance less than 500 micromhos/ centimeter; alkalinity less than 250 milligrams/ liter; and hardness less than 300 milligrams/liter. Water temperature, suspended sediment, and turbidity vary considerably depending on the season and streamflow. A check of water quality records from state and federal agencies discovered no data exists for pesticides/ herbicides in surface water in the project area.

Table 3-5 lists representative water bodies or stream segments on one or more of Montana's 303(d) lists (water quality limited waterbodies). For the nine representative watersheds, six have been on the 303(d) lists:

Belts/Dry Range Landscape

Avalanche Creek – 16.5 miles impaired

Magpie Creek – 12.7 miles impaired

White Gulch – 12 miles impaired

Blackfoot Landscape

Nevada Creek – 18.3 + 24.9 miles impaired

Continental Divide Landscape

Spotted Dog Creek – 10 miles impaired

Telegraph Creek – 4.9 + 2.4 miles impaired.

WILDLIFE

REGULATORY FRAMEWORK

Regulations on wildlife resources are outlined in 36 CFR 219.19 and 219.27. These regulations state that management indicator species (MIS) will be identified by each national forest in order to adequately maintain distributed habitat for these species and to evaluate the impacts of management activities on these species. Forest Service Manual (FSM) 2670.31 (6) directs "identify and prescribe

TABLE 3-5
Impaired Water Bodies for Representative Watersheds

Stream Segment & Years on 303(d) List	Segment Length (miles)	Probable Impairment Causes[1]	Probable Impairment Sources[2]
Belts/Dry Range Landscape			
Avalanche Creek (1996, 1998, 2000, 2002, 2004)	16.5	1, 3	1, 9, 11, 17
Magpie Creek (1996, 1998, 2004)	12.7	1, 2	10, 11
White Gulch (1996, 1998, 2004)	12	1, 2	1, 19, 20
Elkhorn Landscape			
None			
Continental Divide Landscape			
Spotted Dog Creek (1996, 1998, 2000, 2002, 2004)	10	1	1, 6
Telegraph Creek (1996, 1998, 2000, 2002, 2004)	4.9	2, 8, 10, 12	12, 14, 18, 19
	2.4	9, 10, 11	18, 19
Blackfoot Landscape			
Nevada Creek (1996, 1998, 2000, 2002, 2004)	18.3	2, 6, 7, 10, 13	1, 6, 10, 19, 20
	24.9	1, 2, 7, 8	1, 4, 13

Notes:

[1] Causes: 1 = flow alteration; 2 = other habitat alterations; 3 = dewatering; 4 = thermal modifications; 5 = phosphorus; 6 = nitrogen; 7 = nutrients; 8 = siltation; 9 = mercury; 10 = metals; 11 = lead; 12 = riparian degradation; 13 = suspended solids.

[2] Sources: 1 = agriculture; 2 = construction; 3 = land development; 4 = habitat modification (other than hydromodification); 5 = removal of riparian vegetation; 6 = grazing-related; 7 = pasture grazing – riparian construction; 8 = highway/road/bridge construction; 9 = irrigated crop production; 10 = range grazing – riparian; 11 = crop-related; 12 = logging road construction & maintenance; 13 = bank or shoreline modification & destabilization; 14 = silviculture; 15 = intensive animal feeding operation; 16 = confined animal feeding operation (NPS); 17 = hydromodification; 18 = abandoned mining; 19 = resource extraction; 20 = placer mining; 21 = channelization.

Source: Montana DEQ 2004.

measures to prevent adverse modifications or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species."

Forest Service Manual (FSM) 2670 at 2670.22 - Sensitive Species, provides the following direction for sensitive wildlife:

- Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions.
- Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands.
- Develop and implement management objectives for populations and/or habitat of sensitive species.

The Endangered Species Act requires the conservation of threatened and endangered species, and prohibits carrying out or authorizing any action that may jeopardize a listed species or its critical habitat.

The National Forest Management Act (NFMA) provides for balanced consideration of all resources. It requires the Forest Service to plan for diversity of plant and animal communities. Under its regulations, the Forest Service is to maintain viable populations of existing and desired species, and to maintain and improve habitat of management indicator species.

The Helena National Forest Plan provides standards and guidelines for management of wildlife species and habitats on the Forest. The Forest Plan also identifies Management Indicator Species (MIS).

ANALYSIS AREA

The analysis area for wildlife includes species-specific habitats in proximity to proposed treatment areas. These habitats have the potential to be directly or indirectly impacted by herbicide application and disturbances associated with the proposed weed treatment methods.

ANALYSIS METHODS

Published reports in scientific journals were reviewed along with file data from the Helena National Forest, unpublished reports, and personal communications. A detailed discussion of the effects on wildlife of each herbicide proposed is included in the project file (PF-*Wildlife*).

A list of sensitive species that could potentially occur on the Forest was obtained from the list of species compiled by Region 1, Forest Service at http://www.fs.fed.us/r1/wildlife_senspecies.pdf. Information on ecology, distribution, and habitat affinities for sensitive species was also obtained from the Montana Natural Heritage Database on the Internet at http://nhp.nris.state.mt.us/animal/index.html.

Species known to occur on the forest and species with the potential to occur are identified and discussed. Potential impacts were assessed based on animal habitat affinities and probability that a given habitat would be treated with herbicide to control noxious weed communities. Habitat was also modeled for marten, pileated woodpecker, hairy woodpecker, lynx, flammulated owl, and goshawk. Modeling documentation is in the project file.

AFFECTED ENVIRONMENT

MANAGEMENT INDICATOR SPECIES

The Helena NF has identified and monitors populations of several wildlife species in its efforts to manage activities and habitats on the forest. These MIS are discussed below. While classified as a MIS on the Helena NF, goshawks are also listed as Sensitive species. Therefore, goshawks are discussed in the *Threatened, Endangered, Proposed, and Sensitive Species* section of the document.

Marten

Marten are a MIS for large continuous blocks of mature cover. Reviews by Buskirk and Rugerrio (1994) and Clark (1987) indicate that marten are closely associated with mesic late-successional conifer or mixed forests, particularly those with complex structure near the ground. Marten tend to prefer stands with well developed understory consisting of woody debris, abundant shrub and forb vegetation, low branches of living trees, talus fields and squirrel middens (Buskirk and Rugerrio 1994; Clark 1987, Strickland and Douglas 1987). Riparian areas provide important resting and foraging areas, and travel corridors (Clark 1987). Large open areas, clear-cuts, and burned areas tend to be avoided, although marten will use the edges of open areas (Buskirk and Rugerrio 1994; Clark 1987, Strickland and Douglas 1987). Avoidance of clear-cuts and burned areas may persist for as long as 23 years, until regenerated forests provided overhead cover (Clark 1987; Strickland and Douglas 1987). Thus, the likelihood of marten inhabiting burned areas, big game winter ranges, and recently harvested stands proposed for weed treatment is low. The diet of marten consists primarily of voles, mice, and squirrels. Snowshoe hare is the largest usual prey item. However, marten are opportunistic and will feed on a variety of birds and their eggs, reptiles, amphibians, invertebrates, and fruits (e.g., *Vaccinium* spp.) (Buskirk and Rugerrio 1994; Clark 1987).

Across the Forest, marten occur in areas of older, larger spruce and spruce/fir and lodgepole stands in alpine areas (USFS 1999a; USFS 1995b). Based on habitat modeling conducted by the Helena NF, approximately 192, 783 acres of pine marten habitat are estimated to exist on the Forest, with both primary and secondary marten habitat occurring in each of the four landscape areas (Metadata 2004). Within the Belt Landscape, 174 acres of weed infestation are located in either primary or secondary marten habitat, which represents less than one percent of the 38,961 acres of modeled marten habitat. Within the Divide Landscape, approximately 393 of these mapped weed infestations occur within primary or secondary marten habitat, representing less than 1% of modeled marten habitat (52,327 acres total). The Elkhorn Landscape contains 6.3 acres (less than one percent) of mapped weed infestation occurring in 29,558 acres of modeled marten habitat. In the Blackfoot Landscape, 285 acres occur within the 71,937 acres of modeled marten habitat, representing less than one percent of marten habitat (PF-*Wildlife*).

Pileated Woodpecker

Pileated woodpeckers are a MIS for old growth habitat. They inhabit a wide range of habitats from river bottom cottonwood forests to the upper ranges of dry Douglas-fir stands where there is a food source and dead trees large enough to accommodate a nest cavity. Pileated woodpeckers often feed on ants, other insects, and larvae in dead woody material lying on the ground. They tend to nest in snags greater than 21 inches in diameter with nest cavities usually more than 40 feet above the ground (Bull and Jackson 1996). On the Helena NF, pileated woodpecker habitat occurs in mature ponderosa pine and Douglas-fir stands, containing large snags, decaying trees, and downed woody debris (USFS 1995b; USFS 1996a; USFS 2003a).

Based on habitat modeling conducted by the Helena National Forest, approximately 174,980 acres of pileated woodpecker habitat are estimated to exist on the Forest, with habitat occurring in each of the four landscape areas (Metadata 2004). Within the Belt Landscape, 469 acres of weed infestation are located in pileated woodpecker habitat, which represents less than one percent of the 63,870 acres of modeled pileated habitat. Within the Divide Landscape, approximately 400 of these mapped weed infestations occur within pileated woodpecker habitat, representing less than 1% of the 44,033 acres of modeled habitat. The Elkhorn Landscape contains 56 acres (less than one percent) of mapped weed infestation occurring in 19,958 acres of modeled pileated habitat. In the Blackfoot Landscape, 472 acres of weed infestation occur within the 54,119 acres of modeled pileated habitat, representing approximately one percent of modeled pileated woodpecker habitat (PF-*Wildlife*).

Hairy Woodpecker

Hairy Woodpeckers are a MIS for snag dependent species (USFS 2001d). Suitable habitat for this species includes old-growth mesic coniferous and deciduous stands of Douglas-fir, spruce, subalpine fir, ponderosa pine, lodgepole pine, aspen woodland, as well as riparian woodland, and subalpine marsh. Hairy woodpeckers primarily eat insects such as ants and beetles they retrieve from the bark of dead trees, although they also use fruits and seeds in the winter or in times of famine. Hairy woodpeckers have been known to utilize a variety of forest types, including aspen forests and associated wetlands, although they're typically found more frequently in cut or early post-fire forests than in uncut forests. According to Helena NF annual monitoring data, hairy woodpeckers were located on the Forest in "numerous" locations and in a variety of habitats during 2001(USFS 2002e).

Based on habitat modeling conducted by the Helena NF, approximately 289,984 acres of hairy woodpecker habitat are estimated to exist on the Forest, with habitat occurring in each of the four landscape areas (Metadata 2004). Within the Belt Landscape, 2,775 acres of weed infestations are located in hairy woodpecker habitat, which represents three percent of the 88,331 acres of modeled hairy woodpecker habitat. Within the Divide Landscape, 1,037 of mapped weed infestations occur within hairy woodpecker habitat, representing one percent of the 63,997 acres of modeled habitat. The Elkhorn Landscape contains 136 acres (less than one percent) of mapped weed infestation occurring in 23,098 acres of modeled hairy woodpecker habitat. In the Blackfoot Landscape, 1,175 acres of weed infestation occur within the 114,558 acres of modeled hairy woodpecker habitat. This represents one percent of modeled habitat (PF-*Wildlife*).

Elk

Elk are a MIS for summer and winter range and thermal and hiding cover (USFS 1986). Early summer range is mid-to-high elevation grassland, old burns, and meadows interspersed within forests of lodgepole pine, spruce, Douglas-fir, and subalpine fir (USFS 1998a). As summer progresses, elk break into smaller groups and spend more time in higher elevation forested areas. Protection from human disturbance as well as succulent forage are major factors that lure elk to these summer ranges (USDA 2002). Winter ranges are found at lower elevations. Winter ranges typically contain relatively low elevation grasslands and shrublands, usually on south to southwest facing slopes. Adjacent north/northeast-facing slopes often contain forested stands, where they find security and thermal cover (USDA 2002). Adequate winter range is considered crucial for elk survival, and loss of winter range to development, grazing, agriculture, or other intensive land use potentially threatens elk populations in certain areas (USDA 2002). Elk are found throughout the Helena NF in all landscape areas (USFS 1986; USFS 1995b; USFS 1996a; USFS 1997a; USFS 1999a).

Weed infestations can and have decreased the total amount of quality forage available primarily on winter ranges and on transitional ranges on and near the Forest during the past few decades. In comparing the distribution of winter range in all landscape areas with areas proposed for weed treatment, approximately 80 percent of mapped weed acres lie within mapped winter range in the Belt, Blackfoot, and Elkhorn landscapes; and approximately 50 percent lie within mapped winter range in the Divide Landscape (PF-*Wildlife*). The remainder of the weed infestations (20 percent in the Belt, Blackfoot, and Elkhorn landscapes, 50 percent in the Divide Landscape) occur in areas considered either transitional or summer range for elk. Higher elevation summer range, due to its relative inaccessibility, is not as susceptible to infestation by weeds.

Mule Deer

Mule deer are a MIS for "secure" winter range. Mule deer are found in a variety of habitats, though they are generally associated with relatively open habitats. Dense stands of timber are used primarily for hiding and thermal cover. Mule deer are migratory, summering at higher elevations and wintering at low elevations, where their winter range often coincides with that of elk. Individual deer may spend all year at lower elevations. As with elk winter range, it is likely that some mule deer ranges are currently infested with noxious weeds.

Montana's mule deer populations are currently meeting or exceeding objectives in many areas just 4-5 years since the lows experienced during the period 1995-1997. Although populations are not at the highs recorded in the early 1990s, populations are rebounding toward previous levels rather rapidly. Winter weather, summer forage conditions, and hunting season harvest typically play a role in regulating the dynamic nature of mule deer populations in Montana, including on the Helena NF (Muledeernet 2003).

Bighorn Sheep

Bighorn sheep are a MIS for big game. Bighorn sheep habitat is open grasslands usually on steep terrain in mountainous country, often interspersed with or adjacent to cliffs or rocky outcrops. For the most part, bighorn sheep on the Helena NF are relatively sedentary. Though their summer range may expand somewhat, many bighorn sheep incorporate the winter range within their summer range. Lambing areas are usually rocky outcrops or cliffs found within or near the winter ranges. In some cases, summer ranges may be at high elevations and somewhat distant from the winter range, particularly for adult rams. Bighorn sheep winter ranges are often part of elk winter ranges, and based on the mapped distribution of proposed weed treatment areas associated with winter range, it is likely that some winter ranges used by bighorn sheep currently contain weed populations.

THREATENED, ENDANGERED, PROPOSED, AND SENSITIVE SPECIES

Table 3-6 lists special status wildlife species. Several wildlife species that are listed as threatened, endangered, or are proposed for listing, are present on the Helena NF. In addition, several species listed by the Forest Service as sensitive are also present. Many of these "special status" species also serve as MIS. The U. S. Fish and Wildlife Service provided a list of federally listed wildlife species with potential to occur on the Helena NF (USFWS 2002).

Grizzly Bear -Threatened

Grizzly bears are a MIS for habitat effectiveness and open road density. Grizzly bears are wide-ranging and can be found in a variety of habitats from dense forests to subalpine meadows and arctic tundra. Typically, they inhabit rugged mountains and forests with large river valleys undisturbed by human encroachment. Grizzlies require large blocks of lightly roaded country with a mix of productive habitats in order to establish viable populations (USFWS 1993). Across most of the Helena NF, grizzlies are considered to be transient due to fragmentation of suitable habitat by roads and human activity, although no formal research has been undertaken to determine the suitability of habitat outside of the recovery zone.

Approximately 175,555 acres of the grizzly bear ecosystem occurs within the HNF. In recent years, grizzly bears have been expanding their range. There are an estimated 336,165 acres of the grizzly bear distribution area on the HNF, with 283,210 acres of this area being outside the Scapegoat Wilderness. The Scapegoat Wilderness is part of the Bob Marshall Wilderness complex, which is an occupied core habitat block. Although most grizzly bears are yearlong residents of the Scapegoat Wilderness, some bears make use of denning areas, spring habitat, and other isolated resource areas south of the Scapegoat Wilderness and north of Montana Highway 200. Mapped distribution outside of the grizzly bear recovery zone encompasses the Blackfoot LA and extends south into the Continental Divide LA. Specifically, the mapped distribution zone extends north from Mullan Pass and includes all portions of the National Forest from that point to the Northern Continental Divide Ecosystem Recovery Zone (USFS et al. 2002). Therefore the area of analysis for grizzly bears includes all of the National Forest north of Mullan Pass.

Due to this expansion of grizzly bears into previously unoccupied areas, effects to grizzly bears associated with implementation of the Helena National Forest Plan needed to be analyzed. Subsequently, consultation with the U.S. Fish and Wildlife Service was initiated to determine the effects of the environmental baseline on grizzly bears.

Grizzlies eat everything from grasses, sedges, roots, and berries to insects, fish, carrion, and small and large mammals. Grizzlies eat large amounts in summer and fall to build up enough fat reserves to survive the denning period.

Gray Wolf -Endangered/Non-Essential Experimental Population

The gray wolf is currently listed as endangered in the Blackfoot and Continental Divide Landscape Areas and as a Non-essential Experimental Population in the Elkhorn and Belts/Dry Range Landscape Areas.

Gray wolves are nocturnal predatory carnivores. They tend to occupy coniferous forests as well as mixed grasslands, tundra, and shrublands. In general, gray wolves do not typically favor any one habitat more than another. Thus, as long as prey and secure denning and rendezvous sites are available, wolves are not habitat-limited (USFWS 1993).

TABLE 3-6
Helena National Forest Special Status Wildlife Species

Species	Scientific Name	Status on Forest	Potential for Occurrence on Treatment Areas[1]	Habitat
Grizzly Bear	*Ursus arctos horribilis*	Resident/ Transient	Potential within Blackfoot and Divide landscapes	Alpine/subalpine coniferous Forest
Gray Wolf[2]	*Canis lupus*	Resident/ Transient	Potential within Divide and Blackfoot landscapes	Variable
Bald Eagle	*Haliaeetus leucocephalus*	Resident / Migrant	Unlikely	Forest near major waterways
Canada Lynx	*Lynx canadensis*	Resident	Low potential in all landscape areas	
Black-backed Woodpecker	*Picoides arcticus*	Documented	Low potential in all landscape areas	Douglas-fir, lodgepole pine, & subalpine fir forests with lots of snags, Recent burns
Boreal Toad	*Bufo boreas*	Documented	Potential	Adults occur in a wide variety of uplands. Breed in shallow ponds, lakes or slow moving streams.
Plains Spadefoot Toad	*Spea bombifions*	Suspected	Low potential	Grasslands and sagebrush in shallow temporary pools usually following heavy spring or summer rains.
Fisher	*Martes pennanti*	Documented	Recently documented by photograph and other reliable sightings in the Continental Divide LA.	Mesic forested habitats
Flammulated Owl	*Otus flammeolus*	Documented	Potential in low to moderate severity burns, edges of ponderosa pine shrub/grass stands.	Old-growth ponderosa pine, Douglas-fir
Leopard Frog	*Rana pipiens*	Documented Historically near Forest	Potential in low elevation wetland/riparian areas	Marshes, wet meadows, riparian areas, and moist open meadows
Northern Bog Lemming	*Synaptomys borealis*	Suspected	Unlikely	True bogs, wet alpine & sub-alpine meadows
Peregrine Falcon	*Falco peregrinus*	Documented	Unlikely	Open habitats near cliffs and mountains
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Documented	Unlikely	Caves, mines, snags for roosts
Wolverine	*Gulo gulo*	Documented	Unlikely	Far ranging omnivorous habitat generalist
Northern Goshawk	*Accipiter gentilis*	Documented	Low potential in all landscapes.	Mature to old-growth forest

Notes:

1. Potential for Occurrence on Treatment Areas based on habitat associations and general habitats proposed for treatments.
2. Gray wolves west of Interstate Highway 15 are listed as Threatened. East of Interstate Highway 15, they are listed as Non-Essential Experimental.

In recent years, gray wolves have been increasingly observed throughout western Montana. The Bob Marshall Wilderness complex immediately north of the Scapegoat Wilderness is the core of a designated wolf recovery area that extends south into the Blackfoot LA. Based on the availability of prey and habitat on the Helena NF, and the numerous recorded sightings of wolves within the past five years, it is likely that wolves are dispersing southward through the Blackfoot and Continental Divide LAs along the Continental Divide corridor from the growing northern populations (USFS 1998a).

The predominant prey for gray wolves is ungulate populations including elk, deer, and moose. In times of famine, alternative prey, such as beaver, snowshoe hare, rodents, and carrion may be taken. Occasionally, gray wolves will kill mountain lions and sometimes seize ungulate prey killed by lions.

The Helena NF had three established packs up until February 2003, the Great Divide Pack, Castle Rock, and Halfway Pack ranging throughout the Continental Divide LA. In February 2003, the Castle and Halfway Packs were eliminated due to excessive depredation. Currently, the Great Divide Pack is the only known wolf pack on the Helena NF (USFWS 2003, personal communication). However, there have been confirmed sightings of wolves in the sourthern Elkhorn LA and near the location of the former halfway pack (J. Fontaine, USFWS, personal communication).

Bald Eagle -Threatened

Bald eagles are a MIS for river and lake system suitability. Bald eagle nesting and roosting habitat typically includes mature and over-mature mixed conifer, ponderosa pine, and cottonwood stands near large rivers or lakes. Bald eagles are common winter residents in the Missouri River valley and also pass through the Helena NF during migration. There are two active nests near the Blackfoot and Continental Divide LAs, one west of Lincoln and one south of the Nevada Creek Reservoir; however, neither of these are on Forest System land (USFS 1998a). There are three known bald eagle nests on the Forest, all of which are in the Belts/Dry Range LA. The nests occur at Cochran Gulch, Fields Gulch, and downstream from Hauser Dam (PF-*Wildlife*).

The presence of nests indicates there is an adequate summer forage base to support nesting pairs and young. Eagle activity on most areas of the Forest is probably limited to overflights, rest stops at scattered perch sites, and foraging on carrion – particularly in spring and fall (USFS 1998a). In areas where substantial portions of the major rivers become frozen in winter, the bald eagles leave the area in search of more suitable habitat.

Canada Lynx -Threatened

Lynx often inhabit forested benches, plateaus, valleys, and gently rolling ridgetops in rugged mountain ranges. Primary lynx habitat in the Rocky Mountains includes lodgepole pine, subalpine fir, and Englemann spruce forests. Secondary vegetation interspersed throughout high elevation forests, including cool, moist Douglas-fir, grand fir, western larch, and aspen, may also contribute to lynx habitat. They prefer to forage in areas that support their primary prey, the snowshoe hare. Landscapes with varying age classes that support dense understory vegetation provide good foraging habitat. Moist Douglas-fir types are considered secondary habitat that can provide red squirrels, an alternate prey species for lynx during periods when snowshoe hare densities are low. Dry forest types (ponderosa pine, Douglas-fir, and climax lodgepole pine) do not typically provide lynx habitat. Lynx are notoriously elusive and therefore are extremely hard to survey. The most recent report of a lynx comes from the Copper Creek drainage within the Blackfoot River Valley in November of 1998 (USFS 1998a).

Fire can modify lynx habitat in a variety of ways, depending on its location, size, and severity. Large, stand-replacing fires can result in habitat loss if they occur in key areas such as travel corridors or within denning habitat. Fire can also improve lynx habitat when large expanses of even-aged forest are broken up to create a mosaic of age classes, resulting in improved snowshoe hare habitat and improved lynx foraging habitat, as lynx are known to hunt along edges of mature forest within burned forest matrices (Ruediger et al. 2000). Based on modeled and mapped lynx habitat on the Helena NF and locations proposed for weed treatment, recent burned areas proposed for treatment (e.g., Cave Gulch) did not appreciably impact lynx habitat (PF-*Wildlife*).

Based on habitat modeling conducted by the Helena NF, approximately 419,337 acres of lynx habitat is estimated to exist on the Forest, with habitat occurring in each of the four landscape areas (Metadata 2004). Within the Belt Landscape, 279 acres (less than one percent) of mapped weed infestation occurs within approximately 63,293 acres of modeled lynx habitat. Within the Divide Landscape, 1,040 acres of mapped weed infestations occur within approximately 103,668 acres of modeled lynx habitat (one percent). The Elkhorn Landscape contains 206 acres of mapped weed infestations occurring within 46,058 acres of modeled lynx habitat (less than one percent). In the Blackfoot Landscape, 1,150 acres of mapped wed infestation lie within 206,318 acres of modeled lynx habitat (less than one percent) (PF-*Wildlife*).

Black-backed Woodpecker - Sensitive

Black-backed woodpeckers are associated with mid- to high-elevation coniferous forests in the northern Rocky Mountains, concentrated in areas of wood-boring beetle outbreaks associated with fires (Hutto 1995, Kotliar et al. 2002). Black-backed woodpeckers prefer fire-killed Douglas-fir, western larch, and ponderosa pine; lodgepole pine is a secondary species. For black-backed woodpeckers, the presence of dead and dying trees in open feeding areas (typically, recent burns) and forested communities is a prerequisite to higher population levels (USFS 1998a).

Black-backed woodpeckers excavate nest cavities in live or dead trees with deteriorating heartwood in close proximity to foraging areas. They nest 3 to 16 feet above the ground, in trees larger than 12 inches in diameter. Clusters of snags can provide both nesting and foraging habitat.

Habitat modeling by the Cohesive Strategy Team, estimated approximately 37,000 acres of black-backed woodpecker habitat on the Forest in the Belts LA associated with the wildfires of 2000 (Hillis et al. 2002, Project File – Wildlife). Because of the ephemeral nature of these burned areas as pockets of insect outbreaks, it is unlikely that these acres are currently providing black-backed woodpecker habitat. Generally, burned areas provide habitat up to 6 years post-fire. The Snow Talon fire in 2003 created an approximate 16,700 acres of black-backed woodpecker habitat. These acres should still provide habitat given it has only been 3 years post fire. However, based on the species' habitat needs, they are likely to occur throughout the Forest in addition to burned areas, particularly those areas with high levels of pine beetle activity.

Boreal Toad - Sensitive

Boreal toads are found in a variety of habitats from valley bottoms to high elevations on the Helena NF (pp. 9-10 Reichel 1996 and Cooper et al. 2004). While boreal toads are more common in Montana west of the Continental Divide, voucher specimens from Lewis and Clark County have been collected (pp. 46-47 Maxell et al. 2003). Their occurrence on the Helena NF has been documented within the Divide LA, and their occurrence elsewhere, although likely scattered, is suspected (B. Costain, Helena National Forest, personal communication).

Boreal toads breed in any clean standing water (pp. 73-74 Werner et al. 2004). Tadpoles are seen in ponds during the day. During the breeding season, adults can also be found in water; however, movement to nearby upland habitats after the breeding season is quite common.

Fisher - Sensitive

Characteristics of marten and fisher habitat are similar. Fisher habitat primarily consists of mature and old-growth grand fir, cedar, and hemlock stands below 6,300 feet in elevation. They usually inhabit forested habitat within 1,000 feet of riparian areas which they use extensively for foraging, resting, and as travel corridors. Moderate and high severity burn areas are not considered habitat for fishers while low severity burn areas may still offer suitable continuous cover. Typically, fishers prefer forests with continuous cover, although some use of shrubby clearings can occur during certain seasons. Secondary fisher habitat consists of lower elevation spruce, subalpine fir, and mesic Douglas-fir forest that meets the physical attributes of primary habitat (Heinemeyer and Jones 1994, pp. 14-19). Because grand fir, hemlock, and cedar forest types have a low occurrence on the Helena NF, the majority of fisher habitat is probably secondary habitat. The quality of some of the secondary habitat approaches that of primary habitat, although the grand fir, hemlock, and cedar forest types generally are not present (USFS 1998a). Although fishers are rare on the Helena NF they have been documented by photograph and other reliable sightings in the Continental Divide LA (B. Costain, Helena NF, personal communication).

Flammulated Owl - Sensitive

Flammulated owls are dependent on mature to old-growth ponderosa pine/Douglas-fir forests at low elevations in the Rocky Mountains. They are found in mature, open, park-like stands with a well-developed understory of grasses, shrubs, and small trees. Flammulated owls prey primarily on night flying moths in the early spring and on crickets, grasshoppers, moths, beetles, and bugs in the summer (McCallum 1994).

Flammulated owls spend winters in Mexico and Central America, returning to breed in western Montana around the beginning of May when nights are warm enough to support the nocturnal flying insects.

Flammulated owls have been identified sporadically across the Helena NF over the years. Forest-wide flammulated owl surveys were conducted in 2005 as part of a regional effort to understand flammulated owl distribution. These surveys resulted in 31 flammulated owl detections Forest-wide, including all landscapes.

Based on habitat modeling conducted by the Helena NF, approximately 66,241 acres of flammulated owl habitat are estimated to exist on the Forest, with habitat occurring in each of the four landscape areas (Metadata 2004). Modeling of flammulated owl habitat indicates that approximately 66,241 acres of potential flammulated owl habitat is present on the Helena NF. Weed treatments overlap with approximately 2,164 acres of potential flammulated owl habitat Forest-wide (approximately 3 percent of total flammulated owl habitat). In the Belts/Dry LA, from a total of 38,720 acres of potential flammulated owl habitat, weed treatments overlap with 1,213 acres (approximately 3 percent). In the Elkhorns LA, weed treatments overlap 26 acres from a total of 2,141 acres (approximately 1 percent). In the Continental Divide LA, from a total of 10,114 acres of habitat, weed treatments overlap 519 acres (5 percent). In the Blackfoot LA, weed treatments overlap 406 acres of flammulated owl habitat from a total of 15,266 acres (2 percent).

Leopard Frog - Sensitive

Northern leopard frogs are found in or near non-forest habitats, inhabiting dense sedge, wet-meadow, or cattail marsh. Northern leopard frogs are known to occur primarily on low elevation marshes and wetlands on valley bottoms. Breeding takes place in lakes and ponds (temporary and permanent), springs, and occasionally backwaters or beaver ponds in streams. Historically, the northern leopard frog was widespread in Montana, but it now appears to have been extirpated throughout much of the western part of the state (Reichel and Flath 1995). Bullfrogs are a primary predator of northern leopard frogs, and after introductions of bullfrogs were made, northern leopard frog populations began to decrease.

Ideal habitat on the Helena NF that could support leopard frogs would be any low elevation, un-forested marshes, wet meadows, dense sedge, or valley bottom wetlands. Ideally, these sites would not support populations of bullfrogs. One museum specimen, one pre-1990 observation, and one post-1990 observation all near Canyon Ferry Reservoir are the only documented occurrences of the species in the vicinity of the Helena NF (Maxell *et al.* 2003, pp. 60-62). Although not documented as occurring on the Helena NF, the species is suspected to occur there (Reichel 1986, pp. 25-16).

Plains Spadefoot Toad - Sensitive

Plains spadefoot toads are associated with prairies often with areas of sandy soil or gravel loam (pp. 68-70 Werner et al. 2004). They are known to historically occur on the Helena NF (pp. 44-45

Maxell et al. 2003). However, there are no recent sightings (pp. 23-24 Reichel 1996).

Ideal habitat on the Helena NF that could support spadefoot toads would be grasslands and sagebrush areas with sandy or loose soils. They breed in shallow, temporary pools usually following heavy rains. They should be watched for at low elevations in prairie or shrub-steppe habitats on the Helena NF.

Northern Bog Lemming - Sensitive

Northern Bog Lemmings, as the name implies, are associated with sphagnum bogs and fens (Foresman 2001). Other vegetative components at sites where bog lemmings occur include willow, dwarf birch, and sedges (Foresman 2001). Bogs develop on un-drained or poorly drained sites where chemical conditions hinder decomposition of organic matter (Foresman 2001). These wetlands are characterized by standing water interspersed with vegetated ridges or floating mats of vegetation on organic soils. Many bog plants and their associated animals, e.g., bog lemmings, are sensitive and specialized for existence on these distinctive habitats. Some bog lemmings do occur in wet areas along streams. Bog Lemmings are found where the stream gradient is relatively gentle and wetlands extend laterally from the stream. Potential habitat exists only along streams, and then only if gradients are gentle and wetlands approximating bogs are present.

Across the Helena NF, only marginal fragments of suitable habitat for the bog lemming are present (USFS 1998a) and although not documented, they are suspected to occur (B. Costain Pers. Comm.).

Peregrine Falcon - Sensitive

Peregrine falcon eyries are found primarily on cliffs near water. They hunt for waterfowl and other birds, flying high above their intended prey, then swooping or diving to strike their prey in mid-air, killing it with a sharp blow.

Peregrine falcons have been reintroduced into several areas in southwest Montana since 1989. As of 2002, there are at least three known wild eyries on the Helena NF (PF-Wildlife). Although eyries are not established across the entire Forest, as breeding pairs become established and disperse into new areas, many locations have the potential to provide nesting and foraging habitat (USFS 1997a).

Townsend's Big-eared Bat - Sensitive

In western Montana, big-eared bats are most closely associated with caves, cliffs, and rock outcrops of sedimentary origin (often limestone). They also make use of abandoned mine adits, as well as hollowed trees and snags in old-growth forests. Typically, they roost in caves, rock outcrops, lava tubes, buildings, or mine shafts. Townsend's big-eared bats are insectivorous, feeding primarily on small moths typically higher in the forest canopy than most bats, although they occasionally glean beetles, flies, and insects from leaves. Big-eared bats forage more often along forest edges. Other notable feeding sites are over wet meadows and other areas of water. These are areas that can supply suitable insect prey in some abundance (Foresman 2001, pp. 39-41). On the Helena NF, Townsend's big-eared bats are considered rare. Few natural caves exist on the Helena NF, and of those that do, only a limited number harbor any bat species. The occurance of Townsend's big-eared bat has been documented only in the Avalance Creek drainage in the Belts LA (USFS 1998a).

Wolverine - Sensitive

Wolverines are solitary animals, ranging widely over a variety of habitats. Within large roadless areas, wolverine use appears to be concentrated in medium to scattered mature timber and areas around natural openings such as cliffs, slides, basins, and meadows.

Wolverine home ranges can be as large as 150 square miles in Montana. Wolverines feed primarily on rodents and carrion, although they are opportunists, and will consume berries, insects, fish, birds, and eggs when available; however, they seldom eat vegetation. Large mammal carrion is important at all times of year, but it seems to be particularly important in the winter (USFS 1998a).

Wolverines have been observed along the Continental Divide, as well as in the Bob Marshall

Wilderness complex to the north and the Elkhorns to the south (USFS 1998a; USFS 1997a). Suitable habitat is available across the Forest in the form of coniferous montane forest, ungulate winter range, and blocks of lightly roaded and unroaded country (USFS 1998a). Recent observations of wolverine have been confirmed in the Big Belt Mountains (J. Canfield, Helena NF, personal communication).

Modeling of wolverine denning habitat identified approximately 101,400 acres of potential denning habitat on the Helena NF, although none was identified in the Divide LA (Metadata 2004). Denning habitat is often found on talus slopes in high-elevation cirque basins (Margoun and Copeland 1998), and in Montana, natal dens were often associated with snow-covered tree roots, log jams, or rocks and boulders (Hash 1987, cited in Banci 1994). Denning occurs during late winter and early spring, and young may leave the den by late March through May, depending on climate conditions and status of the kits (Magoun and Copeland 1998, Pasitschniak-Arts and Larivière 1995). Because preferred denning habitat is often at high elevations, there is little overlap with mapped weed infestations.

Within the Belt Landscape, 30 acres (less than one percent) of mapped weed infestations occur within approximately 50,000 acres of modeled wolverine denning habitat. The Elkhorn Landscape contains no mapped weed infestations occurring within 11,500 acres of modeled wolverine denning habitat. In the Blackfoot Landscape, 45 acres of mapped weed infestation lie within 39,890 acres of modeled wolverine denning habitat (less than one percent) (PF-*Wildlife*).

Northern Goshawk - Sensitive

Northern goshawks are MIS for old-growth forest. They are associated with old-growth mixed conifer and deciduous woodland, often in mountainous terrain. Northern goshawk nesting habitat is typified by a dense overstory of large trees and an open understory of grass and shrubs, often near clearings. Mature stands of single- and multi-storied trees with small open areas are preferred for nesting and foraging (Graham et al. 1993).

Most of the lower to mid-elevations in all landscape areas contain potential habitat for goshawks. Based on survey and monitoring data, there are at least 17 known goshawk nests across the Helena NF (USFS 2003). Additional survey work in 2004 and 2005 identified several more active territories (FaunaWest 2004 and Project File - *Wildlife*).

Goshawk habitat modeling has been conducted by the Helena NF, and indicates approximately 288,210 acres of goshawk habitat is estimated to exist on the Forest, with habitat occurring in each of the four landscape areas (Metadata 2004). Within the Belt Landscape, 658 acres (less than one percent) of mapped weed infestations occur within approximately 85,116 acres of modeled goshawk habitat. Within the Divide Landscape, approximately 464 acres of mapped weed infestations occur within approximately 62,450 acres of modeled goshawk habitat (less than one percent). The Elkhorn Landscape contains 136 acres of mapped weed infestations occurring within approximately 32,886 acres of modeled goshawk habitat (less than one percent). In the Blackfoot Landscape, 1,083 acres of mapped weed infestations lie within approximately 107,758 acres of modeled goshawk habitat (1 percent) (PF-*Wildlife*).

BIRDS

There are more than 100 species of land birds on the Forest. Neotropical migrant birds are a group of birds that live, breed, and nest in temperate forests of North America during spring and summer and migrate to Mexico, Central America, South America, and the Caribbean Islands during the fall and winter. Species that may be present on the Helena NF include the American redstart, common yellowthroat, Macgillivray's warbler, warbling vireo, willow flycatcher, olive-sided flycatcher, yellow warbler, flammulated owl, and Townsend's warbler. Each of these species has been known to breed in Montana and on the Helena NF. The species above are by no means an exhaustive list, though they do represent the types of Neotropical migrants that occur. The Northern Region Land Bird Monitoring Program monitors trends in land bird populations.

REPTILES AND AMPHIBIANS

Amphibians are aquatic breeders that require healthy riparian and aquatic environments to lay eggs and to develop as larvae. Generally, frogs are tied to aquatic systems throughout their lives, but other amphibians such as toads and salamanders can be found in upland habitats. These habitats include wet and dry coniferous forests of all seral stages, deciduous forests, grasslands, shrublands, talus, and caves (USFS 1998a).

Amphibians that have either been surveyed for or have potential habitat on the forest include the long-toed salamander, Rocky Mountain tailed frog, Pacific chorus frog, Columbia spotted frog, boreal toad, and the leopard frog. The boreal toad and leopard frog are both addressed earlier in this section of this report. The long-toed salamander, boreal toad, and Columbia spotted frog all live in ponds, wetlands, and lakes. The long-toed salamander and the Pacific chorus frog are associated with closed canopy forests.

Reptiles, unlike amphibians, are not directly tied to water resources and are known to inhabit a rather wide variety of habitat types. Several reptile species that have been identified or that have potential habitat on the Forest include the western skink, northern alligator lizard, common garter snake, western terrestrial garter snake, racer, rubber boa, western rattlesnake, and gopher snake. These species occur in a variety of habitats and are generally known to inhabit dry forests.

FISHERIES AND AQUATIC RESOURCES

REGULATORY FRAMEWORK

HELENA NATIONAL FOREST PLAN

The Helena National Forest Plan (1986) includes management objectives for aquatic resources, some of which are applicable to the Proposed Action of weed treatment. The Forest Plan includes the following statement regarding herbicide use: "Use of chemicals within the riparian area will be minimized to the extent feasible, and will be coordinated with wildlife, watershed, and fisheries personnel, and a certified pesticide applicator." Forest-wide standards require that water quality and fish habitat be maintained by coordinating Forest activities and by direct habitat improvement.

A recent supplement to the Forest Service Manual (FSM 2080) implements an Integrated Pest Management (IPM) approach for control of noxious weeds on National Forest System Lands in Region 1 (USFS 2001a). The supplement contains requirements and recommendations for noxious weed management when conducting ground-disturbing activities. The objectives are attained through revegetation of disturbed areas with appropriate seed mixes and includes administrative controls of seed testing and use of weed seed-free hay, mulch, seed, and feed pellets on HNF land. Additionally, Forest-wide standards require that water quality and fish habitat be maintained by coordinating Forest activities and by direct habitat improvement.

INLAND NATIVE FISH STRATEGY AMENDMENT TO THE FOREST PLAN

The Inland Native Fish Strategy (INFISH) amended the Helena Forest Plan in 1995. The INFISH amendment to the Forest Plan established additional Forest-wide fisheries standards. The intent of INFISH was to provide additional protection for existing populations of native trout, outside the range of anadromus fish on 22 forests in the Pacific Northwest, Northern, and Intermountain Regions of the Forest Service. As part of the strategy, Regional Foresters designated a network of priority watersheds. These are drainages that contain excellent habitat or assemblages of native fish, provide for metapopulation objectives, or have excellent potential for restoration. Priority watersheds on the HNF are Copper Creek, Landers Fork, and the Little Blackfoot River (INFISH Implementation Plan 1995).

INFISH also established Riparian Management Objectives (RMOs) and Riparian Habitat Conservation Areas (RHCAs). RMOs are habitat parameters, which describe good fish habitat and provide the criteria against which attainment or progress toward attainment of riparian goals is measured. RHCAs are portions of the watersheds where riparian dependent resources receive primary emphasis. The RHCAs are areas within specific management activities, which are subject to standards and guidelines in INFISH in addition to the standards and guidelines in the Helena Forest Plan. General Riparian Area Management Guidelines of INFISH specify that application of herbicide will only be allowed such that it does not retard attainment of RMOs and avoids adverse effects on inland native fishes.

ENDANGERED SPECIES ACT AND FOREST SERVICE MANUAL

Section 7 of the Endangered Species Act of 1973, as amended, requires Federal agencies to undertake programs for the conservation of threatened and endangered species (TES), and prohibits them from carrying out or authorizing any action that may jeopardize a listed species or its critical habitat.

The Helena National Forest Plan and the Forest Service Manual call for a biological assessment to be written for all projects that have potential to impact any TES species or their habitat. The assessment will address each project's potential to adversely modify a listed species habitat or behavior. If an adverse impact is determined, mitigation measures will be developed to avoid any adverse modification of a listed species habitat or behavior. If all possible mitigation measures do not result in a "no effect" determination, then consultation with the U.S. Fish and Wildlife Service will be initiated.

The Forest Service Manual requires a biological evaluation be completed for all species on the sensitive species list. Guidance requires that activities undertaken do not result in effects to a sensitive species that would result in a trend toward listing under the Endangered Species Act.

Regulations on fish and wildlife resources are outlined in 36 Code of Federal Regulations (CFR) 219.19 and 219.27. These regulations state that Management Indicator Species (MIS) will be identified by each National Forest in order to maintain adequately distributed habitat for these species and to evaluate the impacts of management activities. Additional guidance is found in Forest Service Manual, which states, identifies and prescribes measures to prevent adverse modifications or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species (Forest Service Manual 2670.31 (6). MIS are identified in a planning process and used to monitor effects of planned management activities on viable populations of wildlife and fish, including those that are socially or economically important. Aquatic MIS identified on the HNF are cutthroat trout, which will be used as an indicator of fisheries habitat changes (Helena National Forest Plan).

Forest Service Manual (FSM) 2670 at 2670.22 - Sensitive Species, provides the following direction for sensitive fish:

- Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions.
- Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest.
- Develop and implement management objectives for populations and/or habitat of sensitive species.

ANALYSIS AREA

Proposed weed treatment would occur in the Missouri River and Columbia River basins. More specifically, the proposed treatment areas are located in 105 6th HUC watersheds

ANALYSIS METHODS

A variety of methods were used to collect information compiled for this document. An extensive search was conducted via the Internet on topics as they relate to aquatic resources including but not limited to, effects of the chemicals proposed for use on the aquatic environment, chronic and acute effects on aquatic organisms and ecological risk to the aquatic environment. Data, in the form of reports, existing NEPA documents, memoranda and other documents were provided by US Forest Service personnel, in particular, technical resource specialists on the Helena and other area National Forests. A model was used to predict chemical delivery to surface water via runoff and infiltration. Specific variables used for this model (acreage, flows from specific storm events, amount of chemical applied) were calculated from Helena NF data. For specific details on these model variables, please see analysis methods – Water Resources. A spreadsheet was developed to determination of acres within specific watersheds that could be treated without risking impacts to the aquatic environment.

AFFECTED ENVIRONMENT

Of the 149 6th HUC watersheds in the Project Area, 105 (70 percent) have weed infestations. However, infested areas within each watershed are relatively small). Most areas are less than three percent of total watershed area. In some cases, a high percent of acres occur within 300 feet of flowing water. Only six watersheds currently have infestations covering five percent or more of the total watershed area: Lower Trout Creek, Oregon Gulch, and Cave Gulch in the Belts/Dry Range LA; Middle Crow Creek tributary in the Elkhorn LA; and Grizzly-Orofino Gulch and Upper Little Blackfoot River in the Continental Divide LA. The watersheds with the highest infested acres (20 to 25 percent) are Lower Trout Creek, Oregon Gulch, and Cave Gulch. Oregon, Dry, and Grizzly-Orofino Gulches do not support fish.

Aquatic Organisms

Table 3-7 identifies native and non-native fisheries species within the study area as well as their distribution and their threatened/endangered species or other statuses.

Seven aquatic species on the HNF are given special consideration of endangered, threatened, or sensitive status. Three species are fishes (cutthroat trout, bull trout, and ling) with their statuses identified in Table 1. The other four organisms include the boreal toad (*Bufo boreas*), northern leopard frog (*Rana pipiens*) harlequin duck (*Histrionicus histrionicus*) and northern bog lemming (*Synaptomys borealis*). The Wildlife Specialist Report (PF-Wildlife) contains a discussion of these species and their status.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

Threatened and Endangered Species

Bull Trout

In July 1998, bull trout was listed as "Threatened" under the Endangered Species Act. Critical habitat for bull trout was finalized in September 2005 by the U.S Fish and Wildlife Service (USFWS) as part of developing the Bull Trout Recovery Plan. The critical habitat rule for bull trout did not include any streams on federally administered lands. Consequently there is no critical habitat located on lands administered by the Helena National Forest. However, designated bull trout critical habitat does include streams located on non-federal lands within the Forest boundary and in the immediate vicinity of the Helena Forest in both the Blackfoot and Little Blackfoot River drainages. The fluvial life form (where adults live and mature in main river systems and migrate to small tributaries to spawn and where juveniles live) is an important component for the survival of the species. These fish spawn in late summer through early fall (August to November). Fry hatch at the end of January and typically emerge in early spring (April). Juveniles remain in the small tributaries in low velocity habitat (pools and pocketwater) for the first two years of life. Most juveniles migrate to larger lakes or rivers at the beginning of their third year. Bull trout usually mature at age five to six years. Adult migration begins in early spring (March) and may extend through the entire summer. Some adults may spawn more than once but may not spawn every year. Sediments from roads and increases in run off from vegetation conversions to less dense cover (pioneering/invasive species following a fire) may degrade habitats for resident and spawning fish on the HNF.

TABLE 3-7 Fish Species On The Helena National Forest				
Common Name	**Scientific Name**	**Native or Non-native**	**Probable Distribution (on HNF)**	**Status**
Bull trout	*Salvelinus confluentus*	Native	Clark Fork Drainage	Threatened
Yellowstone cutthroat trout	*Oncorhynchus clarki bouvieri*	Native to Montana but not waters on the HNF	Forest-wide1 (in mountain lakes only)	Sensitive
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*	Native	Forest-wide	Sensitive, Management Indicator Species
Burbot	*Lota lota*	Native	Missouri River Drainage	Sensitive
Mountain whitefish	*Prosopium williamsoni*	Native	Forest-wide	None
Northern pikeminnow	*Ptychocheilus oregonensis*	Native	Clark Fork Drainage	None
Longnose dace	*Rhinichthys cataractae*	Native	Missouri River Drainage	None
Arctic grayling	*Thymalus arcticis*	Native but no longer found in any streams on the Helena National Forest	Park Lake, Missouri Drainage and Heart Lake in the Clark Fork drainage	Sensitive Candidate
Longnose sucker	*Catostomus catostomus*	Native	Clark Fork Drainage	None
Largescale sucker	*Catostomus macocheilus*	Native	Clark Fork Drainage	None
Mottled Sculpin	*Cottus bairdi*	Native	Missouri River Drainage	None
Slimy sculpin	*Cottus cognatus*	Native	Clark Fork Drainage	None
Rainbow trout	*Oncorhynchus mykiss*	Non-native	Forest-wide	None
Brook trout	*Salvelinus fontinalus*	Non-native	Forest-wide	None
Brown trout	*Salmo trutta*	Non-native	Forest-wide	None
Kokanee salmon	*Onchornchus nerka*	Non-native	Missouri River Drainage	None
Walleye	*Sitzaostedion vitreum*	Non-native	Missouri River Drainage	None
Yellow perch	*Perca flavescens*	Non-native	Missouri River Drainage	None
White sucker	*Castostomus commersoni*	native	Missouri River Drainage	None
Mountain sucker	*Castostomus platyrntnchus*	native	Missouri River Drainage	None
Carp	*Cyprinus carpio*	Non-native	Missouri River Drainage	None
Utah chub	*Gila atraria*	Non-native	Missouri River Drainage	None
Flathead chub	*Platygobio gracilis*	native	Missouri River Drainage	None

1 Forest-wide includes: Clark Fork Drainage and the Missouri River Drainage.

Historically, bull trout were likely distributed throughout the Clark Fork Drainage on the HNF (Montana Bull Trout Scientific Group, 1995). Conversations with the HNF Resource Specialists indicate that currently, all fish-bearing waters within the Clark Fork drainage of the HNF should be considered bull trout habitat (Walch and Stuart 2002). **Figures 3-5 through 3-8** summarizes the streams on the HNF that depicts current habitat known to support bull trout.

Forest Sensitive Species

Westslope cutthroat trout

Westslope cutthroat trout is a sub-species of cutthroat trout native to Montana. Its natural range is on both sides of the Continental Divide;

excluding the Yellowstone River drainage. It can be difficult to visually distinguish westslope from other cutthroat trout sub-species and the only way to be certain is by genetic testing.

Westslope cutthroat trout were first described by Lewis and Clark and were once extremely abundant. Various studies have estimated that the westslope cutthroat trout now only occupies between 19-27 percent of its historical range in Montana and about 36percent of its historical range in Idaho (Van Eimeren, 1996). The most recent status review completed by Shepard et al. (2003) states that throughout their historical range westslope cutthroat trout are now estimated to inhabit 59% of the 56,500 miles of stream they historically occupied. However, only 6% of the miles that were historically occupied are currently occupied by genetically pure westslope cutthroat trout (Shepard *et al.* 2003).

Westslope cutthroat trout have been included in various "watch lists" of agencies and conservation groups since 1966. Currently, westslope cutthroat trout are listed by Region 1 of the Forest Service as sensitive. It is a designated Management Indicator Species (MIS) for the Helena NF. The USFWS had been petitioned to include the westslope cutthroat trout under protection of the Endangered Species Act. In 2000, they determined that listing was not warranted, due to the species wide distribution, available habitat in public lands and conservation efforts underway by state and Federal agencies.

The State of Montana has altered fishing regulations to reduce fishing mortality. Montana has also developed a Conservation Agreement signed by nine government agencies and conservation groups (MFWP 1999). This agreement prioritizes protecting genetically pure populations first, then slightly introgressed populations. Currently, the five year term on the MOU and conservation agreement has expired and has yet to be renewed by the various cooperating agencies. However, a new MOU has been drafted and is under review by the various agencies and interested parties. The HNF continues to operate under the expired MOU until a replacement is agreed upon and signed.

The westslope cutthroat trout is found in the Blackfoot, Little Blackfoot, and Missouri Rivers as well as many of their fish-bearing tributaries on the HNF. **Figures 3-5 through 3-8** depict current habitat on the HNF that are known to support westslope cutthroat trout. Many of the streams on the HNF that support cutthroat trout are small and have very low late summer flows. Small young of the year and yearling westslope cutthroat trout can be found in streams less than 18 inches in width.

Yellowstone Cutthroat Trout

The Yellowstone cutthroat trout was first discovered in 1882 by C.E. Bendire. This sub-species of cutthroat trout can visually be distinguished from other trout species by the two prominent red slashes on the lower jaw, the black spots that tend to be concentrated posteriorly and its brownish-yellow or silver coloration.

The historical distribution of Yellowstone cutthroat trout is believed to have included much of the Yellowstone River basin, including portions of the Clarks Fork of the Yellowstone River, Bighorn River, and Tongue River basins in Montana and Wyoming, and parts of the Snake River basin in Wyoming, Idaho, Utah, and Nevada. In recent times, the majority of the indigenous populations in Montana inhabit headwater streams, although the Yellowstone River main stem also supports large numbers of indigenous Yellowstone cutthroat trout. Due to the stocking of Yellowstone cutthroat trout, the distribution of this fish in lakes has actually increased, as it is now believed that over 100 lakes in Montana support pure Yellowstone cutthroat trout. Yellowstone cutthroat trout is a native fish to Montana; however, its historical distribution does not overlap with the HNF. Yellowstone cutthroat trout are found throughout the HNF in mountain lakes.

The Yellowstone cutthroat trout is considered a sensitive fish by the US Forest Service within its historic range. In 1998, it was petitioned for listing as a threatened species under the Endangered Species Act; however, the petition was rejected in February of 2001. Given that the distribution of Yellowstone cutthroat trout on the HNF is outside its historical range, it is not classified as a sensitive species on the HNF.

Burbot

Currently, the burbot is listed by Region I of the Forest Service as sensitive. The burbot is the only exclusively fresh water cod species. It occurs in deep cold waters of lakes and rivers in North America. It typically is not present in waters that exceed 69° F during the summer (Paulson and Hatch 2002). During the day, it remains at the bottom at low light intensity or in areas of aquatic vegetation, rock piles, submerged logs and other underwater structures. At night, it preys on small fish, crayfish, clams, aquatic insects or fish eggs. Species that might be included in its diet are sculpins (Family *Cottidae*), yellow perch and walleye. Adult fish feed mainly on other fish during the summer, increasing the amount of invertebrates in their diet during the winter. The young feed mainly on mayfly nymphs and other aquatic insects, shifting to fish and crayfish as they mature.

The burbot is unique in that it spawns in winter, under the ice. It spawns at night in shallow bays and streams over sand and gravel, in water temperatures near 35° F (Rook 1999; Paulson and Hatch 2002). They spawn in large groups, thrashing about. A female can release up to a thousand eggs, where they are dispersed through the water to drift along the bottom. After spawning, the adults migrate in early spring from lakes to tributary rivers. The young grow rapidly in the first four years spending most of their time in vegetated and debris covered lake shallows and stream channels. As they grow they seek out rocky riffles, then pools and under bank cuts. Young burbot are common prey for other fish such as yellow perch and lake trout.

Arctic Grayling

The Arctic grayling is a native species to Montana and the only remaining indigenous population in Montana is found in the Big Hole River. Currently, Arctic graylings are found in the Big Hole River, the Madison River or in small, clear, cool lakes with tributaries suitable for spawning. The reduction in fluvial Arctic grayling is thought to be related to habitat degradation, competition with non-native fish species and exploitation by anglers. On the HNF, fluvial arctic grayling are no longer found in any of the streams. They are known to inhabit Park Lake within the Missouri River drainage and the Heart Lake within the Clark Fork Drainage.

The Arctic grayling is currently classified as a sensitive species by the US Forest Service. However, with no fluvial Arctic grayling present on the HNF, they are not evaluated as a sensitive species by the Forest. The fluvial Arctic grayling was formally classified as a Candidate species in 1991. A petition to upgrade the status of the fluvial Arctic grayling to Endangered was submitted in October 1991. A recent finding on the petition recommended that listing the fluvial Arctic grayling was "warranted, but precluded' by other higher priority species.

AQUATIC HABITAT

Watershed baseline conditions west of the Continental Divide have been completed. In many of the 6th code hydrologic units, various components of fish habitat are considered to be functioning at risk or functioning at unacceptable risk (USFS 2000 and USFS 2000b).

Fish habitat conditions east of the Continental Divide have not been compiled in a watershed baseline as they have west of the Continental Divide. However, conditions in many 6th HUCs have been assessed to varying degrees with information available in the HNF fishery files. Generally speaking, habitat conditions have been affected negatively in many locations from a variety of human related activities (Walch and Stuart 2002). Habitat for amphibians and reptiles that rely on aquatic habitat is addressed in the Wildlife Technical Report (PF - Wildlife).

VEGETATION

REGULATORY FRAMEWORK

The Forest-wide management goal of the Forest Plan (USFS 1986) is to "control noxious weeds to protect resource values and minimize adverse effects on adjacent private land." Forest management objectives for all Management Areas within the Forest state: "the primary means of preventing, containing, or controlling noxious weeds will be through vegetative management practices and by the use of biological agents such as insects, rusts, molds, and other parasites on host plants. However, herbicides may be used to provide short-term protection on specific sites, after appropriate environmental analysis."

The Endangered Species Act requires the conservation of threatened and endangered species, and prohibits carrying out or authorizing any action that may jeopardize a listed species or its critical habitat.

Executive Order 13112 of February 3, 1999 on invasive species directs Federal agencies to prevent introduction of invasive species; provide for their control; and minimize economic, ecological, and human-health impacts. Under this executive order, Federal agencies cannot authorize, fund, or carry out actions that are likely to cause or promote the introduction or spread of invasive species, unless all reasonable measures to minimize risk of harm have been analyzed and considered.

Forest Service Manual (FSM) 2670 at 2670.22 - Sensitive Species, provides the following direction for sensitive plants:

- Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions.
- Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands.
- Develop and implement management objectives for populations and/or habitat of sensitive species.

The Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) and National Forest Management Act of 1976 (NFMA) provide the broad legislative background for forest vegetation management, including management of sensitive species.

ANALYSIS AREA

The analysis area for vegetation includes vegetative communities in proximity to proposed treatment areas. These plant communities have the potential to be directly or indirectly impacted by herbicide and ground disturbances associated with the proposed weed treatment methods.

ANALYSIS METHODS

Information used came from data on file at the Helena NF, published reports in scientific journals, unpublished reports, and personal communications with resource specialists with knowledge of vegetation, weed control, and herbicide effects. Acreage values were derived from GIS. Information on ecology, distribution, and habitat affinities for sensitive species was obtained from the Montana Natural Heritage Database on the Internet. Only species known to occur are addressed in detail.

Effects of weed management practices on sensitive plants also were assessed based on studies sponsored by the Helena NF and conducted by the Montana Natural Heritage Program (Barton and Crispin 2001; 2002). **Appendix B** contains a list of scientific and common names used in this

TABLE 3-8
Percent of Landscapes by Vegetation Cover Types

Vegetation Type	Belts/Dry Range	Continental Divide	Elkhorn	Blackfoot
Grassland	9.0	6.6	18.2	1.7
Shrubland	1.4	0.2	0.9	0.0
Ponderosa pine	2.4	1.1	0.8	0.0
Douglas-fir	61.6	39.8	28.8	24.1
Lodgepole pine	0.2	2.4	0.1	0.1
Spruce-fir	13.7	39.0	34.8	58.3
Other habitats	2.3	0.4	0.2	2.5
Non-vegetated areas	9.5	10.5	16.1	13.3

Note: Vegetation types represent habitat type grouped by dominant species.

document.

AFFECTED ENVIRONMENT

The Helena NF includes a diversity of habitats ranging from wetlands and riparian areas to high-elevation alpine and subalpine ridges and plant communities. Broad vegetation types, most frequently invaded by noxious weeds, are grasslands, shrublands, and conifer forests with more open overstory canopies (**Table 3-8**).

Grasslands

Grasslands dominated by bluebunch wheatgrass, rough fescue, and Idaho fescue are the most common grasslands on the Forest. These communities have a sparse to moderately dense cover. Annual grasses, forbs, and shrubs are sparse. Litter, moss, and lichens are important components of grasslands. Habitat indicator species in addition to the dominants include western wheatgrass, Sandberg bluegrass, thread-leaf sedge, narrow-leaf sedge, American vetch, and fringed sage. Many grassland communities on the Forest are being invaded by ponderosa pine and Douglas-fir as a result of fire suppression over the last century.

Shrub Communities

Shrub communities dominated by low sagebrush, big sagebrush, shrubby cinquefoil, bitterbrush, mountain mahogany, and skunkbush sumac comprise less than three percent of the vegetation cover on the Forest. Shrub communities generally range from 3,000 to 8,000 feet elevation. Forbs are generally abundant. Common herbaceous species include bluebunch wheatgrass, rough fescue, Idaho fescue, timber oatgrass, and sticky geranium. Large amounts of bare ground and rock are usually present.

Conifer Forests

Generally, noxious weeds do not invade forest communities that have more than 10 percent canopy cover, except where overstory vegetation has been thinned or removed by logging, road construction, fire, or other activities. Forest habitat types that have the greatest area infested with noxious weeds are dry ponderosa pine and Douglas-fir stands with sparse overstory canopies. However, noxious weeds also have invaded the wetter Douglas-fir sites where the overstory has been removed or thinned by logging, road building, or other activities.

Ponderosa pine communities are a relatively minor component of the Forest. They occur mostly at lower elevations, adjacent to grasslands. Ponderosa pine forests have a sparse, open canopy with a grassy understory. Common species include skunkbush sumac, chokecherry, buffaloberrry, common snowberry, Oregon grape, bitterbrush, bluebunch wheatgrass, Idaho fescue, and rough fescue.

Douglas-fir communities are the most common tree-dominated communities on the Forest. Douglas-fir is a shade-tolerant species that occupies a broad range of elevations, soils, and climatic conditions. Common species include ninebark, pinegrass, twinflower, huckleberry, kinnikinnik, beargrass, bluebunch wheatgrass, ponderosa pine, elk sedge, common juniper, spirea, heart-leaf arnica, rough fescue, and mountain snowberry.

Lodgepole pine climax communities are uncommon. Lodgepole pine is a seral species in Douglas-fir and spruce/fir forests. Common species include sweet-scented bedstraw, baneberry, bluejoint reedgrass, dwarf bilberry, twinflower, beargrass, globe huckleberry, pinegrass, and elk sedge. Weed infestations in lodgepole pine forest are infrequent.

Spruce/fir communities consist of Englemann spruce and subalpine fir with a well-developed component of shrubs and herbaceous species. Spruce most commonly occurs in soil with high moisture content, such as riparian areas and higher elevation sites fed by snow melt. Subalpine fir is found most frequently at higher elevations. Common understory species include common horsetail, ground dogwood, sweet-scented bedstraw, dwarf bilberry, meadowrue, smooth woodrush, mountain gooseberry, arrow-leaf groundsel, menziesia, beargrass, twinflower, starry Solomon's seal, Labrador tea, grouse whortleberry, round-leaved violet, and Sitka valerian.

Other Habitats

Other habitats on the Forest include whitebark pine communities, alpine areas, wetlands, and aspen communities. These habitats occupy small acreages but have high ecological values because they often harbor rare species, have high value as wildlife habitat, and have desirable aesthetic qualities.

Whitebark pine communities occupy drier mountaintops, above the cold limits of Douglas-fir. These forests are open with tree islands and dry meadows and rarely have noxious weed infestations. Alpine meadows and timberline shrub communities reflect the effects of wind abrasion, blowing snow, winter desiccation, intense solar radiation, cold, wet and shallow soils, cold temperature and deep snow. Perennial forbs and low prostrate shrubs are typical life forms. Noxious weeds are rare.

Wetlands dominated by sedges and willows are associated with high water tables that are within six inches of the soil surface for at least one third of the growing season. They occur along streams and rivers and in association with springs, seeps, and depressions. Typically, sedges dominate in areas with perennial standing water and willows occupy the transition between flowing water and upland. Typical species are black cottonwood, paper birch, ponderosa pine, willow species, and water birch. Weed infestations can occur where the overstory canopy of trees and shrubs have been removed.

Some wetlands (i.e., fens) produce more biomass than decomposes; consequently, they develop substrates composed of organic muck or peat. These wetlands typically receive their moisture from groundwater seepage and are cold microenvironments that support a diversity of mosses, sedges, and shrubs such as willow, bog birch, and Labrador tea. Peatlands are rare wetlands that have a high probability of harboring sensitive species (e.g., pale sedge, English sundew, linear-leaved sundew, and water bulrush). There are no known weed infestations in fens on the Helena NF.

Aspen communities, perpetuated by periodic fires, occupy small acreages on the Forest, usually intermixed or adjacent to conifer communities (Pfister *et al.* 1977). Fire suppression and intense wildlife grazing eventually lead to invasion by conifer species. These communities occur in moist upland sites, stream terraces, and slumps. Associated species are serviceberry, pinegrass, elk sedge, Oregon grape, and sweet mountain-cicely. No weeds have been identified in aspen communities.

TABLE 3-9
Predominant Weed* Infestations Acres in Landscape Areas

Species	Belts/Dry Range LA	Divide LA	Elkhorn LA	Blackfoot LA	Total Acres
Spotted knapweed	2,409	2,294	638	5,104	10,445
St. Johnswort	--	--	--	11	11
Oxeye daisy		23	--	1	24
Canada thistle	1,107	1,580	667	191	3,545
Musk thistle	76	--	--	--	76
Houndstongue	--	--	--	1	1
Sulfur cinquefoil	2	330	14		346
Leafy spurge	725	117	8	1	851
Dalmatian toadflax	5,573	1,301	465	19	7,358
Common tansy	11	--	--	--	11
Total	9,903	5,645	1,792	5,328	22,668

* Many locations have more than one species of weeds present. To avoid counting acres twice, only the predominant weed is displayed in the table. The result is that some of the less common weeds, such as houndstongue, are under-represented in the table because often it occurs where spotted knapweed predominates.

Source: Helena NF Weed Database

Noxious Weeds

Generally, noxious weeds infest sites that have less than 10 percent overstory canopy cover of trees and sites that have been disturbed by grazing, road construction, logging, or fires. Approximately 8 million acres (9 percent of the total land area) in Montana is infested with noxious weeds (Duncan, 2001), including approximately 2.4 percent of the Helena NF (**Table 3-9**). Weeds are the single most serious threat to natural habitats in the western US (Duncan 2001).

Noxious weed infestations are causing adverse impacts on native plant communities, hydrological cycles, wildlife habitat, soil and watershed resources, recreation, and aesthetic values (Olson 1999, Pimental). A shift from timber, shrub, and bunchgrass vegetation to noxious weeds decreases wildlife forage and species diversity and increases soil erosion (Lacey 1999, Olson 1999). Noxious weeds present on the Forest are described in detail in the project file (PF-Vegetation).

Effects of fire and fire-suppression activities on the spread of noxious weeds and the introduction of new noxious weeds are concerns on the Forest. Forest canopy cover has been lost in many areas that were formerly shaded. Prior to the fires of 2000, shading by conifers inhibited noxious weeds from spreading into areas with unburned overstories.

Post-fire monitoring data collected by the Helena NF (Winfield 2003) suggests that there is an increase in the number of weedy forbs, and noxious, invasive, weed species (especially Dalmatian toadflax) following fire, mostly in the ponderosa pine and Douglas-fir habitats in the Belts/Dry Range LA.

The proliferation of noxious weeds such as Dalmatian toadflax may alter post-fire succession. Studies have found that Dalmatian toadflax, spotted knapweed, and cheatgrass increase in biomass and cover following fire (Brown *et al.* 2002). Management prescriptions for invasive plants following wildfires are needed to reduce or prevent their establishment and spread on burned sites.

There has been limited research on effects of fire on the spread of noxious weeds. The Forest Service (USFS 2001c) reported that underburning on a site with spotted knapweed caused it to increase. Studies of shelterwood timber harvests indicated that timber harvest with understory burning caused spotted knapweed to increase the second year following these activities (Duncan etal 2001). Low-severity burns usually do not kill knapweed, because of their deep taproots, and insufficient heat to kill seeds buried in soil (Duncan etal 2001). High severity burns create favorable conditions for knapweed to colonize from off site, suggesting that spotted knapweed will thrive in low-severity burn areas and spread into high-severity burned areas.

Information collected for the Lolo National Forest (USFS 2001a), following the 2000 fires, indicated that reductions in crown closure due to burning rendered 7,650 acres high risk for noxious weed infestation. High-risk areas were those where:

- Most of the tree canopy was killed and most ground-level native plants were either killed or severely damaged;
- Burn severity was low, moderate, or high;
- Duff and organic soil was consumed, exposing mineral soil;
- Invasive weeds were present in or adjacent to the area prior to wildfires;
- Sites were dry to moderately dry; and
- Unwashed fire-fighting equipment was used which could introduce invasive weed seeds.

SPECIAL STATUS SPECIES

Three Federally listed threatened plant species (water howellia, Ute's ladies' tresses, and Spaulding's catchfly) occur in Montana though none are found on the Helena NF and suitable habitat is not present.

Twenty species of sensitive vascular plants are known or have the potential to occur on the Forest (**Table 3-10**). Of these 20 species, 8 have been documented to be present (**Table 3-11**).

TABLE 3-10 Habitat of Sensitive Plants Documented or Potentially Present	
Habitat	**Common Name**[1]
Ponds	Water bulrush
Wet meadows, riparian areas, marshes, and fens	English sundew, giant helleborine, linear-leaved sundew, wavy moonwort,, and round-leaved orchid
Forest- meadow ecotones	California false-hellebore, short-styled columbine, small-yellow ladies slipper, sparrow's egg lady's slipper
Grasslands	Alpine meadowrue, Hall's rush, Howell's gumweed, Missoula phlox, peculiar moonwort, wavy moonwort
Cliff crevices	Austin's knotweed, Lackschewitz' milkvetch
Douglas-fir forest	Northern rattlesnake plantain
Open gravelly shale slopes	Austin's knotweed
Alpine	Gray's point-vetch, storm saxifrage

TABLE 3-11 Sensitive Plants Documented for the Helena National Forest		
Species	**Number of Occurrences**	**Landscape Area**
Austin's knotweed	7	Belts/Dry Range
English sundew	2	Blackfoot
Hall's rush	3	Continental Divide
Linear-leaved sundew	2	Blackfoot
Missoula phlox	3	Continental Divide
Peculiar moonwort	2	Continental Divide
Small, yellow lady's-slipper	1	Continental Divide
Water bulrush	1	Blackfoot

Note:

1 Scientific names are included in Appendix B.

Sources: Montana Natural Heritage Program; Barton and Crispin 2002.

An evaluation of threatened, endangered, proposed, and sensitive species was conducted to determine species that are most likely to be present in or near proposed weed treatment areas (Barton and Crispin 2001; 2002). Weed treatments pose the greatest risk to long-style thistle and Austin's knotweed in the Belts/Dry Range LA and Missoula phlox in the Continental Divide LA, near MacDonald Pass (Barton and Crispin 2001; 2002). Populations of these species are often intermixed with noxious weeds.

WILDERNESS AND INVENTORIED ROADLESS AREAS

Wilderness Areas are areas of Federally owned land that have been designated by Congress as wilderness, in accordance with the Wilderness Act of 1964. These areas are protected and managed so as to preserve their natural conditions which (1) generally appear to have been affected primarily by forces of nature with the imprint of man's activity substantially unnoticeable; (2) have outstanding opportunities for solitude or a primitive and confined type of recreation; (3) have at least 5,000 acres or is of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and (4) may contain features of scientific, educational, scenic, or historical value as well as ecologic and geologic interest. A Wilderness Study analysis is conducted on candidate areas to determine an area's appropriateness, cost, and benefits for addition to the National Wilderness Preservation System (NWPS).

Inventoried Roadless Areas (IRAs) are areas identified in a set of inventoried roadless area maps, contained in Forest Service Roadless Area

Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, which are held at the national headquarters office of the Forest Service, or any subsequent update or revision of those maps.

REGULATORY FRAMEWORK

Wilderness areas are managed as directed by the Wilderness Act of 1964. Generally, management activities do not occur, yet there are many exceptions. Some of them include trail construction and maintenance, fire suppression, removal of existing structures, dams, and noxious weed treatment.

FSM 2323.26b – Wilderness Management allows plant control for "noxious farm weeds by grubbing or with chemicals when they threaten lands outside wilderness or when they are spreading within the wilderness, provided that it is possible to effectively control the weeds without causing serious adverse impacts on wilderness values."

FSM 2109.14 (13.4), the Pesticide-Use Management and Coordination Handbook, requires Regional Forester approval of pesticide use in designated wilderness areas.

The Helena National Forest Plan sets management goals and standards for Scapegoat Wilderness (Management Area P-1 – Helena NF portion of the Bob Marshall Wilderness Complex) that states the following:

- Management Goals – Maintain plants and animals indigenous to the area by protecting the natural dynamic equilibrium associated with natural, complete ecosystems (FP pg III/56).
- Managers will concentrate on improving conditions at campsites with unacceptable impacts such as the abundance of non-native plant species (FP pg III/58).
- Natural processes such as fire, wind, and insect and disease activity will be the only agents permitted to influence vegetation and its associated wildlife in the wilderness (FP pg III/59).
- Before a decision is made to control noxious weeds with chemicals, an environmental document must be prepared discussing the need for control, risk to human health, and the method to be used (FP pg III/62).
- All project proposals will be analyzed and evaluated to determine the potential water quantity and quality impacts. Mitigation measures will be developed to minimize adverse effects. If the unacceptable effects cannot be adequately mitigated, the project will be redesigned or abandoned (FP pg III/65).

Stated management goals for the Gates of the Mountains Wilderness (Management Area P-2 Helena NF portion of Gates-of-the-Mountain Wilderness) include:

- Maintain plants and animals indigenous to the area by protecting the natural dynamic equilibrium associated with natural, complete ecosystems (FP pg III/66).

Current Forest Service policy is that no development of Inventoried Roadless Areas (IRAs) will occur without Regional Forester approval. Noxious weed treatments would not be considered development.

Forest Plan direction for Management Area P-3 (Recommended for wilderness designation) is to maintain natural vegetative composition.

ANALYSIS AREA

The analysis area for wilderness, proposed wilderness, and inventoried roadless areas is the extent of the individual wilderness area and/or roadless area.

ANALYSIS METHODS

The source of information for the Affected Environment was the Forest Plan and its associated EIS, in addition to the Forest Weed Database and Forest Weed Managers. The analysis is based on the potential for the proposed weed treatment activities to impact those values inherent to designated wilderness or proposed wilderness and traits associated with inventoried roadless areas (e.g., roadless nature).

AFFECTED ENVIRONMENT

Wilderness

Congress designated the 28,600-acre Gates of the Mountains Wilderness in 1964. The wilderness is currently being managed in compliance with existing wilderness regulations. An additional 9,600 acres of IRA (Big Log - see below) are adjacent to the wilderness boundary.

Although no weed infestations within Gates of the Mountains Wilderness are mapped, there are noxious weeds just inside the wilderness boundary along several trails, including, Missouri River Canyon Trail # 257, Big Log Gulch Trail #252, and Porcupine Creek Trail # 263. Sections of these trails leading to the wilderness are more heavily infested. It is estimated that less than five acres total are infested within the Gates of the Mountains.

The Scapegoat Wilderness is 239,000 acres and was designated in August 1972. It is located in the Blackfoot Landscape Area. Burned areas are at high risk for noxious weed infestation.

There are currently about 68 acres of weed infestation identified in the Scapegoat Wilderness. The majority (72 percent) is spotted knapweed, followed by Canada thistle (21 percent), Dalmatian toadflax (four percent), and houndstongue and ox-eye daisy (both two percent). Infestations occur in 24 locations.

Inventoried Roadless Areas and Recommended Wilderness

Portions of three IRAs are designated by the Forest Plan as Management Area P-3, Recommended Wilderness. The three areas include Big Log, which is adjacent to the Gates of the Mountains Wilderness, the Mount Baldy IRA in the Belts/Dry Range LA, and the Electric Peak IRA located in the Continental Divide LA. Weed infestation in IRAs is shown in **Table 3-12**.

There are 23 IRAs in the Helena NF (**Table 3-13**). Currently, approximately one half of a percent of the total acres of IRA is known to be infested with noxious weeds.

WILD AND SCENIC RIVERS

REGULATORY FRAMEWORK

The Wild and Scenic Rivers Act (16 US 1271) and Interagency Guidelines provide the following direction for establishing preliminary classifications for eligible Wild and Scenic Rivers. These classifications along with applicable Forest standards are discussed below.

Wild - Rivers or sections of rivers are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America. Agricultural use is restricted to the amount of domestic livestock grazing currently practiced. Motorized travel on land or water may be permitted, but is generally not compatible with this classification.

Scenic - Rivers or sections of rivers are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads. A wider range of agricultural uses is permitted to the extent currently practiced. Row crops are not considered as an intrusion of the "largely primitive" nature of scenic corridors as long as there is not a substantial adverse effect on the natural-like appearance of the river area. Motorized travel on land or water may be permitted, prohibited, or restricted to protect the river values.

TABLE 3-12 Recommended Wilderness Areas and Weed Infestation			
IRA	Acres	Acres of Weed Infestation	Known Weed Species
Big Log	9,651	110	Spotted knapweed, Canada thistle, Dalmatian toadflax, leafy spurge
Mount Baldy	17,459	6	Musk thistle, spotted knapweed
Electric Peak Total	27,753	79	Spotted knapweed, Canada thistle
Total	**54,863**	**195**	

Recreational - Rivers or sections of rivers are readily accessible by road or railroad, may have some development along their shorelines, and may have undergone some impoundment or diversion in the past. Adjacent lands may be managed for a full range of agricultural uses, to the extent currently practiced. Motorized travel on land or water may be permitted, prohibited, or restricted. Controls will usually be similar to surrounding lands and waters.

TABLE 3-13 IRAs and Weed Infestation by Landscape Area			
IRA	Acres	Acres of Weed Infestation	Known Weed Species
Belts/Dry Range LA			
Holter	2,334	26	Spotted knapweed
Grassy Mountain	6,845	13	Spotted knapweed
Devils Tower	7,149	154	Spotted knapweed, Canada thistle, leafy spurge
Irish Gulch	7,739	66	Leafy spurge
Ellis Canyon	15,415	2	Musk thistle
Hellgate Gulch	17,959	178	Spotted knapweed, Canada thistle, leafy spurge, Dalmatian toadflax
Cayuse Mtn	20,648	168	Spotted knapweed, musk thistle, Canada thistle, Dalmatian toadflax
Camas Creek	31,751	15	Spotted knapweed
Middleman Mtn-Hedges Mtn	35,212	1028	Leafy spurge, Spotted knapweed, musk thistle, Canada thistle, Dalmatian toadflax
Total	**145,052**	**1650**	
Blackfoot LA			
Anaconda Hill	19,594	35	Spotted knapweed
Bear-Marshall-Scapegoat-Swan	53,806	125	Spotted knapweed, Dalmatian toadflax, Canada thistle, houndstongue
Crater Mountain	9,882	88	Spotted knapweed, Canada thistle
Lincoln Gulch	7,820	0	
Nevada Mountain	50,827	95	Spotted knapweed, Canada thistle
Ogden Mountain	11,939	100	Spotted knapweed
Silver King/Falls Creek	7,119	0	
Spectmen Creek	13,357	16	Canada thistle
Total	**174,344**	**459**	
Continental Divide LA			
Nevada Mountain Total	50,827	11	Spotted knapweed
Jericho Mountain Total	9,043	.2	Spotted knapweed
Lazyman Mountain Total	12,209	85	Spotted knapweed, Canada thistle, sulfur cinquefoil, Dalmatian toadflax, leafy spurge
Total	**72,079**	**96**	
Grand Total*	**446,338**	**2,399**	

*Includes IRA designated as recommended wilderness from **Table 3- 12**.

Streams determined to be eligible for protection under the Wild and Scenic Rivers Act will be protected to maintain their potential classification pending suitability studies.

Wild, Scenic and Recreational Management Standards were adopted from Forest Service Handbook 1909.12 - Chapter 8. Section 8.21c says "For a river to be eligible for designation to the National System, one or more of the following values within the river area must be outstandingly remarkable: 1) scenic, 2) recreational, 3) geological, 4) fish and wildlife, 5) historical, 6) cultural, 7) other values, including ecological values."

Forest-wide standards in the Forest Plan (Amendment No. 2) for Wild and Scenic Rivers that apply to this project give direction on management of range and motorized travel and to protect the outstandingly remarkable resource values of fisheries.

ANALYSIS AREA

The analysis area for Wild and Scenic Rivers are those streams and adjacent lands within the Helena NF that are potentially eligible for protection under the Wild and Scenic Rivers Act.

ANALYSIS METHODS

The source of information for the Affected Environment was the Forest Plan and its associated EIS. The analysis is based on the potential for the proposed weed treatment activities to impact those values inherent to rivers or streams on the Helena NF that are eligible for Wild and Scenic Rivers designation.

AFFECTED ENVIRONMENT

Amendment 2 to the Forest Plan (April 1989) identified segments of four streams on the Helena NF as eligible for protection under the Wild and Scenic Rivers Act. They include portions of Copper Creek, Little Blackfoot River, Beaver Creek, and the Missouri River (from Hauser Dam to Cochran Gulch). These stream segments will be further studied to determine their suitability for inclusion into the Wild and Scenic Rivers System.

Table 3-14 describes the extent of the known current weed infestation within the eligible stream segments on National Forest System lands. In most cases, the weed infestations follow the rivers and roads within the corridors, indicating how they became infested. Burned areas are at higher risk for weed infestation.

TABLE 3-12
Current Weed Infestation In Eligible Stream Segments

Landscape Area/Segment	Weed Species	Acres Infested on NFS lands[1]
Belts/Dry Range	**Total**	**297**
Beaver Creek	Spotted knapweed	137
	Leafy spurge	101
	Canada thistle	3
	Total	241
Missouri River	Spotted knapweed	45
	Leafy spurge	11
	Total	56
Continental Divide	**Total**	**65**
Little Blackfoot	Canada thistle	65
Blackfoot	**Total**	**30**
Copper Creek	Spotted knapweed	30
Total of Weeds in Eligible Segments		**392**

[1] Within the eligible Wild and Scenic River segments (1/4 mile on either side of the river).

Copper Creek is eligible as a recreational river. The outstandingly remarkable values are fish and wildlife. It provides critical spawning and rearing habitat for bull trout (fluvial strain) and cutthroat trout. Riparian zones offer unique habitat for threatened grizzly bear.

Little Blackfoot River has two eligible segments. The upper segment above Kading Cabin is eligible as a wild river, the segment below that is eligible as a recreational river. The outstandingly remarkable value is fish. The river provides high quality habitat for westslope cutthroat trout. Portions of these reaches are inhabited by fluvial bull trout populations.

Beaver Creek is eligible as a recreational river. The outstandingly remarkable value is fish. It is the only spawning tributary for the "Blue Ribbon" stretch of the Missouri River between Hauser Dam and Holter Reservoir.

Missouri River is eligible as a scenic river from Hauser Dam to Cochran Gulch. The outstandingly remarkable values are scenery, recreation, geology, fish, and wildlife. It provides nationally renowned fishing for trophy-sized brown trout, represents the Eldorado thrust fault, has outstanding cliffs and seeps and was one of main travel routes for the Lewis and Clark expedition.

RECREATION

REGULATORY FRAMEWORK

The goal of the Helena Forest Plan (1986) relative to recreation is to provide a range of motorized and non-motorized recreation opportunities and experiences, with the emphasis on dispersed recreation.

The Forest Service Manual, FSM 2300, describes the Forest Service Authority, Objectives, Policy, and Responsibility for recreation management.

Pertinent Federal laws are the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act, and the Wilderness Act of 1964.

ANALYSIS AREA

Recreation opportunities on the Helena NF were analyzed by landscape area: the Belts/Dry Range LA, the Blackfoot LA, Continental Divide LA, and the Elkhorn LA.

ANALYSIS METHODS

The source of information for the Affected Environment was the Forest Plan and its associated EIS. The analysis is based on the potential for the proliferation of noxious weeds if left untreated, and proposed weed treatment activities to impact recreational opportunities on the Helena NF.

AFFECTED ENVIRONMENT

Noxious weeds can affect the recreation experience. Invading weeds such as spotted knapweed, tansy, Scotch thistle, and yellow starthistle detract from the desirability of using recreation sites and enjoyment of the forest environment. These species diminish the usefulness of sites because the stiff plant stalks, thorns, or sharp bristles can discourage or prevent walking, sitting, or setting up a camp. Noxious weeds also detract from the recreation experiences by reducing the variety and amount of native flora to observe or study and reducing forage availability for wildlife and recreational livestock.

Noxious weeds are frequently spread through recreational activities, particularly along roads, trails and dispersed recreation sites. As stated in Chapter 1, about 198 miles of roads are known to be infested on the Helena NF.

The Helena NF provides a variety of recreational experiences including dispersed camping, hiking, hunting, fishing, mountain biking, snowmobiling, horseback riding, cross-country skiing, and driving for pleasure. Passenger vehicle roads (levels 3, 4, and 5) provide the primary transportation routes into and through the Helena NF. While these roads provide access for a variety of purposes (commercial, residential, administrative), the primary public benefit may be recreational (USDA 2001). Level 3, 4, and 5 roads are designed and maintained for use by passenger vehicles. Level 1 and 2 roads are closed for more than 1 year or are for use by high-clearance vehicles. There are 678 miles of Level 3-5, and 2,703 miles of Level 1 and 2 roads on the Helena NF (USDA 2001).

Belts/Dry Range Landscape Area

The Belts/Dry Range LA is managed for a diversity of recreation opportunities, including hiking, hunting, camping, fishing, off-highway vehicle trail riding, auto-touring, horseback riding, snowmobiling, picnicking, and cross-country skiing. The scenic beauty, wildlife diversity, landscape, air and water quality, history and social feelings of non-crowded recreation are sustained and protected.

Existing developed recreation sites include Meriwether, Coulter, Vigilante, Skidway, Deep Creek, and Gipsy Lake. Four rental cabins (Indian Flats, Bar Gulch, Thompson, and Flynn Memorial) and seven special use cabins are available within the landscape area. Four to six authorized outfitter/guide services operate under Special Use Permits in the Big Belt Mountains.

Approximately 42 percent of the dispersed, permitted use, special use, rental cabin and special use cabin sites in this Landscape Area have known weed infestations.

Dispersed recreation use occurs primarily in the Deep Creek, East Fork Deep Creek, Birch Creek Basin, Duck Creek Pass, Avalanche, Magpie Creek, and Beaver Creek drainages. There are 21 heavily used dispersed recreation areas. The 28,600-acre Gates of the Mountains Wilderness Area is accessed from trailheads along Beaver Creek and from the Gates of the Mountains recreation area on the Missouri River between Upper and Lower Holter Lake.

Approximately 320 miles of level 3-5 roads provide access to the Belt LA (USDA 2001f). In addition, about 125 miles of trail are available for non-roaded and OHV use.

Blackfoot Landscape Area

The Blackfoot LA is accessed primarily from Montana Highway 200 and features 244 miles of trails, 492 miles of roads, with most use occurring during the big game hunting season and on holiday and winter weekends. Some of the most popular activities include driving for pleasure, hunting, fishing, snowmobiling, hiking, camping, picnicking, off-highway vehicle use, cross-country skiing, firewood cutting, mountain biking, horseback riding, and berry picking. There are seven heavily used dispersed recreation areas. Other uses more unique to the area include the annual Race to the Sky Sled Dog Race, hiking the Continental Divide National Scenic Trail, and enjoying the two cabins available for short-term rental. The Rogers Pass watchable wildlife site (administered by the Lincoln District) is a renowned raptor flyway located just east of the Forest boundary (USFS 1995b).

Within the 80,700-acre Forest portion of the Scapegoat Wilderness, the types of allowable activities are defined by the Wilderness Act. Several Forest Service authorized outfitter and guide services provide big game hunting and summer horseback camping and fishing opportunities in the area under Special Use Permits.

Approximately 78 percent of the dispersed, permitted use, special use, rental cabin and special use cabin sites in this Landscape Area have known weed infestations.

Continental Divide Landscape Area

The Continental Divide LA is easily accessible from major travel routes and surrounding communities. Subdivision and heavy seasonal recreation use characterize the area. The area has 323 miles of trails, 770 miles of roads, four developed campgrounds, one picnic area, and one rental cabin. A variety of motorized and non-motorized recreation trail opportunities occur in the Continental Divide LA. Of the 323 miles of "system" trails within the Continental Divide LA, 219 miles are snowmobile routes located on public roads.

Currently there are no designated motorized trails in the area for use during summer and fall, however, illegal ATV use occurs on non-designated trails. The Little Blackfoot River area is one of the most popular recreation corridors. The area offers summer and winter dispersed and developed recreation opportunities including auto-touring, picnicking, camping, fishing, hiking, horseback riding, hunting, cross-country skiing, and snowmobiling. Numerous mountain biking routes have been "user" established in the mountains south of Helena. The Mount Helena National Recreation Trail is located adjacent to the city of Helena and extends approximately 5.7 miles from the Mount Helena City Park south to the residential area of Park City. A cross-country skiing site is located on private and NFS land near the former Frontier Town on MacDonald Pass near Helena. Several cultural and historic sites are features of attraction to visitors. Gulches south of Helena (Grizzly, Dry, Orofino), as well as the Little Blackfoot Corridor and Ten-Mile Creek (Rimini

Road), are rich in mining history and scenery (USFS 1996a, 2002d).

Only one Forest Service-authorized outfitter-guide regularly uses the LA (Blackfoot Meadows). Other Special Use Permit-authorized activities occurring in Continental Divide LA include sled dog races, snowmobile events, and mountain bike trips. The Charter Oak Mine is the only Forest interpretation/ educational site in the LA. Kading Cabin has increasingly been used for various Helena NF community outreach and education programs such as Artists-in-Residence, Forest-Community Concerts, and Passports in Time. There are six heavily used dispersed recreation areas. Approximately 56 percent of the dispersed, permitted use, special use, rental cabin and special use cabin sites in this Landscape Area have known weed infestations.

Elkhorn Landscape Area

The Elkhorn LA is accessed from Interstate Highway 15, U.S. Highway 287, and Montana Highway 69. The area is popular for camping, picnicking, hiking, upland bird and big game hunting, mountain biking, cross-country skiing, driving for pleasure, sightseeing, snowmobiling, horseback riding, and target shooting. Public access to and recreational use of the area is somewhat constrained due to the many large private in-holdings and private property adjacent to the Forest boundary. There are several areas where NFS land is not accessible to the public due to the lack of recorded easements. These areas are suitable for various types of recreation, but due to limited access are primarily used by adjoining landowners. There are nine heavily used dispersed recreation areas.

The Elkhorn Mountains Travel Management Plan (USFS 1997c) restricted motorized travel to designated routes on Federal land throughout the Elkhorn Mountains. Most of the designated routes offer access to non-motorized trailhead facilities. Under the Travel Plan portions of Forest Road #258 (Iron Mine), #8578 (Queen's Gulch), and #8580 (East Fork Dry Creek) are available for use by off-highway vehicles and full-size vehicles under a "motorized trail" designation (USFS 1997c).

A developed site in the Elkhorn Mountains is located near the town of Elkhorn. The site consists of day-use picnic tables, some interpretive activities, and outhouses. The historic mining town of Elkhorn and the associated cemetery are visitor destinations in southwest Montana. The cabins at Eagle Guard Station and the Strawberry Lookout are included in the cabin rental program.

Approximately 64 percent of the dispersed, permitted use, special use, rental cabin and special use cabin sites in this Landscape Area have known weed infestations.

Hunting is one of the most popular recreation activities in the Elkhorn LA. Dispersed recreation (camping) use occurs mostly in Crow Creek and South Fork Crow Creek drainages. While hunting occurs on both private and public land, the majority of hunting takes place on public land. This use primarily occurs during the archery and rifle big game seasons, although mountain lion and upland bird hunting are also popular in the area. One authorized outfitter/guide service operates in the Elkhorn Mountains under a Special Use Permit.

Fishing occurs in several streams within the area. Muskrat Creek, which contains both cutthroat and brook trout, is often fished at a popular dispersed site near the Forest boundary. The East Fork of Dry Creek, Queen's Gulch, and Crow, Elkhorn, McCarty, and Rawhide creeks all have fishable populations of brook trout; however, this use is believed to be limited. Leslie, Hidden, and Tizer lakes have Yellowstone cutthroat trout and are popular fishing/camping/hiking destinations.

Cross-country skiing occurs mostly from the town of Elkhorn toward Elkhorn or Crow Peaks on Forest Road #258 and #8578. The popularity of these roads may be in part due to the good snow conditions and the ability to drive the county road (which is plowed during winter months) to Elkhorn. Snowmobiling is popular on the designated open routes from the town of Elkhorn. Snowmobile use is concentrated primarily in areas also used by cross-country skiers (USFS 1997c).

RESEARCH NATURAL AREAS

Research Natural Areas (RNAs) are designated areas representing as many as possible of the major, natural timber types or other plant communities in an unmodified condition.

REGULATORY FRAMEWORK

At the time the Forest Plan was signed, there were no areas formally designated as RNAs, although three areas were proposed. The Forest Plan was amended in 1997, formally designating Cabin Gulch, Indian Meadows, and Red Mountain as RNAs and continuing management of Granite Butte as a candidate RNA.

The Forest Service Manual 4063 - Research Natural Areas directs that if practicable, exotic plant or animal life should be removed from RNAs.

The establishment records for all of the RNAs say "Pest management and noxious weed control will be as specific as possible against target organisms and induce minimal impact on other components of the area. If invasive exotics are discovered within the RNA, measures will be taken to control or eradicate these populations."

The Decision Notice establishing the RNAs (PF-RNAs) selected an alternative that included this direction: "Procedures permitted for control of noxious weeds and use of herbicides are described in FSM 4063. The need for, and type of, noxious weed control would be reviewed on a case-specific basis and covered by an appropriate review under the National Environmental Policy Act (NEPA)." This analysis serves as the NEPA review.

ANALYSIS AREA

The analysis areas for RNAs are the RNAs themselves.

ANALYSIS METHOD

Information for the Affected Environment came from the Establishment Records for the individual RNAs, which were completed in 1997, current GIS layers and weed inventory. The analysis is based on the effect the activities in each alternative would have on the establishing criteria for each RNA, and potential for affecting ecological integrity.

AFFECTED ENVIRONMENT

There are three RNAs designated within the project area (see **Figure 3-9**). They include Cabin Gulch (2,408 acres) in the Belts/Dry Range LA, and Indian Meadows (855 acres) and Red Mountain (1901 acres) in the Blackfoot LA. One area, Granite Butte (500 acres), also in the Blackfoot LA is proposed for designation.

Cabin Gulch RNA

The current database does not indicate a weed infestation in this location (PF-Weed Database), however, the establishment record showed occurrences of noxious weeds primarily on the lower edge of the RNA adjacent to Soup Creek (USFS 1997a pg. 6).

The Cabin Gulch RNA is located in the Middleman Mountain/Hedges Inventoried Roadless Area.

Indian Meadows RNA

About 10 percent (106 acres) of the northwest corner of the RNA is in the Scapegoat Wilderness. The RNA borders private land in the southeast corner for about 130 feet. There are no known weed infestations in this RNA.

Red Mountain RNA

This RNA is adjacent to the southwest boundary of the Scapegoat Wilderness Area. There are no known weed infestations in this RNA.

Granite Butte Proposed RNA

The Granite Butte Proposed RNA is representative of subalpine fir forest types. It also includes wet meadows. There was about 5 acres of Canada thistle in near the center of the RNA that was sprayed with picloram in 1999 (PF-Weed Database) and is monitored.

CULTURAL RESOURCES

REGULATORY FRAMEWORK

The primary legislation governing modern heritage management is the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992). All other heritage resource management laws and regulations support, clarify, or expand on the National Historic Preservation Act. Federal Regulations 36 CFR 800 (Protection of Historic Properties), 36 CFR 63 (Determination of Eligibility to the National Register of Historic Places, 36 CFR 296 (Protection of Archaeological Resources), and Forest Service Manual 2360 (FSM 2360) provide the basis of specific Forest Service heritage resource management practices. These laws and regulations guide the Forest in identifying, evaluating, and protecting heritage resources.

The Forest Plan is consistent with the laws discussed above. Additional Forest-wide management standards that apply to the alternatives considered include:

- Significant evaluated cultural resource sites would be preserved in place wherever possible.
- A survey for cultural resources would be made prior to ground-disturbing activities.
- The Forest would consult with Native American traditional religious leaders to identify sites to be protected in accordance with the American Indian Religious Freedom Act of 1978.

The Forest Service is required to consider effects of agency actions on heritage resources that are determined eligible for the National Register of Historic Places (NRHP) or on heritage resources not yet evaluated for eligibility. Eligible heritage resources are termed "historic properties." The Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation are also an important element of management of cultural resources on public land.

Several other laws address various aspects of heritage resource management, including the National Environmental Policy of Act of 1969 (NEPA), National Forest Management Act of 1976 (NFMA), Antiquities Act of 1906, Historic Sites Act of 1935, and the Archaeological Resource Protection Act of 1979 as amended in 1988 (ARPA). ARPA and two other regulatory acts describe the role of tribes in the federal decision-making process, including heritage management. ARPA requires Tribal notification and consultation regarding permitted removal of artifacts from federal land. The Native American Graves Protection and Repatriation Act of 1990 recognizes tribal control of human remains and certain cultural objects on public land and requires consultation prior to their removal. The American Indian Religious Freedom Act of 1978 requires federal agencies to consider impacts on traditional tribal cultural sites. The National Historic Preservation Act (NHPA) specifically calls for tribal participation in the consultation process (Section 106).

ANALYSIS AREA

The area analyzed in this section includes all NFS land that may be affected by the Project. Research on known heritage properties included an area approximately one-quarter mile beyond proposed treatment boundaries. The extended area of analysis provides contingencies for potential over-spray from aerial application of herbicides, or poorly defined site boundaries.

ANALYSIS METHODS

The Heritage Resource Atlas (USFS no date) was compared to potential treatment acres to determine if any cultural resources have been recorded within treatment areas. Due to the various scales of the treatment area maps, it was not always possible to positively ascertain if a resource was located within a proposed treatment area. All resources within treatment areas and any cultural resources that could not be precisely located due to the differing scale of maps were noted.

Review of records at the Helena NF Supervisor's Office also included a search of recent cultural resource reports that have not yet been added to the heritage atlas. These reports were searched for any cultural resources within the four Landscape Analysis Areas. The records review located 109 previously recorded cultural resources. Each site form was reviewed to confirm site location compared to treatment areas for each alternative. The cultural resources that were not located within treatment areas were excluded from further analysis.

AFFECTED ENVIRONMENT

The Cultural Resources Investigation (PF – Heritage) contains all sites located during the records search within proposed treatment areas, including site number and name, a brief site description, and eligibility recommendation.

There are 83 previously recorded cultural resources located in the areas currently infested with weeds (**Table 3-15**).

The previously recorded resources include prehistoric and historic resources. The historic resources include cabins, placer and hard rock mining sites, earthen dams, and historic roads and trails. The prehistoric resources include rock art sites, rock shelters with rock art, lithic scatters, occupation sites, and quarries.

In addition to previously recorded cultural resources, there are weed infested areas that contain historic mining resources not yet recorded. A cursory review of the USGS quadrangles indicates several areas in the Belts/Dry Range and Continental Divide LA that are rich in historic mining resources.

SOCIO-ECONOMICS AND ENVIRONMENTAL JUSTICE

REGULATORY FRAMEWORK

Forest-wide goal #16: Manage the Forest in a manner that is sensitive to economic efficiency.

The Environmental Justice Executive Order 12898, released by the White House in February 1994, places attention on any adverse human health and environmental effects of agency actions that may disproportionately impact minority and low-income populations. Low-income populations are households that live below the subsistence or poverty level as defined by local, states, or national government. The Order simultaneously directs Federal agencies to avoid making decisions that discriminate against these communities.

Environmental justice means that, to the greatest extent practicable and permitted by law, populations are provided the opportunity to comment before decisions are rendered on, are allowed to share in the benefits of, are not excluded from and are not affected in a disproportionately high and adverse manner by, government programs and activities affecting human health or the environment.

ANALYSIS AREA

The analysis area is the five counties where weed treatment activities would occur.

ANALYSIS METHOD

Employment and demographic information was gathered from the US Census Bureau and the Montana Department of Commerce. Information

TABLE 3-13
Previously Recorded Cultural Resources Within Weed Infestation Areas

Treatment area	Belts/Dry Range	Elkhorn	Blackfoot	Continental Divide	Total
Sites Eligible	17	1	7	5	30
Sites Ineligible	24	5	3	4	36
Sites with Unknown Eligibility	8	0	2	7	17
Total Number of Cultural Resources	49	6	12	16	83

on treatment costs was gathered from personal contacts with weed managers in various federal agencies and private weed treatment companies.

AFFECTED ENVIRONMENT

POPULATION AND DEMOGRAPHICS

According to the 2000 US Census, the combined population in the five counties containing affected landscape units was 79,262 (**Table 3-16**).

TABLE 3-14
Population by County, 2000

County	Number of Residents	Percent Growth 1990-2002
Lewis and Clark	55,716	17.3
Jefferson	10,049	26.6
Broadwater	4,385	32.2
Powell	7,180	8.5
Meagher	1,932	6.2
State of Montana	902,195	12.9

Source: US Census Bureau 2002.

Federal, state, county, and municipal governments are the primary employers in the five-county region, followed by services and retail trade. Manufacturing accounts for the majority of the employment in Broadwater County. **Table 3-16** and **Table 3-17** present the average annual number of employees by industry, in 2000 for the five counties.

Powell and Meagher Counties did not grow at the state level and are not expected to experience any significant growth because, in addition to the lack of employment, there is little privately-owned land available for development.

Meagher and Powell Counties have a small business base making employment statistics hard to obtain. If there are fewer than five businesses in a category, the Census does not publish employment numbers in order to protect the confidentiality of employers, accounting for the Not Available (na) listing in many categories (**Table 3-18**).

Median household income and the unemployment rate also reflect the difference between the growing counties and those that showed stagnate growth during the census period (**Table 3-19**).

TABLE 3-15
Industry Employees – Lewis and Clark, Jefferson and Broadwater Counties, 2000

Industry	Lewis and Clark	Jefferson	Broad-water
Agriculture/ forestry/fish	281	28	29
Mining	17	311	72
Construction	1,258	150	48
Manufacturing	1,023	119	325
Trans, comm., utilities	1,216	68	29
Wholesale trade	797	54	40
Retail trade	5,081	263	155
Finance, insurance, real estate	1,841	43	32
Services	7,987	261	160
Government	8,359	863	241

Source: MT Department of Commerce 2001.

TABLE 3-16
Industry Employees – Meagher and Powell Counties, 2000

Industry	Meagher	Powell
Total, all industry	292	1,143
Agri, Forestry, fish	18	48
Information	na	40
Construction	21	42
Manufacturing	na	na
Trans. and\warehousing	na	40
Wholesale trade	na	20
Retail trade	58	137
Finance, insurance, real estate	na	41
Services	64	378
Health care services	80	288

Source: US Census Bureau 2002.

Helena, the state capital, continues to attract new residents because of government and government-related jobs in the retail trade and services industries. In fact, approximately 60 percent of the five-county population is located in the greater Helena area.

TABLE 3-17 Household Income (1999) and Unemployment (2002)		
County	1999 Median Household Income	2002 Unemployment Rate
Lewis and Clark	$37,360	4.3%
Jefferson	$41,506	5.1%
Broadwater	$32,689	4.6%
Powell	$29,595	4.8%
Meagher	$22,471	7.2%
State of Montana	$33,024	4.9%

Source: US Census Bureau 2002, MT Department of Commerce 2000.

WEED TREATMENT COSTS

A range of costs for each treatment method was developed from four different sources and each was evaluated for relative effectiveness (**Table 3-20**). More information is available in the project file (PF-Social/Economic).

The Helena NF employs 4.4 permanent employees to manage noxious weeds. In fiscal year 2002, 22 seasonal employees were hired (5.5 full time equivalents [FTE]) to assist and implement the control strategies of the noxious weed program. Approximately $340,000 was spent on salaries to implement the program out of a budget of $1.75 million. Fire restoration funds contributed $1.4 million, and the remainder came from Regional allocations and grants. Approximately 5,500 acres were treated in fiscal year 2002 at an average cost of $61.82 per acre (PF-Social/Economic).

HUMAN HEALTH AND SAFETY

REGULATORY FRAMEWORK

Safety standards for herbicide use are set by the Environmental Protection Agency, Occupational Health and Safety Administration (OSHA), Code of Federal Regulations (40 CFR part 170), and individual states. In addition, several sections of the Forest Service Manual (FSM; 1994) provide guidance to the safe handling and application of herbicides. These include:

TABLE 3-18 Weed Control Methods and Costs		
Method	General Effectiveness	Cost/ Acre
Ground application of herbicide – vehicle access	High	$24 – 115
Ground application – primarily vehicle access-some backpacking (current method)	High	$62
Ground application of herbicide – backpack access	High	$125-350
Aerial application of herbicide	High	$18 – 24
Biologicals ($1 per insect, 40 insects per acre)	Low - High	$40
Grazing	Low	$20-48
Handpulling	High for small infestations of tap-rooted weeds; low for high density infestation > 1 acres or rhizomatous.	$8,800

- Preparation of a safety plan for all pesticide use projects (FSM 2150).
- Consultation of pesticide handling requirements set forth in the Forest Service Health and Safety Code Handbook (FSH) 6709.11, before handling pesticides (FSM 2156).
- Pesticide-Use Management and Coordination Handbook that requires the Forest to review pesticide use proposals in terms of human health (FSM 2109.13.2).
- Recommendation to complete risk assessments prior to pesticide use to ensure public safety (FSM 2109.14).
- Completion of project work plans prior to implementation, including a description of personal protective clothing and equipment required (FSM 2109.14.3).
- Safety Planning that requires development of a safety plan to protect the public and employees from unsafe work conditions when pesticides are involved (FSM 2109.16, FSM 2153.3).

- Safety and Health Hazard Analysis that requires completion of a Job Hazard Analysis (Form FS-6700-7) to determine hazards on the project and identify ways to eliminate them (FSM 2109.16.2, FSM 6700, FSH 6709.11).

Finally, FSM 2109.16.3 states the requirement for, and defines *Pesticide Risk Assessment: "Pesticide Risk Assessment. Another method of helping to ensure safety in pesticide use is to conduct risk assessments. Analyses estimate the possible pesticide doses to workers and the public who may be affected by a pesticide application; and the potential effects on fish, wildlife, and other non-target organisms. These estimated doses are then compared with levels of no observed effects based on tests of laboratory animals.*

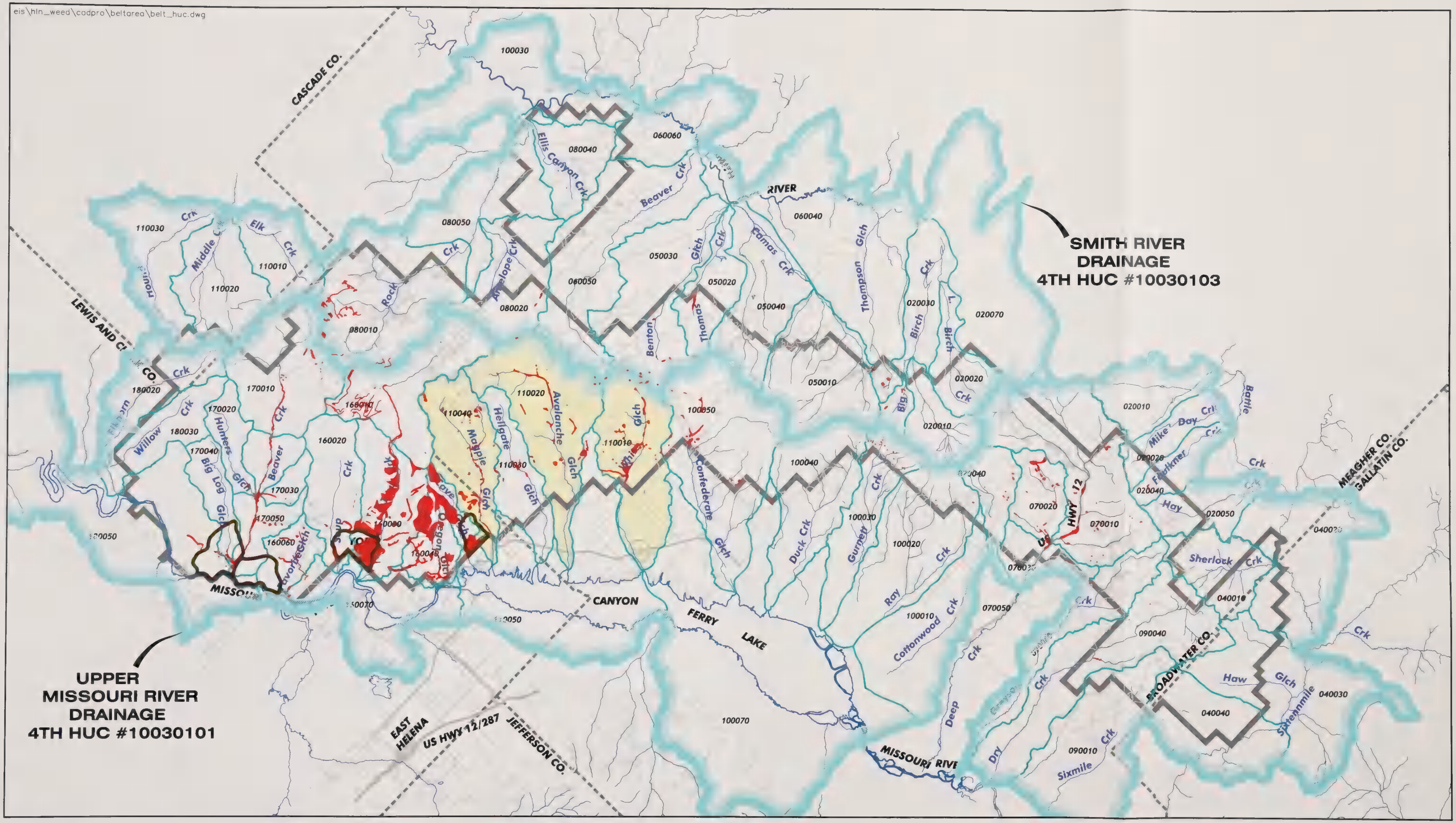
These analyses are usually incorporated into the decision making documents prepared in compliance with the National Environmental Policy Act (FSM 1950). A pesticide risk assessment does not, in itself, ensure safety in pesticide use. The analysis must be tied to an action plan which provides mitigation measures to avoid potential risks identified by the risk assessment."

ANALYSIS METHODS

The effects analysis compares the application rates, location and timing, and Environmental Protection Measures specified in Chapter 2 with scientific literature on toxicity and risks. The review of the effects of herbicide application in this document includes possible doses of pesticide workers and the public may receive, and are compared to levels of no observed effects.

AFFECTED ENVIRONMENT

There is no affected environment for this issue.



LEGEND

Weed Treatment Areas

Grazing Areas

Helena Forest Boundary

Roads

County

Streams

090010 5th/6th Hydrologic Unit Code (HUC)

6th HUC Boundary

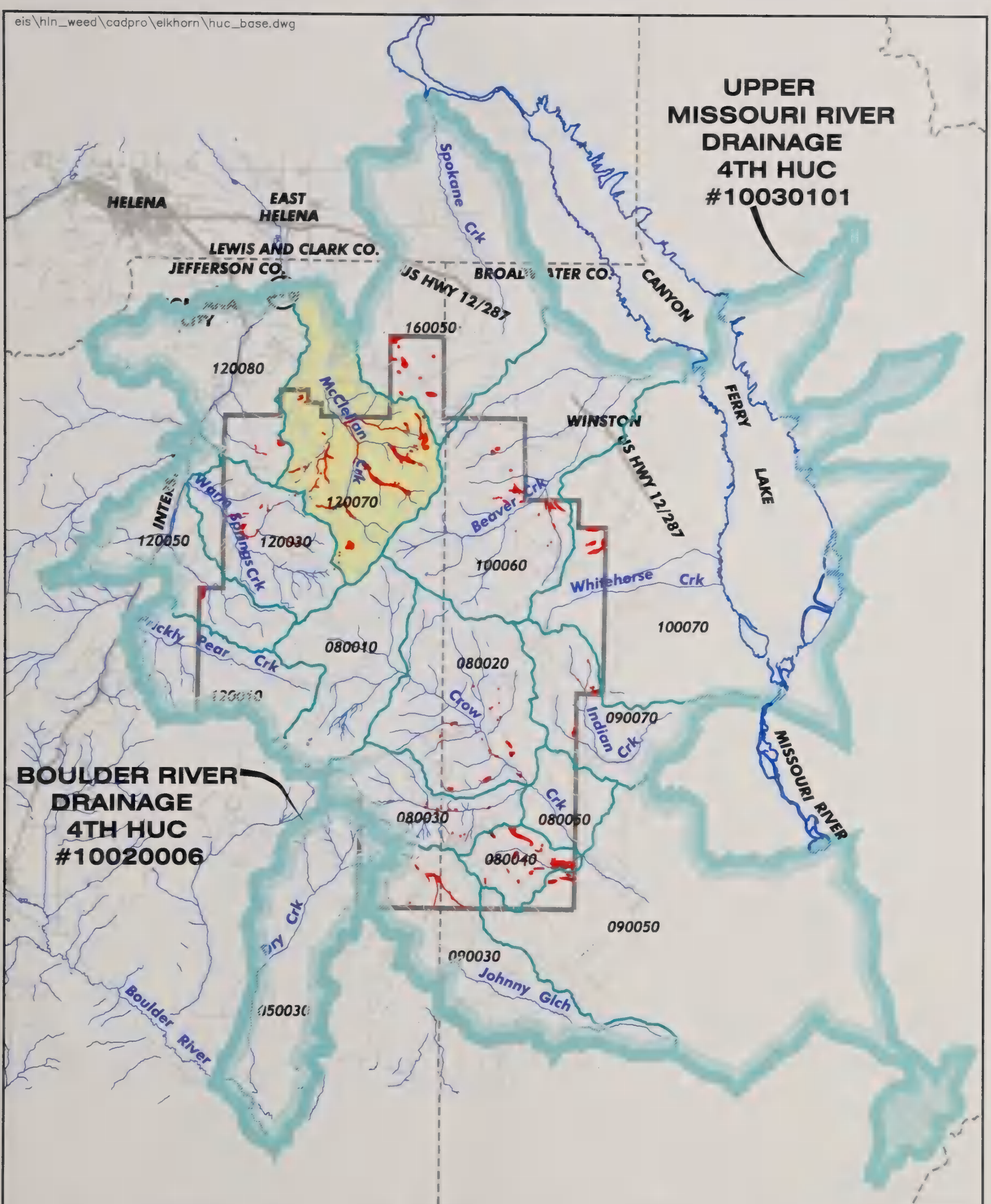
Representative Watershed

4th HUC Boundary

0 Miles 5

Note: Basemap data from Helena National Forest GIS database.

6th HUC Boundaries
Belts/Dry Range Landscape Area
Noxious Weed Treatment Project
Helena National Forest
FIGURE 3-1



N

0 Miles 5

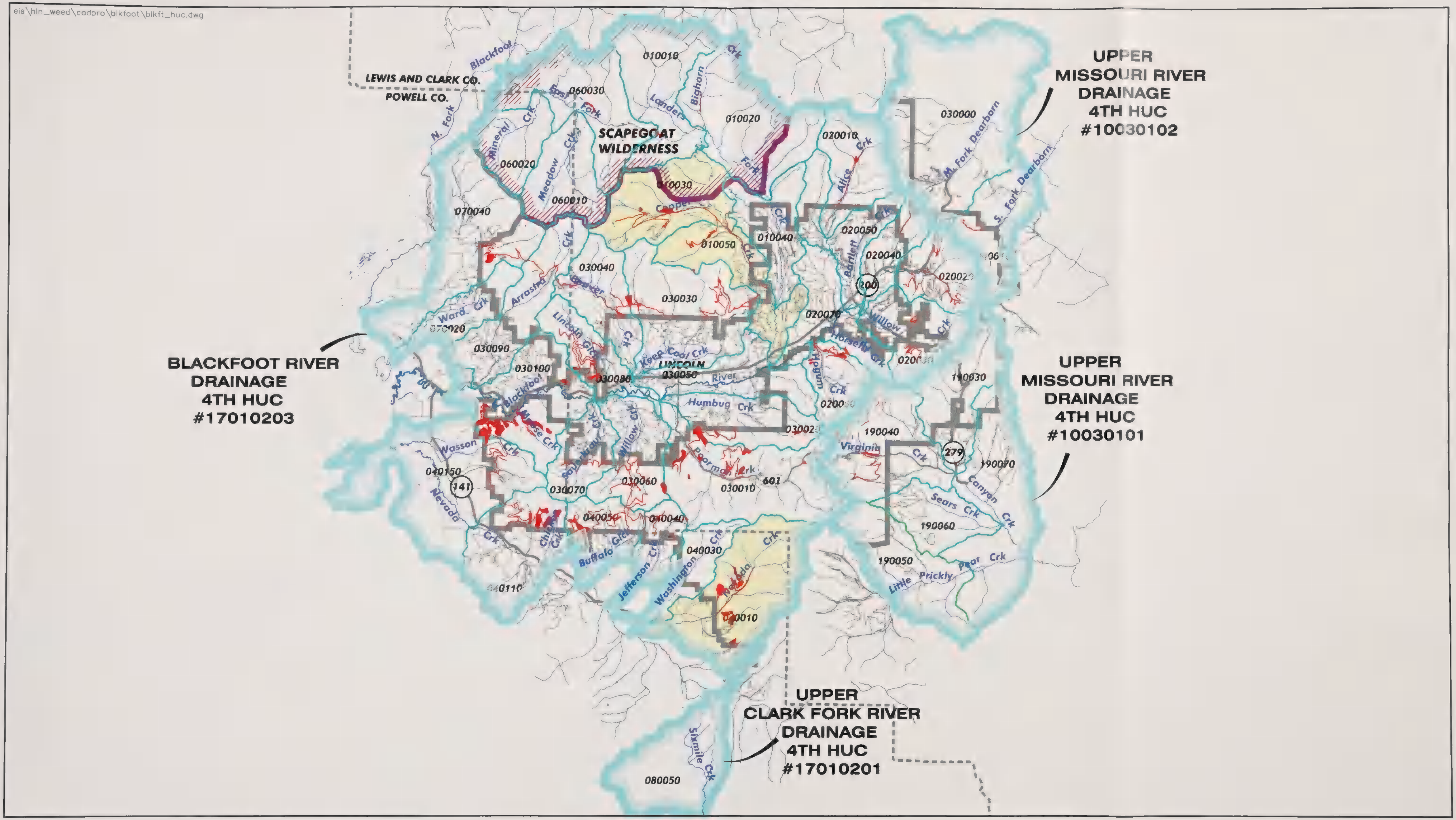
Note: Basemap data from Helena National Forest GIS database.

LEGEND

Weed Treatment Areas
Helena Forest Boundary
County
Perennial Streams
Roads

090010 5th/6th Hydrologic Unit Code (HUC)
6th HUC Boundary
Representative Watershed
4th HUC Boundary

6th HUC Boundaries
Elkhorn Landscape Area
Noxious Weed Treatment Project
Helena National Forest
FIGURE 3-2



0 Miles 5

N

Note: Basemap data from Helena National Forest GIS database.

LEGEND

- Weed Treatment Areas
- Helena Forest Boundary
- Wilderness Boundary
- County
- Streams
- Roads
- 090010 5th/6th Hydrologic Unit Code (HUC)
- 6th HUC Boundary
- Representative Watershed
- 4th HUC Boundary

6th HUC Boundaries - Blackfoot Landscape Area
Noxious Weed Treatment Project
Helena National Forest
FIGURE 3-3

LEGEND

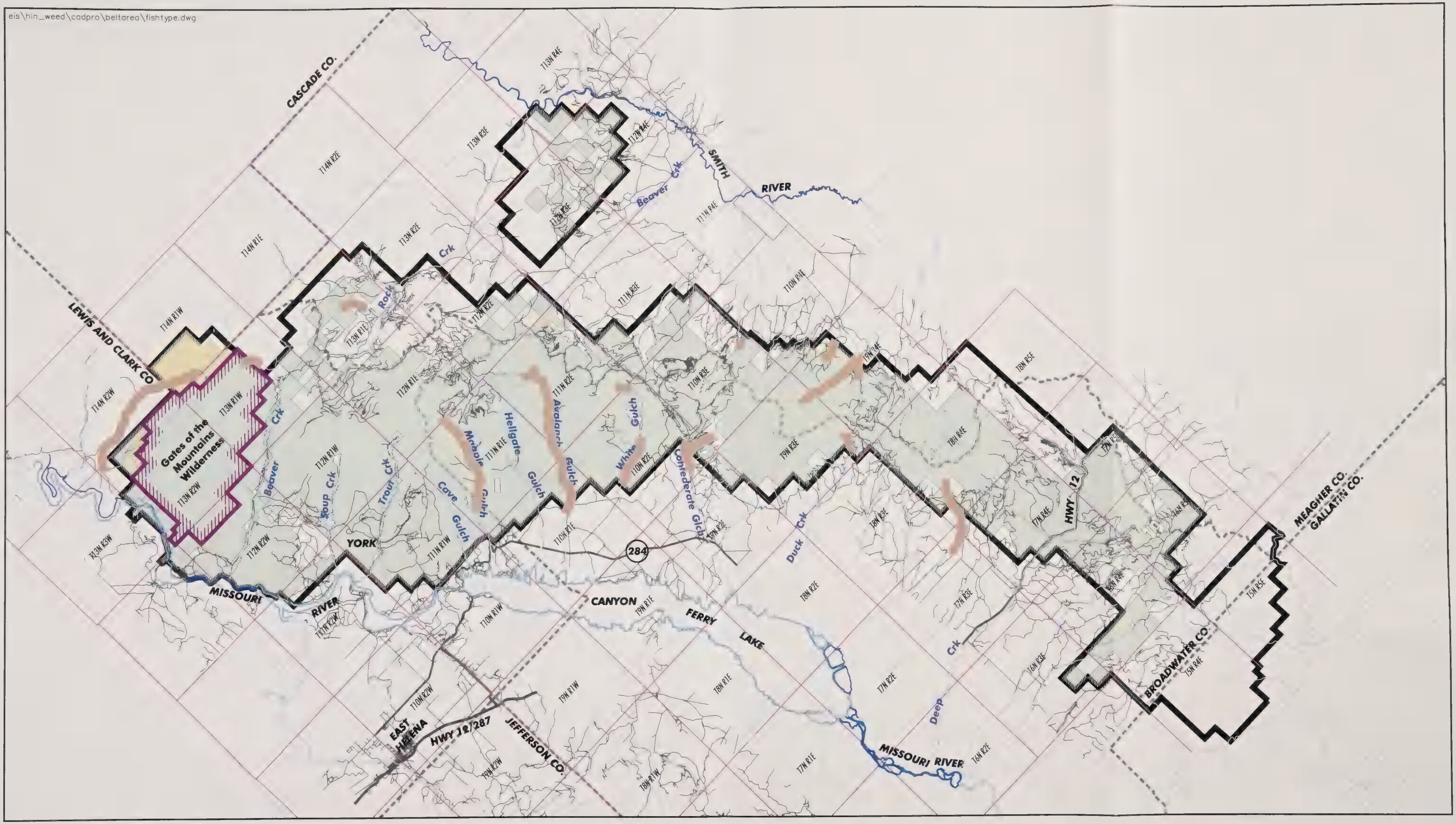
- Weed Treatment Areas
- Grazing Areas
- Helena Forest Boundary
- County
- Streams
- Roads
- 050060 — 5th/6th Hydrologic Unit Code (HUC)
- 6th HUC Boundary
- Representative Watershed
- 4th HUC Boundary

N

0 Miles 4

Note: Basemap data from Helena National Forest GIS database.

6th HUC Boundaries
Continental Divide Landscape Area
Noxious Weed Treatment Project
Helena National Forest
FIGURE 3-4



0 Miles 5

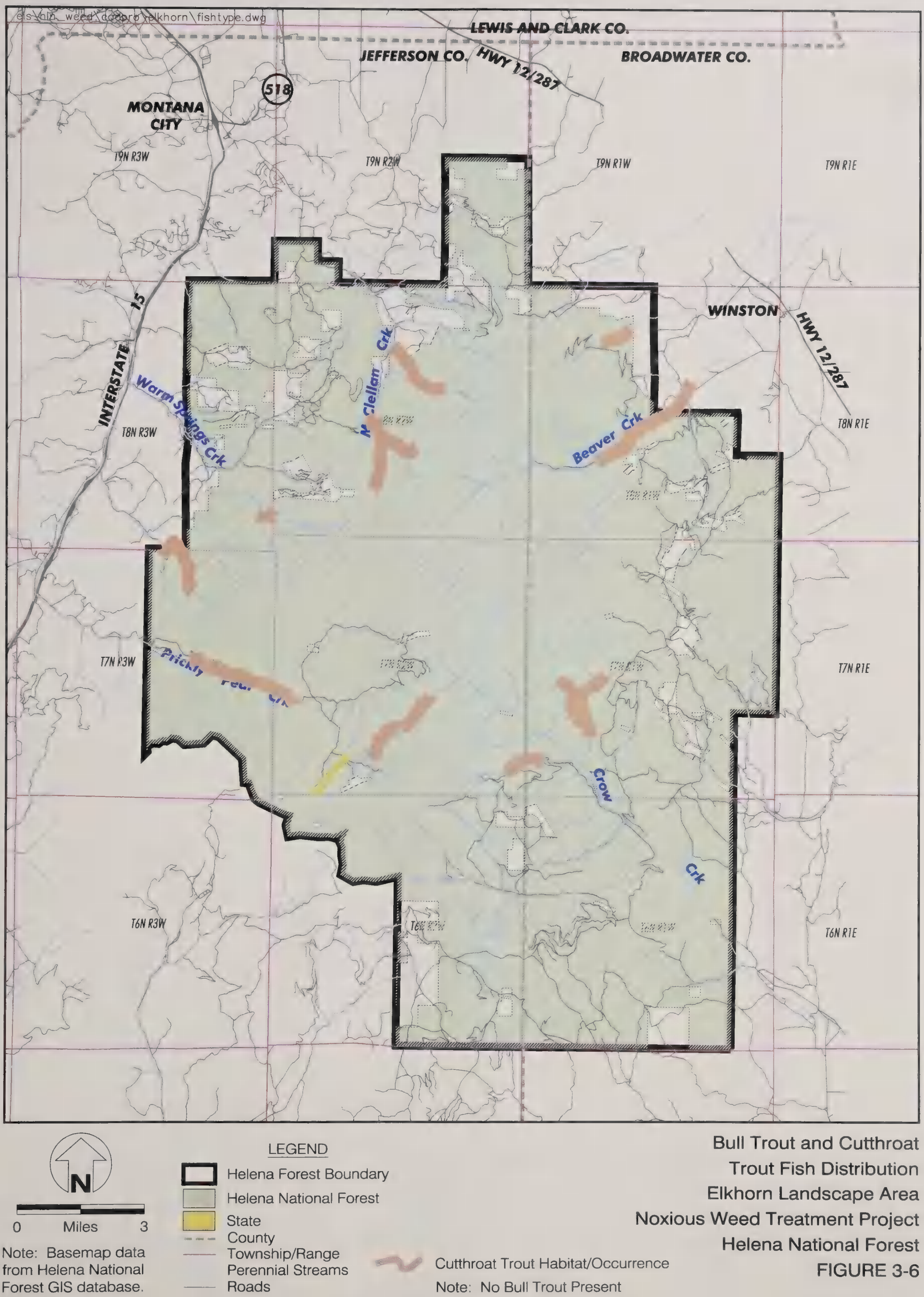
Note: Basemap data from Helena National Forest GIS database.

LEGEND

- Helena Forest Boundary
- Helena National Forest
- State
- Wilderness Boundary
- County
- Township/Range
- Perennial Streams
- Roads
- Cutthroat Trout Habitat/Occurrence

Note: No Bull Trout Present

Bull Trout and Cutthroat Trout Fish Distribution
Belts/Dry Range Landscape Area
Noxious Weed Treatment Project
Helena National Forest
FIGURE 3-5



Bull Trout and Cutthroat Trout Fish Distribution
Elkhorn Landscape Area
Noxious Weed Treatment Project
Helena National Forest
FIGURE 3-6

N

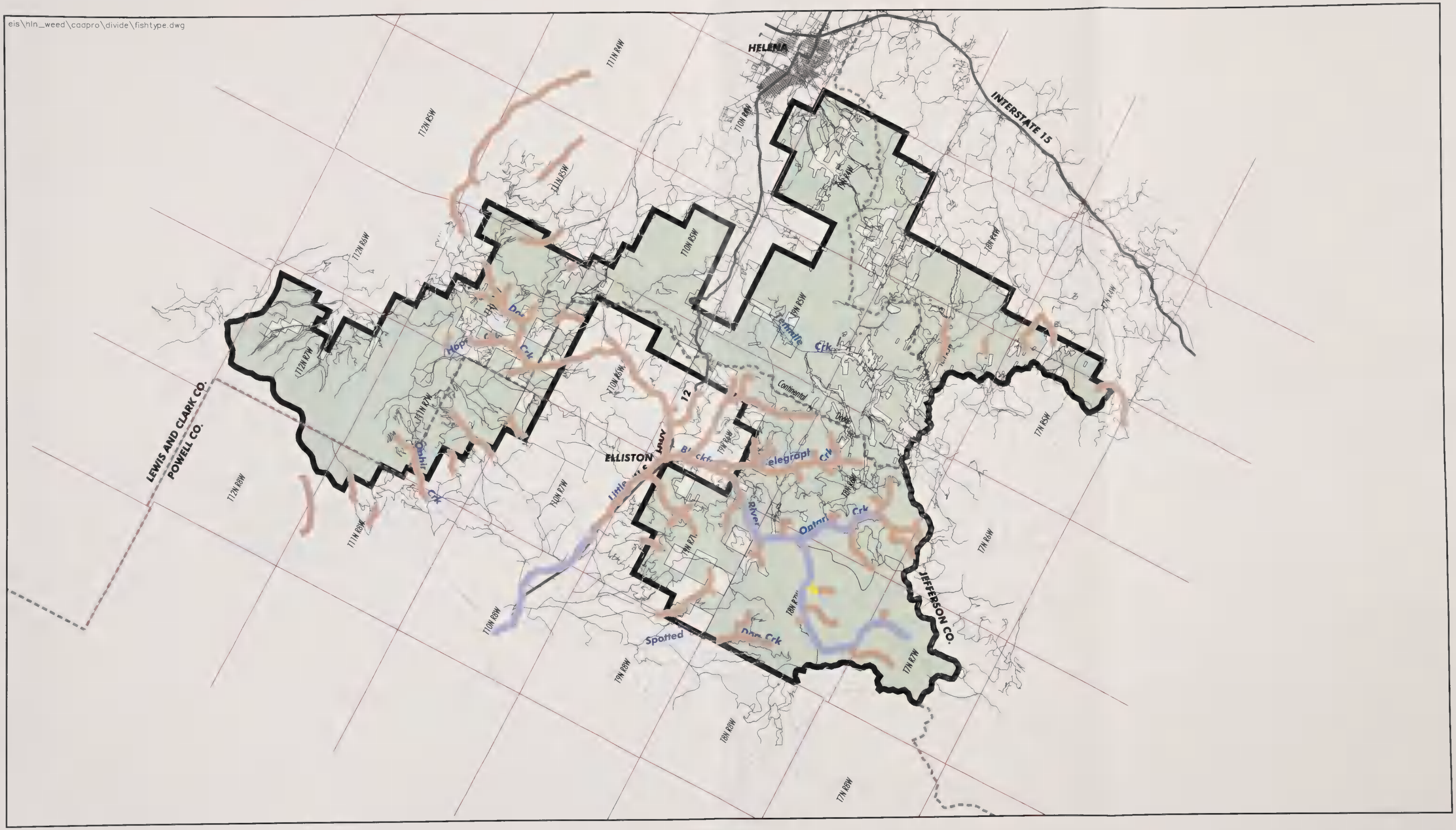
0 Miles 5

Note: Basemap data from Helena National Forest GIS database.

LEGEND

- Helena Forest Boundary
- Helena National Forest
- Wilderness Boundary
- County
- Township/Range
- Perennial Streams
- Roads
- Cutthroat Trout Habitat/Occurrence
- Bull Trout Habitat/Occurrence
- Cutthroat and Bull Trout Habitat/Occurrence

Bull Trout and Cutthroat Trout Fish Distribution
Blackfoot Landscape Area
Noxious Weed Treatment Project
Helena National Forest
FIGURE 3-7



LEGEND

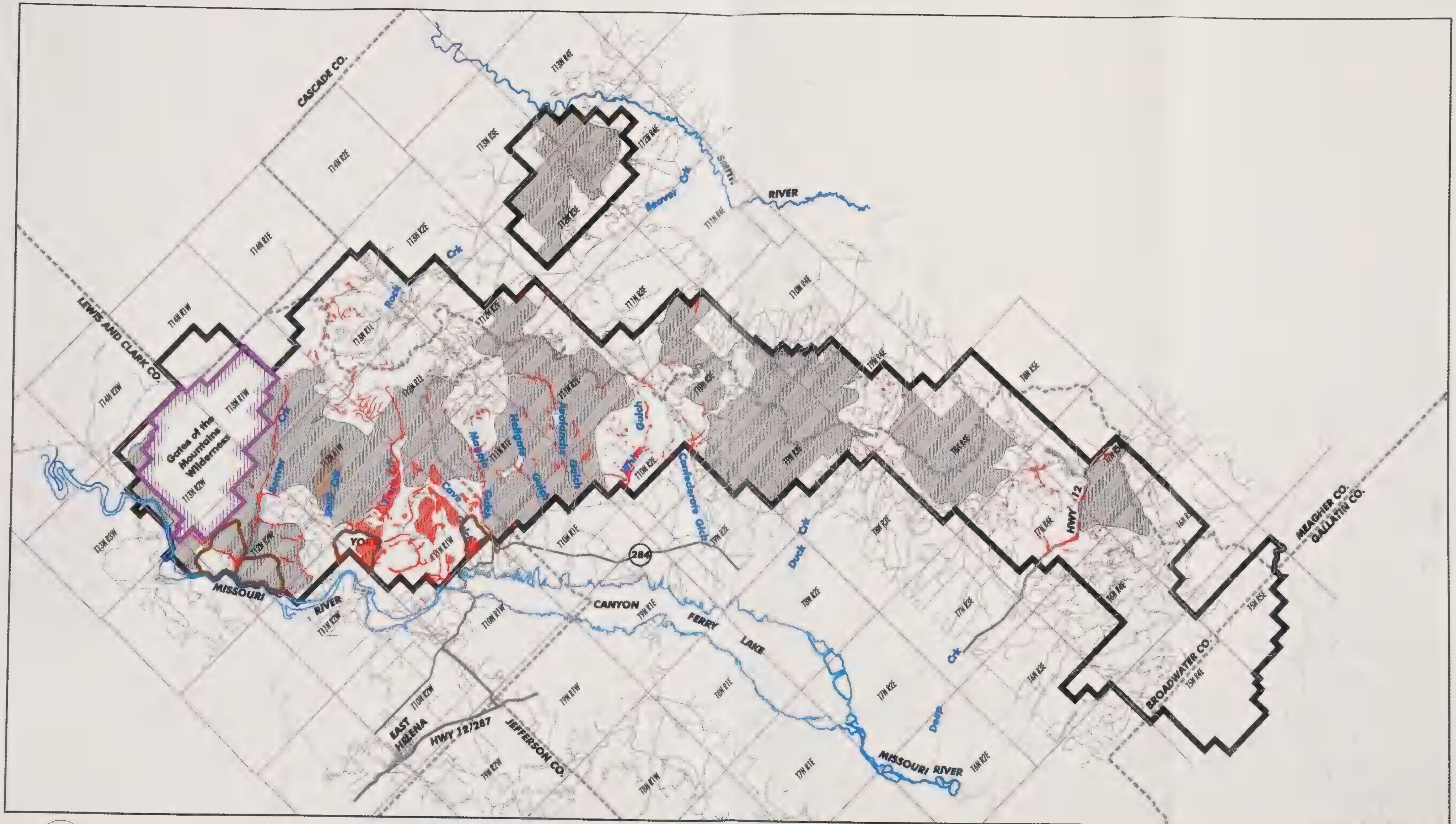
- Helena Forest Boundary
- Helena National Forest
- County
- Township/Range
- Perennial Streams
- Roads
- Cutthroat Trout Habitat/Occurrence
- Bull Trout Habitat/Occurrence
- Cutthroat and Bull Trout Habitat/Occurrence

N

0 Miles 4

Note: Basemap data from Helena National Forest GIS database.

Bull Trout and Cutthroat Trout Fish Distribution
Continental Divide Landscape Area
Noxious Weed Treatment Project
Helena National Forest
FIGURE 3-8



0 Miles 5

Note: Basemap data from Helena National Forest GIS database.

SPECIAL MANAGEMENT AREAS

- Wilderness Area
- Roadless Area
- Research Natural Area
- Eligible Wild and Scenic River Segment

LEGEND

- County
- Township/Range
- Perennial Streams
- Roads
- Helena Forest Boundary
- Weed Treatment Areas (Ground and Aerial Application)
- Grazing Areas

Special Management Areas
Belts/Dry Range Landscape Area
Noxious Weed Treatment Project
Helena National Forest
FIGURE 3-9

N

0 Miles 5

Note: Basemap data from Helena National Forest GIS database.

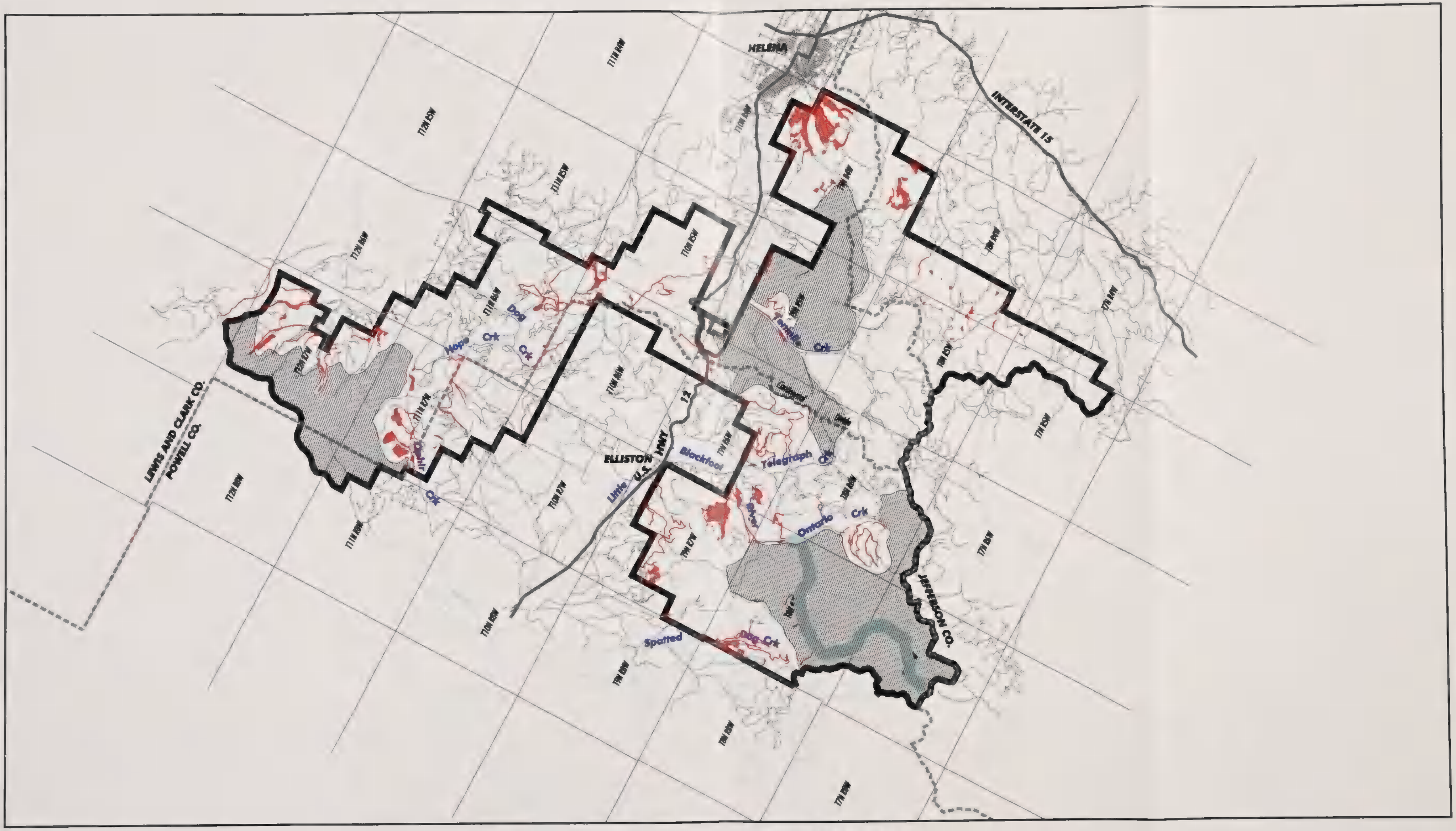
LEGEND

- County
- Township/Range
- Perennial Streams
- Roads
- Helena Forest Boundary
- Weed Treatment Areas (Ground and Aerial Application)

SPECIAL MANAGEMENT AREAS

- Wilderness Area
- Roadless Area
- Research Natural Area
- Eligible Wild and Scenic River Segment

Special Management Areas
Blackfoot Landscape Area
Noxious Weed Treatment Project
Helena National Forest
FIGURE 3-10



LEGEND

- Helena Forest Boundary
- County
- Township/Range
- Perennial Streams
- Roads
- Weed Treatment Areas (Ground and Aerial Application)
- Grazing Areas

SPECIAL MANAGEMENT AREAS

- Roadless Area
- Eligible Wild and Scenic River Segment

0 Miles 4

Note: Basemap data from Helena National Forest GIS database.

Special Management Areas
Continental Divide Landscape Area
Noxious Weed Treatment Project
Helena National Forest
FIGURE 3-11

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

CHANGES BETWEEN THE DRAFT AND FINAL EIS

Main changes in Chapter 4 include:

- Updated the Cumulative Effects introduction. Tables 4-1 and 4-2 have been updated to reflect current, on-going and reasonably foreseeable actions. Added reference to Appendix G which presents by category the range of past activities considered in the resource cumulative effects analysis
- Corrected and updated Table 4-3 to clarify the proper form of herbicides proposed for use (i.e. corrected to reflect the Forest is only proposing to use the salt forms, i.e. water soluble forms) and to reflect current source documents.
- Updated Table 4-4 and associated discussion to include the fires of 2003.
- Expanded discussion of Table 4-7 to clarify the results of picloram modeling Highlighting was added In Table 4-7 for clarity in indicating those HUCs which do not contain fish.
- Expanded discussion of the sensitive plant species peculiar moonwort to clarify risks to this species.
- Corrected discussion of Alternatives A and B in Research Natural Areas to reflect application of herbicide totaling approximately five acres in the Granite Butte proposed RNA (rather than in Cabin Gulch RNA as identified in the DEIS).
- Corrected Table 4-17 to properly display costs for the Continental Divide Landscape Area.
- Updated discussions of Soil Resources, Water Resources, Wildlife, Fisheries and Aquatic Resources, Vegetation, and Human Health and Safety to reflect current research and literature, cumulative effects discussions were updated and expanded.
- Additional discussion was added to the Fisheries and Aquatic Resources section in response to public comments regarding: toxicity, intermediate breakdown products (degradates), cumulative risk and additive negative effects, chronic effects of herbicides, risks for combinations of herbicides as well as surfactants and dyes.
- Expanded cumulative effects discussion for Fisheries and Aquatic Resources to clarify the distinction in the use of different definitions of cumulative effects under National Environmental Policy Act (NEPA) and Endangered Species Act (ESA).
- Updated wildlife discussions to reflect current modeling procedures and current vegetation information. Expanded discussion on amphibians reflecting current research. The plains spadefoot toad has been added to the R1 sensitive species list and is now included in the wildlife analysis and discussion. Updated discussion of grizzly bear to reflect current consultation with USFWS on environmental baseline for grizzly bear.
- Updated and corrected Table 4-18, to reflect current literature and updated risk assessments.

INTRODUCTION

This chapter discloses the direct, indirect, and cumulative effects of the alternatives described in Chapter 2.

DIRECT AND INDIRECT EFFECTS

Direct effects are caused by the action and occur at the same time and place as the action. Indirect effects are caused by the action and occur later in time or farther removed in distance, but are still reasonably foreseeable.

Direct and indirect effects analysis for each alternative and each resource are based on description of the alternatives provided in Chapter 2, including the Features Common to All Alternatives; the EPMs (**Table 2-4**); Ongoing Weed Treatment, Prevention, and Education Program; and assumes all would be implemented as described. Included in the EPMs is a buffer on aerial spraying under Alternative A:

> "On each side of streams, a 300-ft buffer would be established where aerial application would initially not be allowed. Through site-specific drift monitoring at the time of application, this buffer may be reduced by 50-foot increments as long as monitoring results are favorable. In no case would aerial application buffers be less than 100 feet."

To assess impacts of Alternative A with this EPM, all resource analyses assume a 100-foot aerial buffer, as that is the assumption that would show most impacts. Where effects are displayed quantitatively, calculations were made with the 100-foot aerial buffer. A buffer of 300 feet compared to a buffer of 100 feet would reduce acres treated through aerial application by approximately 2,375 acres.

In the resource section this buffer is referred to as the "riparian aerial spray buffer." There are other buffer widths planned for other sensitive areas. These may be referred to specifically or may be included in the general term "buffer," which would include all the specific buffers.

Also, every resource assumed that all acres indicated in Chapter 2 would be treated in each of the alternatives. Due to the way the inventory and mapping was done, treatment acres may be less than those indicated. This is mostly caused by areas of no or light weed infestation included within a weed location "polygon" in the GIS data. The minimum size of a GIS weed polygon is .12 acres, where the actual size might be one plant or a small patch.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA requires identification of irreversible and irretrievable commitments of resources. These effects are identified in resources where they may occur, Soils, Vegetation and Wilderness and Inventoried Roadless Areas.

SHORT-TERM AND LONG-TERM EFFECTS

Unless otherwise specified, short-term effects are those that occur within three years after treatment, and long-term effects are those that occur in three to ten years after treatment.

CUMULATIVE EFFECTS

Cumulative effects are impacts on the environment that result from the incremental impact of actions when added to other past, present, and reasonably foreseeable future actions. For each resource, an analysis area was identified and used to assess cumulative effects of the alternatives. Unless otherwise stated, direct, indirect and cumulative effects area, or the geographic scope, is the treatment area. For temporal scope, the timeframe for project implementation is 12 years and for cumulative effects analysis, an additional 10 years past the final implementation year is considered. In some cases, longer-term effects are discussed.

PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIVITIES

Weed control efforts including aerial and ground application of herbicides will continue on privately-owned and public land within and adjacent to the Helena NF. Government agencies such as the Bureau of Land Management, Bureau of Reclamation, Lewis and Clark National Forest, Gallatin National Forest, Beaverhead-Deerlodge National Forest, Lolo National Forest, Montana Department of Transportation, Montana Department of Natural Resources and Conservation, Lewis and Clark County, Powell County, Meagher County, Jefferson County, and Broadwater County all use herbicides to control weeds adjacent to the Helena National Forest. Activities that alter vegetation or otherwise may potentially act as a weed vector, such as timber harvesting, fuel reduction, livestock grazing, and recreational use (hunting, hiking, motorized recreation, etc.) will continue to be dominant land uses. Wildfire will continue to be a source of disturbance. Reasonably foreseeable and ongoing (previously planned) activities on NFS lands considered in the effects analysis are shown in **Table 4-1** and **Table 4-2**.

These activities represent the type, scope, scale, and intesnsity of activities that are on-going annually under current Forest Plan management direction.

The existing resource condition is a result of the accumulated impacts from past actions or activities. This existing condition is one component of the cumulative effects analysis. The range of past activities considered in the resource cumulative effects analysis include historic livestock grazing, past timber harvest, past wildfires, fire management including suppression and prescribed burning, mineral exploration and development, extirpation and reintroduction of wildlife species, local settlement, road construction, recreation and other human activities, and past weed management practices. A summary table of the general effects and results of these past activities on individual resources is provided in Appendix G.

TABLE 4-1
Reasonably Foreseeable Activities Considered in the Cumulative Effects Analysis

Project Name	Type Of Project	Location
MT Army National National Guard Biathlon	Special Uses	T. 10 N., R.6 W.
Edith Holloway	Hazardous Fuels	Big Belts Mtns – Holloway Gulch
Burned Area Fenceline clearing	Vegetation	Maudlow-Toston Fire Areas
Halverson Road SUP	Special Uses	Deep Creek/Black Butte
Cabin Gulch Vegetation Mgt.	Vegetation	Big Belts, Cabin Gulch
South Belts Travel Plan	Travel Management	Big Belt Mountains
York 38 Special Mountain Bike Race	Special Uses	York
Slump Spring Water Development	Range	Magpie Drainage
Whiskey and Joe Springs Water Development	Range	Culp Gulch
Austin Placer	Minerals	Hope Creek Drainage
Montana Army National Guard	Special Use	T8N, R7W, Sec 1
Butte Creek Water Development	Range	N. Big Belts
Cave Gulch Road Restoration	Road Mgt.	Cave Gulch
Strawberry Riparian Fence and Water Dev.	Range	Strawberry Creek, Elkhorn Mtns.
Elk Ridge High Lifter	Range	N. Big Belt Mountains
South of Helena Hazardous Fuels	Veg and Fuels Treatment	South of Helena
Holliday Access	Special USes	Little Blackfoot River
Spring Hill Exchange	Lands	Spring Gulch
Lewis and Clark County Comm. Site	Special Uses	Hedges Mtn.
Mine Shaft Cattle Guard, Fence, & Water Dev.	Range	N. Elkhorns
North Pasture Division Fence	Range	Slate Lake Allotment
Lincoln Springs Subdivision Fuels Mitigation	Hazardous Fuels	T15N, R9W, Sec 34,35
Old Sheep Camp Water Development	Range	N. Big Belts
Pikes Gulch Water Development	Range	N. Big Belts
East Nevada Allotment	Range	Nevada Creek Watershed
Shinglemill Allotment	Range	Nevada Creek Watershed
West Nevada Allotment	Range	Ogden/Dalton Mtn.
Blackfoot Travel Plan	Travel Management	Lincoln Ranger District-wide

Notes:
MCH = 3-methylcyclohex-2-en-1-one
Source: Jan. 2006 Quarterly Schedule of Proposed Actions, Helena NF

TABLE 4-2 Ongoing Activities Considered in Cumulative Effects		
Project Name	**Type Of Project**	**Location**
Baldy Allotment AMP	Range	South Belts
North Belts Travel	Travel Management	North Belts
Clancy Unionville AMP	Range	Clancy Uniionville
Snow Talon Fire Salvage	Vegetation	Snow Talon Fire area
Fire Restoration Projects (Cave Gulch and Maudlow Toston)	Restoration	Big Belt Mountains
Lewis & Clark County Communication Site	Special Uses	Stonewall Mountain
East Stemple Prescribed Fire	Fuels	Virginia Creek
Elliston Face Hazardous Fuels Reduction	Fuels	Elliston area
Maudlow-Toston Post-Fire Salvage	Timber/Restoration	South Big Belts
Closures III – Hazardous Mine Openings	Minerals	Elkhorns & Big Belt Mountains
Sheps Park Restoration	Vegetation	Elkhorns
Tucker Gulch SUP	Special Uses	Tucker Gulch
Wilson Creek Ruddville Chrysos	Minerals	Tizer Basin
Heinrich Placer	Minerals	Big Belt Mountains
Grassy Bugs Salvage	Vegetation	T7N, R5E, Sec 33,34
Poorman Creek Placer Gold Exploration	Minerals	Poorman Creek
Deep Creek Hazardous Fuels	Vegetation	South Big Belt Mountains
Crow Creek #1 & 2	Trail Reconstruction	Elkhorn Mountains
Jacobson Placer Exploration	Minerals	Confederate Gulch, Big Belt Mountains
Hicks Placer Mining	Minerals	Avalanche Gulch, Big Belt Mountains
Shelley Spring Development	Range	North Big Belts
Cooperative Urban Interface Fuels Program	Fuels Reduction	Helena Ranger District
Tucker/Dry Gulch	Fuels Reduction	T9N, R4W, Sec 1,20
MT Army National Guard military training	Special Use	T9N, R6W, Sec 2
Jimtown Fire Mine Holes	Minerals	T11N, R1W
Snow Talon Fire Rehabilitation	Fire Rehabilitation	Copper Creek Drainage/Scapegoat Wilderness
Post-fire Mushroom Harvest	Special Forest Products	Lincoln Complex Fires
Recreational Outfitter and Guide Permits	Special Uses	Forest-wide
Flesher Trailhead	Recreation	Flesher Pass
Helmville Gould Trail Maintenance	Recreation	Trail #467

SOIL RESOURCES

DIRECT AND INDIRECT EFFECTS

ALTERNATIVES A AND B

Effects of Herbicide Use

Data indicate that exposure to herbicides can affect diversity and the relative biomass of individual species of soil microorganisms. Exposure to herbicides can influence soil microbial populations (Forlani *et al.* 1995, Ka *et al.* 1995; Wardle and Parkinson 1991). It is likely that a temporary shift in the soil microbial community may occur immediately following herbicide applications. Presumably, this is caused by microorganisms that are resistant to, or adapted to utilize the herbicide as an energy source, allowing them to gain a competitive advantage over non-adapted microorganisms. However, other researchers found that herbicide additions had no effect on soil bacteria, nematodes, or collembola beyond what could be expected due to the associated reduction in ground cover (Wardle *et al.* 2001). Clearly, the complex interactions between soil biota, environment, and herbicide type make predictions of impacts on soil biota difficult.

If herbicide-induced reductions of biodiversity do occur, a decrease in the extent of decomposition, nutrient cycling, and disease suppression occurring in the soil may be observed (Brussaard *et al.*, 1997). While herbicide exposure can influence the diversity of soil microorganisms, the reported data indicate that this influence is transient as long as adequate time is allowed for the soil community to rebound between exposures. Brady and Weil (1999) report that negative effects of most pesticides on soil microorganisms are temporary and populations generally recover after a few days or weeks. Considering this short recovery time, the soil microbial community is expected to return to pre-herbicide levels within a year of herbicide application under the proposed schedule. Even in the presence of more highly persistent herbicides, microbial populations are expected to rebound in the short-term (1 to 3 years after treatment begins) once the herbicide application program enters the maintenance mode and applications occur less frequently.

Certain herbicides, such as glyphosate and dicamba, have been observed to cause weight reductions or mortality in earthworms. Surviving earthworms would be expected to recover, but the population may be decreased by 50 percent or more after each herbicide application. Soils with reduced earthworm populations would exhibit reduced water infiltration, nutrient cycling, and fewer stable soil aggregates compared to similar soils with greater earthworm populations (Brady and Weil 1999). In areas where earthworms are susceptible to the type of herbicide applied, the population may remain suppressed until application ceases.

A study of the effects of herbicide on soil arthropods found that no significant change in the arthropod population occurred due to herbicide exposure (Fuhlendorf et al. 2001). The arthropod population was extremely variable from year to year regardless of herbicide application.

Surfactants may be used to increase the efficiency of herbicides. Limited data are available for use in predicting the effects of surfactants on soil quality. Oakes and Pollak (1999) found that the proprietary surfactant used in the formulation of Tordon® 75D caused damage to submitochondrial particles when applied in the presence or absence of the remaining ingredients of the herbicide. This indicates that damage to eucaryotic soil organisms would occur. However, in this case, it is presumed that the damage would be limited to that described above for herbicide effects on soil biota. It is unknown whether surfactants added to herbicides would cause additional impacts on soil quality beyond those already discussed for herbicides.

Slight increases in soil erosion may occur in areas where weeds are treated until native vegetation becomes established. Since these areas experience increased erosion as a result of weed infestation, any additional increase resulting from weed removal would be inconsequential and would cease once native vegetation is established.

Unintentional exposure of native vegetation to herbicides may occur where herbicide "drift" occurs during application. In the relatively small area where this occurs, impacts to soils are expected to be minimal and include the effects described above but to a lesser degree since less herbicide would be applied to such areas.

Herbicide exposure would cause a slight, temporary reduction in soil quality due to changes in the soil microbial population. Because these effects are not intense or long-term, no significant reduction in soil productivity would occur and productivity would be improved by weed control. A reduction in the earthworm population in soil exposed to glyphosate, and possibly other herbicides, would cause a slight decrease in soil water infiltration and nutrient cycling until the earthworm population recovers. Overall, herbicide applications would increase soil quality by controlling weeds and minimizing their negative effects (Lacey *et al.*, 1989; Olson 1999a; Olson and Kelsey, 1997). **Table 4-3** lists herbicides solubility, potential for mobility, and half-life.

Application Method

Aerial application of herbicide (Alternative A only) would not affect soils beyond the herbicide effects.

Soil compaction could occur when a downward force, such as that applied by wheeled vehicles or hoofed animals, compresses the pore space within a soil. In general, fine grained soils are more susceptible to compaction compared to coarse grained soils. Susceptibility to compaction also increases with increasing soil moisture content (Horn and Baumgartl 2000).

In order to avoid or reduce the severity of compaction resulting from weed treatment on the HNF, ground-based weed control measures should be conducted during times when soil moisture is minimal and areas where soils are consistently wet, such as land types 36B and 136 should be avoided. Whereever possible, vehicular, or horse travel should be limited to established trails and roadways.

When off-road or off-trail travel is necessary, it may be desirable to use different routes during subsequent entries in order to disperse the effect of compaction over a broader area. While this may expose more area to compaction, the degree of compaction will be less severe, and the soil more able to recover, than if travel was concentrated along one route. An exception to this is in areas of very wet, fine grained soils where even a single entry could cause detrimental compaction that would prevent the reestablishment of vegetation for a prolonged period of time. In such areas, application method may be changed to avoid these impacts.

Biocontrol

Biological control agents are not expected to have any negative effect on soil quality since these herbivorous insects have a high degree of host specificity and would not be expected to target beneficial, native vegetation. Biological control

TABLE 4-3
General Characteristics of Herbicides to be Used

Herbicide	Solubility (ppm)[1]	Potential For Mobility[2]	Half Life (Days)[1]
Chlorsulfuron	300 (pH 5), 7,000 (pH 7)	High	30 to 120
Clopyralid amine salt	300,000	Very High	15 to 287
Dicamba	400,000	Very High	7 to 42
Glyphosate	12,000 to 900,000	Extremely Low	3 days - several years
Hexazinone	33,000	Very High	30 to 180
Imazapic	2,200	Moderate (increases with pH)	31 to 233
Imazapyr	500,000	High	Several months
Metsulfuron methyl	1,750 (pH 5.4), 9,500 (pH 7)	High	14 to 180
Picloram	200,000	Very High	20 – several years
Sulfometuron methyl	10 (pH 5), 300 (pH 7)	Moderate	20 - 30
2, 4-D	890 to 800,000	Moderate	30 or less
Triclopyr	23 to 2,100,000	Very High	30 to 46

[1]OSU (199- infoventures 1995a-j; OSU 1996a-h; USEPA 1990; USEPA; 1990a; USFS 1995d; USFS 1996c; USFS 1996d; USFS 1997c, USFS 1998b,c; USFS 1999c,d; USFS 2000c; Tu et al. 2001; USFS 2001d,f; USFS 2003b-d; USFS 2004; USFS 2004 a-f ; USEPA 2005.

[2]OSU (1994).

agents would provide the benefit of weed control without the potential for changes to soil biota communities.

Grazing

High-intensity, short-duration grazing would occur on approximately 1,356 acres and would cause a degree of soil compaction that is proportional to the intensity and duration of grazing.

Handpulling

Incidental handpulling of weeds would result in minor soil disturbance where weeds are pulled. This would be outweighed by the benefit of removing the weeds as spread to other areas would be reduced and desirable vegetation would have the chance to reestablish, thereby protecting the soil against erosion.

ALTERNATIVE A

This Alternative would provide control of weed infestations in previously untreated, difficult to access areas. Effective treatment of weeds would reduce the negative impacts of weeds on soil quality (Lacey *et al.* 1989; Olson 1999a; Olson 1999b). Herbicide use would have minor and short-term negative impacts on soil productivity. Aerial application would have no ground disturbing effect. Ground application, grazing, and handpulling would have minor soil disturbing or compacting effects. These effects would not be considered detrimental soil disturbance, as they would occur on relatively small areas that would subsequently support desirable plant species. Minor, short-term negative effects would be greatly outweighed by beneficial, long-term improvements in soil quality and productivity.

ALTERNATIVE B

Approximately 7,319 more acres would receive ground herbicide application than in Alternative A. This increase in ground application would require more traffic, exposing more soil to minor compaction, as compared to Alternative A. This alternative would result in non-treatment of approximately 3,755 acres until the weed populations in these areas spread to treatable areas. While this acreage would not be subject to the effects of herbicide exposure, it would be exposed to increased erosion and reduced productivity, especially where non-treated acreage occurs in landtypes with a moderate or severe erosion hazard rating. In addition, allowing the weed population to exist in these areas would make future weed control more difficult as the weeds would be more deeply rooted and established.

Herbicide use would have minor and short-term impacts on soil productivity. Ground application, grazing, and handpulling would have minor soil disturbing effects. These effects would not be considered detrimental soil disturbance. Minor, short-term negative effects would be greatly outweighed by beneficial, long-term improvements in soil quality and productivity in areas where weeds are treated.

ALTERNATIVE C

Where weeds are treated, effects from herbicide use and biological control would be the same as those described in Alternative B. Approximately 6,797 acres of infestation would remain untreated and it is likely that infested acreage would continue to increase. While this alternative would reduce the acreage of soil subjected to the relatively minor or temporary negative effects of herbicide application, weeds would continue to displace native species and soil productivity would diminish.

The larger weed population resulting from Alternative C would provide less annual input of organic matter to the soil, especially near the surface. As the soil organic matter content declines, the amount of water available to plants stored in soil also declines (Brady and Weil 1999). Abundance of soil microbial biomass is generally related to the organic matter content of soils (Brady and Weil 1999). It is possible that weed infested soil with reduced organic matter content may support smaller populations of microorganisms than non-infested soil.

Soil erosion would increase, especially on landtypes with moderate or severe erosion hazard ratings. With less canopy and basal cover than native species, weeds would be less able to dissipate the kinetic energy of rainfall, overland flow, and wind that cause soil erosion (Torri and Borselli 2000, Fryrear 2000). Lacey *et al.* (1989) measured significantly greater sediment yield from spotted knapweed dominated sites (0.06 tons per acre) compared to adjacent native grass dominated sites (0.01 tons per acre) following 30 minutes of simulated rainfall.

Soil nutrient availability would decrease under Alternative C. Noxious weeds directly limit nutrient availability through their ability to out-compete native species for limited soil resources. Weeds have high nutrient uptake rates and can deplete soil nutrients to very low levels (Olson 1999a). Potassium, nitrogen, and phosphorous levels were 44 percent, 62 percent, and 88 percent lower on spotted knapweed infested soil than from adjacent grass covered soil (Olson 1999a citing Harvey and Nowierski 1989). In addition, some weed species germinate prior to native species and exploit nutrient (and water) resources before native species are actively growing (Olson 1999a). In instances where weed decomposition occurs slowly, nutrients remain immobilized in the plant tissue and unavailable for uptake by other species.

Weeds indirectly limit nutrient availability due to increased soil erosion that can occur in infested areas. Erosion selectively removes organic matter and the finer sized soil particles that store nutrients for plant use, leaving behind soil with a reduced capacity to supply nutrients (Brady and Weil, 1999).

CUMULATIVE EFFECTS

This soil cumulative effects analysis evaluates scientific uncertainty relating to existing soil conditions in areas affected by past management activities, as well as the cumulative effects of noxious weeds and proposed weed treatments.

REGULATORY FRAMEWORK FOR SOIL CUMULATIVE ENVIRONMENTAL EFFECTS ANALYSIS

Soil management objectives have been defined by Region 1 of the U.S. Forest Service (USFS 1999f). The purpose of these soil management objectives is to design management actions that maintain or improve soil productivity and thus, comply with direction in the National Forest Management Act (1976). These soil management objectives state that new management actions should be designed so the cumulative detrimental soil impacts from past management activities combined with effects of proposed actions "should not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality" (USFS 1999f). Restoration actions may be warranted to achieve a net improvement in soil quality.

GEOGRAPHIC SCOPE FOR SOIL CUMULATIVE ENVIRONMENTAL EFFECTS ANALYSIS

The appropriate geographic area for soil cumulative effects analysis has been defined as the "land area affected by a management activity" (USFS1999f). This is because soil productivity is a site-specific attribute of the land. The productivity of one area of soil is not dependent on the productivity of an adjacent area of land. Similarly, if one acre of land receives soil impacts resulting from management activities and a second management activity that may affect soil is planned for that same site, then soil cumulative effects are possible on that site. Thus, cumulative effects to soil productivity are appropriately evaluated on a site-specific basis.

This site-specific productive function of soil is in contrast to the integrated hydrologic function of a watershed, which is dependent on the integrity of the whole system to maintain proper function. Evaluation of cumulative effects to soil productivity does not require an integrated "watershed-type" assessment. A larger geographic area such as a watershed or project area is not considered an appropriate geographic area for soil cumulative effects analysis. This is because assessment of soil quality within too large an area can mask or "dilute" site-specific effects (Nesser 2001). Thus, cumulative effects to soils should be evaluated for site-specific activity areas (i.e., proposed noxious weed treatment areas), but should not be evaluated for the entire watershed or project area.

THEORETICAL APPROACH FOR SOIL CUMULATIVE ENVIRONMENTAL EFFECTS ANALYSIS

Noxious weeds tend to occur in areas affected by previous, ground-disturbing activities, such as livestock grazing, timber harvest, fire and fire suppression, mining, road or trail construction, and recreation. In addition to direct and indirect soil effects resulting from the presence of noxious weeds (as documented in the original Soils Specialist Report), affected areas likely have some degree of residual soil impacts from these previous activities, such as soil compaction, displacement, erosion or severe burning. The magnitude and extent of residual effects from past activities has not been field validated in areas of noxious weed infestation or on sites proposed for noxious weed treatment. Thus, information regarding current, site-specific soil conditions is incomplete or unavailable for most, if not all areas proposed for noxious weed treatment.

Cumulative soil effects are likely where residual impacts from previous activities are combined with the presence of noxious weeds, and with proposed weed treatments. Lacking information regarding current site-specific soil conditions, it is not possible to confidently predict these soil cumulative environmental effects. Thus, this analysis makes an estimate of soil cumulative effects based on a theoretical approach (Solomon 2005). Such an approach is most applicable for extensive, wide-ranging analyses, such as the Helena National Forest Noxious Weed Treatment Project.

The theoretical approach used for this analysis characterizes environmental outcomes based on a set of commonly shared assumptions. These environmental outcomes and associated assumptions include two scenarios:

- Outcome A: Some areas affected by noxious weeds do not have substantial residual soil impacts resulting from previous activities. Soil productivity is not limited by effects of past activities on these sites, and there is potential for improved soil productivity with noxious weed treatment. In these areas, it is assumed that proposed weed treatment activities would effectively result in improved soil productivity. Thus, proposed weed treatment activities would have a beneficial soil cumulative effect.
- Outcome B: Some areas affected by noxious weeds do have substantial residual soil impacts resulting from previous activities. Soil productivity is limited by effects of past activities on these sites, and there is not potential for improved soil productivity with noxious weed treatment. In these areas, it is assumed that proposed weed treatment alone would provide no net change in soil productivity. Thus, proposed weed treatment activities would not result in beneficial soil cumulative effects, unless other restoration actions are implemented. Through the adaptive management process incorporated into Alternatives A and B (FEIS, Chapter 2, Adaptive Management Strategy), additional restoration measures would be identified and implemented in these areas. Consequently, Alternatives A and B would lead toward a net improvement in soil productivity with adaptive management and added soil restoration measures.

These environmental outcomes are used as the basis for characterizing soil cumulative environmental effects for sites where noxious weed infestations and proposed noxious weed treatments coincide with areas impacted by previous livestock grazing, timber harvest, fire and fire suppression, mining, road or trail construction, and recreation.

CHARACTERIZATION OF SOIL CUMULATIVE ENVIRONMENTAL EFFECTS AS OUTCOMES

Livestock Grazing

During the "early days" of livestock grazing, large numbers of animals grazed with little restriction on season of use. This resulted in heavy utilization of forage, leading to bare soil and accelerated erosion. During this period, soil productivity was likely impaired as a consequence of reduced plant litter input to sustain nutrient cycling, and as a consequence of soil erosion (National Research Council 1994, page 1).

Since the 1950's and 1960's, animal numbers have been reduced, season of use has been limited, and forage utilization standards have been implemented. This has likely resulted in increased soil cover and minimized soil erosion, while retaining increased plant litter for improved nutrient cycling. With contemporary grazing management, there is a probable trend for improving soil productivity compared to conditions during the "early days".

In areas where reduced livestock numbers and implementation of forage utilization standards set a trend for improving soil conditions, the cumulative effect of treating noxious weeds in areas affected by historic livestock grazing would likely lead to Outcome A (i.e. proposed weed treatment activities would effectively result in improved soil productivity). Thus, proposed weed treatment activities would have a beneficial soil cumulative effect.

Timber Harvest

Timber harvest prior to establishment of the Helena National Forest generally involved individual tree removal, use of horses to yard logs, minimal road construction, and no site preparation following tree removal. Timber harvest conducted in this manner created minimal soil effects, which are not expected to persist under present conditions.

Timber harvest conducted after establishment of the Helena National Forest has generally involved industrial-scale tree removal, use of heavy equipment to yard logs, with construction of roads and log landings, and site preparation for tree regeneration by machine piling and burning surface organic material or by broadcast burning.

Prior to implementation of Best Management Practices in 1988, industrial-scale timber harvest using heavy equipment likely resulted in impaired soil productivity as a consequence of soil compaction, rutting, displacement, severe burning, accelerated erosion or mass wasting associated with logging roads, skid trails, log landings and site preparation (McIver and Starr 2000, page 16). Soil impacts, such as compaction or displacement, can persist for decades following management activities. Thus, pre-1988 timber harvest probably created substantial soil impacts which persist under existing conditions.

In areas where industrial-scale logging resulted in impaired soil productivity with soil impacts that persist under existing conditions, the cumulative effect of treating noxious weeds in areas affected by historic timber harvest would likely lead to Outcome B (i.e. proposed weed treatment would provide no net change in soil productivity). Thus, proposed weed treatment activities would not result in beneficial soil cumulative effects, unless other restoration actions are implemented. Through the adaptive management process incorporated into Alternatives A and B, additional restoration measures would be identified and implemented in these areas. Consequently, Alternatives A and B would lead toward a net improvement in soil productivity with adaptive management and added soil restoration measures.

Fire and Fire Suppression

Ecosystems in the arid, intermountain west have been subject to periodic wildfire disturbance cycles. With fire disturbance, soils have experienced effects such as volatilization of organic material and accelerated erosion. The magnitude and extent of soil effects have been variable depending on the ecological setting, and climate or weather conditions during burning (Pierce et al. 2003; Pierce et al. 2004).

Following establishment of the Helena National Forest, the majority of fire disturbances have been limited in magnitude and extent by fire management activities, including both fire suppression and prescribed burning. Fires that are managed through suppression actions or prescribed fire, burn relatively fewer acres with low to moderate intensity. For soils affected by low to moderate intensity burning, soil productivity is not likely impaired (DeBano et al. 1998, page 63-64).

In areas where soils have been affected by low to moderate intensity burning, the cumulative effect of treating noxious weeds in areas affected by fire would likely lead to Outcome A (i.e. proposed weed treatment activities would effectively result in improved soil productivity). Thus, proposed weed treatment activities would have a beneficial soil cumulative effect.

Fire suppression has led to a minority of wildfire events attaining catastrophic proportions when ecological and climatological conditions result in uncontrollable wildfires. These catastrophic fires typically burn at higher intensity, resulting in soil severe burning and subsequent accelerated erosion. Soil productivity has likely been impaired on sites affected by severe burning and accelerated erosion (DeBano et al. 1998, page 63-64).

In areas where severe burning and accelerated erosion resulted in impaired soil productivity and soil impacts that persist under existing conditions, the cumulative effect of treating noxious weeds would likely lead to Outcome B (i.e. proposed weed treatment would provide no net change in soil productivity). Thus, proposed weed treatment activities would not result in beneficial soil cumulative effects, unless other restoration actions are implemented. Through the adaptive management process incorporated into Alternatives A and B, additional restoration measures would be identified and implemented in these areas. Consequently, Alternatives A and B would lead toward a net improvement in soil productivity with adaptive management and added soil restoration measures.

Mining

Historic mining activities involved displacement of soil materials to extract precious minerals, and resulted in accumulation of mine tailings which are sometimes contaminated with heavy metals. Soil productivity has likely been substantially impaired in areas affected by soil displacement and accumulation of mine tailings, especially those contaminated with heavy metals.

In areas where soil displacement and accumulation of mine tailings resulted in impaired soil productivity and soil impacts that persist under existing conditions, the cumulative effect of treating noxious weeds would likely lead to Outcome B (i.e. proposed weed treatment would provide no net change in soil productivity). Thus, proposed weed treatment activities would not result in beneficial soil cumulative effects, unless other restoration actions are implemented. Through the adaptive management process incorporated into Alternatives A and B, additional restoration measures would be identified and implemented in these areas. Consequently, Alternatives A and B would lead toward a net improvement in soil productivity with adaptive management and added soil restoration measures.

Road and Trail Construction

Road and trail construction result in soil displacement and compaction, and create areas of bare soil leading to accelerated soil erosion. Soil productivity is impaired on areas affected by road and trail construction. However, land affected by roads and trails is being managed for transportation and access uses, and is not being managed for productivity. Consequently, there is no management imperative to strive for improved productivity on soils affected by roads and trails.

In areas where road and trail construction has resulted in impaired soil productivity and soil impacts that persist under existing conditions, the cumulative effect of treating noxious weeds would likely lead to Outcome B (i.e. proposed weed treatment would provide no net change in soil productivity). Thus, proposed weed treatment activities would not result in beneficial soil cumulative effects. Because these lands are not being managed for productivity, there would be no need for further restoration actions.

Recreation

In areas where visitor numbers are high and recreation use is concentrated, off highway vehicle use and dispersed recreational camping have resulted in soil displacement and compaction, leading to areas of bare soil and accelerated soil erosion.

In areas where off highway vehicle use and dispersed camping resulted in impaired soil productivity and soil impacts that persist under existing conditions, the cumulative effect of treating noxious weeds would likely lead to Outcome B (i.e. proposed weed treatment would provide no net change in soil productivity). Thus, proposed weed treatment activities would not result in beneficial soil cumulative effects, unless other restoration actions are implemented. Through the adaptive management process incorporated into Alternatives A and B, additional restoration measures would be identified and implemented in these areas. Consequently, Alternatives A and B would lead toward a net improvement in soil productivity with adaptive management and added soil restoration measures.

CONCLUSIONS FOR SOIL CUMULATIVE ENVIRONMENTAL EFFECTS ANALYSIS

The fact that soil cumulative environmental consequences are analyzed with uncertainty and limited information has three major implications (Solomon 2005):

1. Outcomes reported as consequences must be viewed as products of professional judgment;
2. Projections of consequences must be viewed as working hypotheses;
3. These hypotheses must be verified, suggesting a need for adaptive management.

Adaptive management uses awareness of uncertainties to allow actions to be taken, and is the alternative to becoming paralyzed by lack of knowledge (Solomon 2005). Under Alternatives A and B, an adaptive management strategy would be implemented to address the uncertainty associated with soil cumulative effects resulting from residual impacts of past management activities combined with the presence of noxious weeds and proposed weed treatment.

Under this adaptive management strategy in Alternatives A and B, monitoring would be implemented to evaluate weed treatment areas and determine if desirable plant species are thriving in treated areas (FEIS, Chapter 2, Monitoring, Soil). If observations suggest desirable plant species are not successfully recolonizing the weed treatment areas, then these sites could be targeted for additional evaluation to determine need for further soil restoration measures. Such an adaptive management strategy would comply with the Region 1 soil management objectives to move toward a net improvement in soil quality by pursuing additional soil restoration measures.

Because there is opportunity for an adaptive management strategy to address uncertainty regarding soil cumulative effects, no missing information was deemed essential to making a reasoned choice among the alternatives being considered for proposed weed treatment.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

No irreversible or irretrievable commitment of the soil resource is expected to result from Alternative A. Under Alternative B approximately 3,755 acres would be susceptible to the irretrievable loss of soil productivity as weeds spread uncontrolled in areas that would otherwise receive treatment under Alternative A. Herbicide application may have relatively minor effects on soil microbial populations and productivity but these effects would not be irreversible or irretrievable. Alternative C would result in the irreversible and irretrievable loss of soil productivity due to increased erosion of the biologically active upper soil horizon on approximately 6,797 untreated acres and possibly more as weeds spread to other areas.

CONSISTENCY WITH FOREST PLAN AND OTHERS LAWS AND POLICIES

As each Alternative provides some measure of weed control, they are consistent with the Forest Plan standards which state that all management activities would be planned to sustain site productivity and that reduction of sedimentation associated with management activities on highly sensitive granitic soils would have first priority for soil erosion control. They are also consistent with the Soil Conservation and Domestic Allotment Act (16 U.S.C. 590), as they limit decreases in soil productivity and suppress sedimentation. These Alternatives are also consistent with 43 C.F.R. §

1901 and MCA 76-13-101 which authorize land supervisors to manage vegetation in a way that reduces soil erosion. Additionally, preventing weed propagation is consistent with the Montana County Noxious Weed Management Act.

WATER RESOURCES

DIRECT AND INDIRECT EFFECTS

ALTERNATIVE A

Fate of Herbicide

Any liquid herbicide sprayed on target vegetation would fall on foliage and surrounding soil. The fate and transport of herbicides include the following possible transfer and degradation mechanisms (Siegel 2000):

- Adsorption and detoxification by plants;
- Photodegradation by sunlight;
- Volatilization;
- Adsorption to soil particles and organic matter;
- Chemical degradation;
- Microbial degradation;
- Solubilization and dilution in surface runoff; and
- Leaching through soil horizon and potentially to groundwater.

The extent to which each of the mechanisms listed above occurs is dependent upon a variety of factors, including meteorological conditions (e.g., magnitude and distribution of precipitation, sunlight, and wind); soil conditions (e.g., thickness, permeability, and organic matter content); land slope; depth to groundwater; and chemical characteristics of herbicide. The combination of these mechanisms influences both magnitude and duration of impacts on water resources.

Microbial decomposition and volatilization are the predominant breakdown process of herbicides in soil. Leaching of herbicides through the soil horizon is the least likely route for water resource impacts. Refer to the Soil Resources Specialist Report in the project file (PF - Soil Resources) for more information on the fate of herbicides in soil. Direct application of herbicides to surface water is the route most likely to cause impacts on water resources. Mobilization in ephemeral channels also can affect water resources if run-off occurs soon after application. The combination of transfer and degradation factors listed above would likely result in herbicide concentrations that are not harmful to the environment (assuming proper and safe application procedures). Refer to the later discussion under "Herbicide in Surface Water" regarding results of modeling that were used to simulate the mixing of herbicides with surface water in the project area.

General Impacts on Surface Water

Direct impacts on water resources would be associated primarily with herbicide application on or near streams, lakes, ponds, springs, and/or wetlands. Such adverse effects, if any, could occur from aerial spray drift, or improper application rates or accidental spills of herbicides. EPMs (Chapter 2) would prevent the aerial application of herbicides near water bodies, and monitor to assure that drift does not reach non-application areas. Studies show that little or no herbicide drift occurs beyond 100 feet from the release area when applied under proper conditions (Felsot 2001). Spot treatment using ground methods can occur near perennial seeps, springs, and wetlands using aquatic label herbicides. Spot treatment also can occur within riparian aerial spray buffers. Picloram use would be prohibited within 50 feet of streams or subirrigated land. Less persistent herbicides would be used within 50 feet. Selection of appropriate herbicide would be based on product label restrictions and site characteristic evaluations (**Appendix E**).

Label instructions for herbicide use include the following restrictions: (1) no spray if precipitation is occurring or imminent; (2) no spray if air turbulence would affect normal spray pattern; (3) no spray if snow or ice covers target foliage; and (4) use only water as a chemical carrier. Most proposed application areas on the Helena NF have adequate soil development and vegetative cover that overland flow of precipitation would be minimal. Applied herbicide would tend to stay at or very near the intended application area. See later section "Sediment Impacts" for additional concerns in recently burned forested areas.

If any herbicide drift from aerial application reaches a stream or other water body, the small amount of herbicide in the drift would likely be diluted to very low, non-harmful concentrations. As stated previously for proposed environmental protection measures, aerial spray operations would be closely monitored, including use of spray drift cards. Monitoring efforts at the Mormon Ridge and Sawmill RNA spray projects, including sampling of herbicide drift patterns and water chemistry, suggest risk to water resources is minimal as long as mitigation/environmental protection measures are followed (USFS 1996b; USFS 2001c). See next section "Herbicide in Surface Water" for information about calculations performed to estimate concentrations of an herbicide (picloram) after mixing with surface water.

Some herbicide treatment would occur along roads in the Helena NF. EPMs previously described in Chapter 2 should prevent adverse impacts on surface water where herbicides are applied along roads near streams.

Herbicide in Surface Water

Results of calculating or modeling the mixing of herbicide with surface water are presented in detail in the project file (PF - Aquatic Resources). Values used to calculate flow in each of 105 watersheds that would have herbicide treatment for the Proposed Action are presented in **Table 4-4**. Also included in this table are resultant flow rates for two time periods (June and September) used to model dilution of herbicides in primary streams for each watershed. Typical high flow (flood magnitude for 2-year recurrence interval [Q_2]) and low flow conditions (mean monthly flow in September exceeded 20 percent of the years [$Q_{.20}$]) were used for the two modeled time periods. The calculated Q_2 flows for the 105 watersheds are in the range of 2 to 140 cfs, with the $Q_{.20}$ flows in the range of 0.1 to 20 cfs (**Table 4-4**).

Picloram was used in the model as the target herbicide because it is the only chemical that has a "high risk quotient" for fisheries (see **Table 4-6** in the *Fisheries and Aquatics* section). For Alternative A, the model shows that 19 of the 105 watersheds would exceed the "safety factor" for picloram toxicity to fish as calculated after mixing the herbicide in each watershed stream. Several of the watersheds do not support fish. The model assumes that all acres within the designated treatment polygon are treated with picloram in a single year. However, this would not be the case for actual treatment because some areas would be spot treated or not treated, including riparian aerial spray buffers, sensitive areas, scattered weed areas, and heavy canopy areas. Therefore, the model results are conservative with respect to total herbicide application areas used as one of the input parameters.

When compared to Montana's surface water quality standard of 500 micrograms per liter (µg/L) for picloram, results of the modeling show that three 6th HUC watersheds (Cave Gulch, Oregon Gulch, and Grizzly-Orofino Gulch) would exceed the standard with resultant calculated concentrations in the range of 590 to 1,300 µg/L (**Table 4-4**). These calculated exceedences would occur only during the fall low-flow period. As shown on **Table 4-4**, Cave Gulch and Oregon Gulch (located in Belts/Dry Range LA) both have 20 to 25 percent of their watershed areas proposed for weed treatment. Grizzly-Orofino Gulch, located in the Continental Divide LA, has 5 to 10 percent of its watershed area proposed for treatment. It is important to note that both Oregon Gulch and Grizzly-Orofino are dry gulches and do not have water flow. In addition, Cave Gulch has historically been dry and has only recently contained water in response to the fires of 2000.

Due to predicted toxicity exceedances, an EPM was developed to eliminate potential impacts. Treatment schedules for these drainages would be adjusted (treated in spring, acres reduced, increased timeframe, alternative herbicide) per EPMs discussed in *Chapter 2*. Another EPM addresses use of silicone-based surfactants that would be used outside of riparian areas or other high-runoff sites. Site characterization evaluation procedures would be used to determine where the application of herbicides mixed with surfactants is suitable. The proposed EPMs should result in no adverse impacts on surface water quality, including irrigation water that may be present downstream of the Helena NF.

Impacts on Impaired Water Bodies

Table 4-4 shows that out of the 105 6th HUC watersheds that would be affected by Proposed Action weed treatments, 53 stream segments are on Montana's 303(d) lists of impaired water bodies (nineteen streams in Belts/Dry Range LA, eight streams in Elkhorn LA, fifthteen streams in Continental Divide LA, and eleven streams in Blackfoot LA). These include six streams in the nine representative watersheds presented in the Water Resources section of Chapter 3. Sources identified for the impairments in these streams are primarily agriculture and resource extraction, with primary causes including flow alteration, metals, and other habitat alterations. Therefore, establishment of TMDLs for these water bodies in the Helena NF is not deemed necessary for the Proposed Action to proceed.

Two watersheds that are impaired (Cave Gulch and lower Trout Creek in Belts/Dry Range LA) would have 20 to 25 percent of the watershed area treated for weeds. Two other watersheds that are impaired (middle Crow Creek tributary in Elkhorn LA; Upper Little Blackfoot River in Upper Clark Fork LA) would have 5 to 10 percent of the watershed area treated. The remaining impaired water bodies that are located in watersheds to be treated would have less than 5 percent of the area treated for weeds. The EPMs described in Chapter 2 should prevent any adverse impacts on impaired water bodies.

Canyon Ferry Reservoir and Hauser Lake are also on Montana's 303(d) lists for nutrients, organic enrichment, and/or pesticides. Because of the relatively small treatment areas within the combined watersheds on the west side of the Belts/Dry Range LA, it is expected that proper use of herbicides, along with proposed EPMs, would not cause adverse impacts on water in these lakes and the Missouri River.

Sediment Impacts

If relatively large areas of weeds rapidly die from herbicides, short-term increases in erosion and sedimentation may result until replacement vegetation is established. Due to the limited acreage proposed for treatment as compared to total drainage area, however, increases in runoff or sediment are expected to be minor. Additional vehicle and foot traffic from performing treatment activities would be minimal and not result in increased erosion and sedimentation. No new roads or trails would be constructed to complete Alternative A. Refer to the project file (PF – Soil Resources) for additional information about soil conditions and potential erosion.

Deep Creek, Dry Creek, Magpie Creek, and Cave Gulch, all watersheds in the Belts/Dry Range LA, had major burn effects in 2000; Copper Creek, Landers Fork and Moose-Wasson Creek in the Blackfoot LA ha major burn effects in 2003 (**Table 4-4**). Because of the reduced vegetative cover from burning in these watersheds, increased runoff and sedimentation are occurring until additional vegetation is established. Recovery of normal hydrologic conditions in affected watersheds is expected to occur within two to seven years of the fire. Treatment of weeds in these areas may further reduce vegetative cover for the short-term; however, as the weeds are replaced by native vegetation, the sedimentation problems would diminish.

A combination of grazing, biological, and handpulling methods would be employed to remove weeds on a total of 1,444 acres (Alternatives A and B). These methods would not cause any adverse impacts on water resources because they would only have short-term minimal disturbance to the ground (e.g., ground trampling from grazing animals). Follow-up treatment of some areas with inadequate weed eradication, or areas of new weed infestation, is not expected to cause adverse impacts on water resources because this treatment would be in relatively small areas and would occur over a period of several years after the initial applications.

TABLE 4-4
Calculated Surface Water Flow and Sensitivity Issues by Watershed

Stream[1]	6th HUC[2]	Area in Helena NF[3] (mi²)	% Drainage Area >6,000 feet[4]	Average Annual Precipitation[5] (inches)	$Q_{.20}$ for Sept.[6] (cfs)	Q_2[7] (cfs)	Sensitivity Issues[8]
Belts/Dry Range Landscape – 4th HUC No. 10030101 (Upper Missouri River)							
Faulkner Creek	020040	2.97	97.0	25.1	1.13	15.55	
Sherlock Creek	040010	8.46	51.5	21.1	2.34	34.65	
Upper Deep Creek	070010	39.32	55.8	29.1	14.70	134.04	Burn 2000
Upper Deep Creek tributary	070020	11.90	44.9	23.2	3.63	45.77	Burn 2000
Middle Deep Creek	070030	5.23	13.8	18.2	1.23	19.12	Impaired; Burn 2000
North Fork Deep Creek	070040	10.59	84.4	34.4	5.55	45.85	Burn 2000
Dry Creek	090040	24.72	41.2	21.3	6.31	85.34	Impaired; Burn 2000
Greyson Creek	090060	8.46	80.3	23.9	2.77	37.38	
Ray Creek	100020	7.12	97.4	35.3	3.98	33.26	Sensitive Fish Spp.
Gurnett Creek	100030	5.10	99.9	37.3	3.16	25.00	
Confederate Gulch	100050	32.07	68.6	32.7	14.31	116.10	Impaired; Sensitive Fish Spp.
White Gulch	110010	20.05	33.0	22.1	5.47	68.79	Impaired; Sensitive Fish Spp.
Avalanche Creek	110020	35.72	40.1	22.8	9.69	117.08	Impaired; Sensitive Fish Spp.
Hellgate Creek	110030	13.33	30.5	20.2	3.34	47.67	Impaired
Magpie Creek	110040	24.49	31.5	21.3	6.28	81.36	Impaired; Burn 2000; Sensitive Fish Spp.
Cave Gulch & others	110050	9.04	16.9	17.2	1.87	31.45	Impaired; Burn 2000; 20-25% treatment area; > picloram std.
Upper Trout Creek	160010	30.34	64.1	26.1	10.04	109.43	Impaired
Soup Creek	160020	20.19	23.2	18.7	4.40	65.89	
Lower Trout Creek	160030	23.50	8.9	18.4	4.94	67.55	Impaired; 20-25% treatment area
Oregon Gulch	160040	9.54	2.4	14.2	1.53	28.46	20-25% treatment area; > picloram std.
Favorite Gulch	160060	9.24	0.0	13.0	1.32	26.57	
Missouri River area	160070	3.78	0.0	11.1	0.47	12.20	Impaired
Upper Beaver Creek	170010	26.66	60.1	25.6	8.70	96.74	Impaired
Hunters Gulch	170020	8.91	50.0	21.2	2.46	36.18	
Middle Beaver Creek	170030	4.04	11.2	14.7	0.72	14.92	Impaired
Big Log Gulch	170040	9.76	20.3	17.4	2.05	34.42	
Lower Beaver Creek	170050	17.65	7.2	15.0	2.88	51.78	Impaired
Missouri River area	180050	20.91	8.6	16.8	3.93	60.89	Impaired
Belts/Dry Range Landscape – 4th HUC No. 10030103 (Smith River)							
Big Birch Creek	020030	3.73	100	35.7	2.24	19.03	
Upper Camas Creek	050010	25.22	94.7	34.9	12.55	99.48	Impaired; Sensitive Fish Spp.
Thomas Creek	050020	6.62	12.9	21.6	1.92	23.26	
Benton Gulch	050030	14.93	37.7	25.1	4.96	54.30	Impaired

TABLE 4-4
Calculated Surface Water Flow and Sensitivity Issues by Watershed

Stream[1]	6th HUC[2]	Area in Helena NF[3] (mi^2)	% Drainage Area >6,000 feet[4]	Average Annual Precipitation[5] (inches)	$Q_{.20}$ for Sept.[6] (cfs)	Q_2[7] (cfs)	Sensitivity Issues[8]
Thompson Gulch	060040	2.56	92.1	29.1	1.21	13.54	Impaired; Sensitive Fish Spp.
Beaver Creek	060050	14.47	69.2	25.3	4.87	58.17	Impaired
Upper Rock Creek	080010	36.21	77.8	28.0	12.98	131.79	
Antelope Creek	080020	14.75	65.4	26.0	5.14	58.62	
Ellis Canyon Creek	080040	16.50	12.0	20.5	4.14	51.15	
Elkhorn Landscape – 4th HUC No. 10030101 (Upper Missouri River)							
Middle Crow Creek	080020	33.08	78.7	26.3	10.96	122.04	Impaired
South Fork Crow Creek	080030	16.16	83.7	25.8	5.54	66.14	Sensitive Fish Spp.
Middle Crow Creek tributary	080040	7.72	35.2	18.3	1.77	30.29	5-10% treatment area; Sensitive Fish Spp.
Johnny Gulch	090030	7.97	100	24.2	2.66	36.85	
Lower Crow Creek	090050	2.54	23.9	16.3	0.55	10.91	Impaired
Indian Creek	090070	9.11	92.7	24.5	3.05	40.86	Impaired
Beaver Creek	100060	32.72	76.9	24.1	9.65	120.44	Impaired; Sensitive Fish Spp.
Whitehorse Creek	100070	8.76	71.6	23.9	2.85	37.80	
Warm Springs Creek	120030	17.34	35.8	19.7	4.10	61.37	Impaired; Sensitive Fish Spp.
Middle Prickly Pear Creek	120050	5.92	54.7	21.4	1.71	25.73	Impaired
McClellan Creek	120070	26.05	42.6	22.4	7.07	89.78	Impaired; Public water supply for East Helena
Lower Prickly Pear Creek	120080	6.03	6.8	14.4	1.02	20.23	Impaired
Spokane Creek	160050	5.85	48.8	18.8	1.42	25.02	
Continental Divide Landscape – 4th HUC No. 10030101 (Upper Missouri River)							
Clancy Creek	120040	12.89	84.5	23.4	3.95	54.41	Impaired; Sensitive Fish Spp.
Lump Gulch	120060	28.47	45.9	23.4	8.17	98.10	Impaired; Sensitive Fish Spp.
Upper Tenmile Creek – south	130010	40.33	69.3	28.3	14.53	141.98	
Upper Tenmile Creek – north	130020	16.61	32.0	16.3	3.05	58.13	Impaired
Greenhorn Creek -south	130030	13.69	22.7	16.8	2.66	46.88	
Middle Tenmile Creek	130050	13.18	19.7	15.7	2.36	44.51	Impaired; public water supply for Helena
Lower Tenmile Creek	130070	0.71	0.0	13.0	0.13	2.87	Impaired; public water supply for Helena
Grizzly-Orofino Gulch	150030	14.35	9.1	13.7	2.11	44.06	5-10% treatment area; > picloram std.
Upper Little Prickly Pear Creek – south	190010	16.30	51.6	23.2	4.84	61.53	
Upper Little Prickly Pear Creek – north	190020	17.00	52.0	25.7	5.78	63.89	Impaired
Marsh Creek	190050	8.05	60.6	25.5	2.88	34.19	
Continental Divide Landscape – 4th HUC No. 17010201 (Upper Clark Fork)							

TABLE 4-4
Calculated Surface Water Flow and Sensitivity Issues by Watershed

Stream[1]	6th HUC[2]	Area in Helena NF[3] (mi²)	% Drainage Area >6,000 feet[4]	Average Annual Precipitation[5] (inches)	Q.20 for Sept.[6] (cfs)	Q2[7] (cfs)	Sensitivity Issues[8]
Upper Little Blackfoot River – south	060010	28.03	97.4	32.5	12.56	109.60	Impaired; TES Fish Spp.
Ontario & Monarch Creeks	060020	19.80	96.0	27.6	7.32	80.80	TES Fish Spp.
Telegraph Creek	060030	17.71	81.2	21.7	4.77	71.26	Impaired; Sensitive Fish Spp.
Mike Renig Gulch	060040	6.49	84.7	20.8	1.80	29.98	Sensitive Fish Spp.
Upper Little Blackfoot River – north	060050	17.49	62.2	23.0	5.10	67.41	Impaired; 5-10% treatment area; TES Fish Spp.
Hope Creek	070010	25.71	74.3	24.1	7.72	97.07	Sensitive Fish Spp.
Dog Creek	070020	7.18	66.9	19.7	1.83	31.44	Impaired; Sensitive Fish Spp.
North Trout Creek	070030	5.67	70.2	20.7	1.58	25.82	Sensitive Fish Spp.
Snowshoe Creek	070040	5.72	71.6	21.0	1.62	26.11	Impaired; Sensitive Fish Spp.
Elliston Creek	070050	8.87	42.2	17.5	1.89	35.11	Impaired; TES Fish Spp.
Ophir & Carpenter Creeks	070060	9.11	87.6	21.4	2.54	40.46	Impaired; Sensitive Fish Spp.
Trout Creek	070070	7.56	78.9	19.5	1.90	33.80	Sensitive Fish Spp.
Spotted Dog Creek -West	080010	0.35	100	23.7	0.15	2.44	
Spotted Dog Creek -east	080020	9.06	80.2	22.0	2.63	39.69	Impaired; Sensitive Fish Spp.
Blackfoot Landscape – 4th HUC No. 17010203 (Blackfoot River)							
Upper Landers Fork	010010	29.13	98.2	42.4	18.62	113.48	Sensitive Fish Spp.
Bighorn Creek	010020	37.38	85.3	35.4	18.29	137.59	Sensitive Fish Spp.; Burn 2003
Upper Copper Creek	010030	26.35	75.7	41.5	16.49	99.50	TES Fish Spp.; Burn 2003
Lower Copper Creek & Landers Fork	010050	13.22	58.0	30.4	5.75	52.25	Impaired; TES Fish Spp.; Burn 2003
Alice Creek	020010	17.64	70.0	35.0	9.08	69.27	Sensitive Fish Spp.
Upper Blackfoot River	020020	15.48	45.9	26.8	5.60	57.74	Impaired; Sensitive Fish Spp.
Willow Creek	020030	12.35	53.5	26.9	4.58	48.61	Impaired; Sensitive Fish Spp.
Upper Blackfoot River tributary	020040	3.47	31.1	26.0	1.37	14.83	
Hogum Creek	020060	11.86	35.2	23.8	3.74	43.99	Sensitive Fish Spp.
Horsefly Creek	020070	6.29	19.5	23.9	2.10	23.35	TES Fish Spp.
Poorman Creek	030010	38.76	58.1	29.3	14.65	133.22	Impaired; TES Fish Spp.
Humbug Creek	030020	8.34	35.8	24.3	2.79	32.48	Sensitive Fish Spp.
Keep Cool Creek	030030	20.98	47.3	31.0	9.03	75.58	Sensitive Fish Spp.
Beaver Creek	030040	13.80	39.4	33.5	6.81	51.05	TES Fish Spp.
Willow Creek	030060	9.30	46.3	25.9	3.35	37.11	Sensitive Fish Spp.
Sauerkraut Creek	030070	7.88	49.7	27.3	3.10	32.48	Sensitive Fish Spp.
Lincoln Gulch	030080	9.14	35.0	25.8	3.28	35.03	TES Fish Spp.

TABLE 4-4
Calculated Surface Water Flow and Sensitivity Issues by Watershed

Stream[1]	6th HUC[2]	Area in Helena NF[3] (mi^2)	% Drainage Area >6,000 feet[4]	Average Annual Precipitation[5] (inches)	$Q_{.20}$ for Sept.[6] (cfs)	Q_2[7] (cfs)	Sensitivity Issues[8]
Arrastra Creek	030090	14.46	60.4	33.8	7.21	56.87	Impaired; TES Fish Spp.
Moose Creek area	030100	13.41	13.8	22.2	3.81	43.31	Sensitive Fish Spp.
Upper Nevada Creek	040010	28.49	78.8	26.6	9.71	107.21	Impaired; TES Fish Spp.
Jefferson Creek	040040	4.26	85.9	28.0	1.83	20.84	Impaired; Sensitive Fish Spp.
Buffalo Gulch	040050	7.76	44.6	25.8	2.83	31.51	Impaired; Sensitive Fish Spp.
Chicken Creek area	040110	6.94	42.9	24.3	2.36	28.44	Sensitive Fish Spp.
Wasson Creek area	040150	7.62	36.0	25.2	2.69	30.03	Burn 2003
Meadow Creek	060010	18.99	84.2	44.1	13.25	76.17	
East Fk Blackfoot River	060030	30.21	85.9	41.6	18.77	114.48	Sensitive Fish Spp.
North Fk Blackfoot River	070040	6.59	46.1	31.5	3.19	27.48	Impaired; TES Fish Spp.
Blackfoot Landscape – 4th HUC No. 10030101 (Upper Missouri River)							
Virginia Creek	190040	22.24	68.6	27.2	7.97	84.43	Impaired; Sensitive Fish Spp.
Blackfoot Landscape – 4th HUC No. 10030102 (Upper Missouri River)							
Middle Fk Dearborn River	030000	7.59	50.4	28.8	3.21	31.52	Impaired
South Fk Dearborn River	040010	8.23	34.9	23.9	2.69	31.96	

[1] See Figures 3-5 through 3-8 for stream locations and HUCs (hydrologic unit code). Fk = Fork.

[2] HUC = hydrologic unit code; HUCs reported in this table are 6th-Code.

[3] Drainage areas (A) calculated from 6th HUCs received from Helena National Forest (Helena NF) clipped to the forest boundary.

[4] Elevations derived from USGS National Elevation Dataset 30m DEM; statistics computed using the Zonal Statistics command in ArcInfo Spatial Analyst 8.2. Percent area greater than 6000 feet elevation (HE) was created by reclassifying the DEM to areas <6000 feet and areas >6000 feet; the reclassified grid was vectorized and intersected with the clipped HUCs; areas were recalculated for the resulting theme.

[5] Average annual precipitation (P) from Oregon Climate Center PRISM polygon data; the PRISM data were intersected with the clipped HUCs and areas recalculated; an area-weighted average was calculated to determine average annual precipitation for each watershed.

[6] $Q_{.20}$ = monthly mean streamflow for September exceeded 20% of the years. Calculated using the following regression equation: $Q.20 = 0.00537(A^{0.917})(P^{1.35})$. Used to represent fall-time flows. Source: Parrett et. al, 1989.

[7] Q_2 = flood magnitude for 2-year recurrence interval. The southwest region was used for all watersheds. Calculated using the following regression equation: $Q2 = 2.48(A^{0.87})((HE+10)^{0.19})$. Used to represent spring-time flows. Source: Omang 1992.

[8] "Impaired" means the stream or river segment is on the 1996, 1998, 2000, 2002, and/or 2004 303(d) Lists of impaired water bodies in Montana. Some of the impaired stream reaches may be downstream from the Helena NF boundary. "Burn 2000" indicates those areas that had significant timber burned within the watershed during 2000. "% Treatment Area" is the portion of the watershed that is proposed for ground and/or aerial weed treatment (see Herbicide in Surface Water section). "> Picloram Std." indicates that mixing modeling shows the resultant picloram concentration in the watershed stream would exceed Montana's surface water standard of 500 micrograms per liter without prescribed EPMs during the fall period only (see Herbicide in Surface Water section). "Sensitive Fish Spp" means those fish species identified by the Helena NF as sensitive. "TES Fish Spp" means those fish species identified by the U.S. Fish & Wildlife Service as threatened or endangered.

Source: Montana DEQ 2004 (for impaired status).

Point-Source Impacts

Potential point-source impacts on water resources include leaks and spills of liquid herbicides, and improper storage, handling, or rinsing of herbicide containers. These types of inadvertent releases of chemicals would have the greatest potential to adversely impact groundwater. Mixing and loading operations would occur in areas where accidental spills would not directly impact a stream or other water body before it could be contained. One of the EPMs previously described in Chapter 2 (**Table 2-4**) states that procedures would be followed for mixing, loading, and disposal of herbicides, as well as a preparation of a spill plan (**Appendix C**). Application of herbicides would be performed by or directly supervised by licensed applicators. These measures are expected to prevent point-source impacts from accidental herbicide releases to water resources.

Impacts on Groundwater

Adverse impacts on groundwater from herbicide application in the Helena NF are not expected, primarily because of the attenuation/degradation factors previously discussed in the "Fate of Herbicide" section of this section. Approximately 1,300 acres, or 6 percent of the proposed weed treatment areas for Alternative A, have soil types that typically have shallow groundwater conditions (see Soil Resources Report in project file; PF – Soil Resources). In these areas of wet meadows, floodplains, and near the streams, the EPMs proposed by the Helena NF in Chapter 2 (**Table 2-4**) would help prevent adverse impacts on groundwater from herbicide application in these areas. As part of these Environmental Protection Measures a Relative Aquifer Vulnerability Evaluation (RAVE) site characteristic evaluation has been done for each proposed weed treatment area within the project. Each site has been evaluated for depth to ground water, soil texture, percent organic matter, distance to surface water, geomorphic setting, herbicide leaching index, precipitation zone, pesticide application frequency, and pesticide application method/percent ground cover. Refer to the following section ("Impacts on Water Supply Sources") for a discussion of potential impacts on water supply wells.

Impacts on Water Supply Sources

Two watersheds in the project area are public water supply sources – McClellan Creek in the Elkhorn LA for the town of East Helena, and Tenmile Creek in the Continental Divide LA for the town of Helena (**Table 4-4).** These two watersheds, however, have relatively small treatment areas (less than 3 percent) with respect to total watershed area. Neither of these two watersheds had calculated picloram concentrations in the streams that exceed Montana's water quality standards (see "Herbicide in Surface Water" section). In addition, the diversion locations are generally located upsteam of the herbicide application areas. The one exception to this is some weed treatment in the near vicinity of Chessman Reservoir. Wells used by the Town of East Helena are located well downstream of the herbicide application areas in McClellan Creek. Environmental Protection Measures are more than adequate to assure that drinking water quality standards will be met. Therefore, no adverse impacts on water quality are expected in the two public water supply drainages.

Numerous groundwater supply wells are located in the lower portions of some watersheds in the project area, mostly on private land located near Helena NF property boundaries. Most of these wells are for non-public supply for purposes of irrigation, stock watering, and/or drinking water. Some wells in the Helena NF are located at campgrounds or other facilities that are considered public water supply sources (e.g., Park Lake Campground). These wells are completed in both bedrock and alluvium to a variety of depths. Some public water supply wells are located near Helena NF property, such as at Frontier Town, Marysville House, Great Divide Ski Area, Feathered Pipe Ranch, Camp Child, and town of Elliston School District.

Because of the relatively small treatment areas with respect to total watershed areas, and the distance from herbicide application areas to the places of use, no adverse impacts on groundwater supplies in these watersheds are expected. Designated beneficial uses of all water resources in affected watersheds should be maintained during and after implementation.

ALTERNATIVE B

Alternative B would include all components of Alternative A, but would eliminate aerial application of herbicides. This alternative would result in non-treatment of approximately 3,755 acres. All direct and indirect impacts previously described under Alternative A would be similar for Alternative B with the following exceptions. Because weeds generally have less ground cover than native vegetation, the non-treated areas could have potential for increased runoff, erosion, and sedimentation in affected watersheds. The elimination of aerial application of herbicides would reduce the percentage of treatment area, and thus chemical loading in the chemical mixing calculations, especially for those watersheds that have greater than 5 percent of the watershed area proposed for herbicide application under Alternative A. An exception is Grizzly-Orofino Gulch, which has only ground methods proposed for weed treatment. Based on results of the chemical mixing calculations previously described in the "Herbicide in Surface Water" section, the same three watersheds (Cave Gulch, Grizzly-Orofino Gulch, and Oregon Gulch) would exceed the picloram standard for surface water.

Due to the predicted exceedance, an EPM was developed to eliminate the potential impacts. Treatment schedules for these drainages would be adjusted (treated in spring, acres reduced, increased timeframe, alternative herbicide) per the EPMs discussed in *Chapter 2* (**Table 2-4**). The EPM should result in no adverse impacts on surface water quality.

ALTERNATIVE C

Under the No Action Alternative, no additional treatment of weeds beyond currently authorized treatment would occur on the Helena NF. Direct and indirect impacts associated with the No Action Alternative (C) would be similar to those described above for Alternative B due to the similarity in treatment methods and acres (18,913 for Alternative B versus 15,871 for Alternative C).

Invasive weeds can reduce infiltration and increase runoff and sediment production because weeds lower basal cover and allow crusting of exposed soil (Lacey *et al.* 1989). Tap-rooted weeds can reduce infiltration because they do not have the dense, fine root system of grasses. Water runoff was 56 percent higher and sediment yield was 192 percent higher on spotted knapweed plots compared to bunchgrass plots during a simulated rainfall period (Lacey *et al.* 1989). Where weeds invade areas along stream channels, riparian vegetative cover can be reduced or eliminated, causing greater stream bank instability. Overall reductions in vegetative canopy cover can also cause increases in stream temperature and decreases in organic matter.

CUMULATIVE EFFECTS

The cumulative effects study area for water resources includes the four landscape areas shown on **Figure 1-1**, as well as the major drainages located immediately downstream of the landscape areas. For the Belts/Dry Range LA, the major drainages include the upper Missouri River, Canyon Ferry Reservoir, Hauser Lake, Holter Lake, and Smith River. For the Elkhorn LA, major drainages include the upper Missouri River and Canyon Ferry Reservoir. Major drainages for the Continental Divide LA are the upper Missouri River and Little Blackfoot River. For the Blackfoot LA, the cumulative effects area includes the upper Blackfoot and upper Missouri Rivers.

Cumulative effects common to Alternatives A and B include additional, relatively minor herbicide loading to the environment. Herbicide application would continue in some areas by the Helena NF, county, and private entities in selected areas immediately surrounding some Helena NF properties. Information regarding the extent this is occurring on private land is limited. Several local agencies were contacted in an attempt to determine the level and location of picloram usage within watersheds in the cumulative effects analysis area. Data are not available on where, how much, or when picloram is used, except in very limited areas.

EPMs are in-place and proposed (**Table 2-4**) that assure direct and indirect impacts from herbicide use are minimized and that water leaving Helena NF lands is of acceptable quality. Herbicide application on other land must also meet acceptable levels of water quality protection. Weed treatments on private land would likely occur more in the valley bottoms where soil conditions are more conducive to infiltration rather than runoff. Many of these lower portions of the watersheds also have greater streamflow, which would allow for more dilution if herbicide was mixed with surface water. Cumulatively, there is a very slight risk that Helena NF and adjacent land practices would result in adverse impacts on water resources.

Other activities that have affected and would continue to affect water resources on the Helena NF include fires, timber harvest, road building, livestock grazing, continued spread of noxious weeds, and recreational use, including off-road vehicles.

Implementation of Alternatives A and B would reduce negative cumulative effects of weed treatments on the Helena NF, primarily sedimentation. There may be short-term (less than one year) increases in sedimentation until native vegetation is reestablished; however, there would be long-term benefits. Implementation of Alternative C would perpetuate past and present conditions and could lead to a cumulative effect of long-term erosion and elevated sediment levels in streams in those areas of weeds that would not be treated.

CONSISTENCY WITH FOREST PLAN AND OTHER LAWS AND POLICIES

The Proposed Action and Alternatives would be consistent with the following management objectives in the Helena NF Plan: (a) maintain quality of water that currently meets water quality standards by applying accepted soil and water conservation practices; (b) maintain soil productivity and minimize sediment yield by applying soil and water conservation practices; (c) identify the effectiveness of best management practices; and (d) minimize use of chemicals to the extent feasible by coordinating with wildlife, watershed, and fisheries personnel, and using a certified pesticide applicator. The Proposed Action and Alternatives also would meet all water quality standards and maintain beneficial uses of surface water and groundwater resources, assuming implementation of environmental protection measures and other mitigations, as necessary.

WILDLIFE

DIRECT AND INDIRECT EFFECTS

Many of the potential impacts on wildlife would be the same for most, or all, groups of wildlife. Impacts associated with Alternatives A, B, and C include those effects from herbicide application on wildlife (ingestion, inhalation, or dermal) and on habitat; from increased noise and human disturbance; and from weed infestations and the resulting habitat modifications. Impacts common to all wildlife are discussed as well as specific impacts on individual species or groups of species.

EFFECTS COMMON TO ALL ALTERNATIVES

Weed Infestations

The effects of noxious weed infestations on wildlife are typically a result of the loss of suitable habitat and the displacement of native forage. The effects can ripple through the system causing habitat structure changes that can alter ecosystem interactions. Grass and forb production can be reduced, which can negatively affect big game, predators, small mammals, birds, reptiles, and amphibians. Noxious weeds can have detrimental impacts to wildlife, especially big game species that occupy foothill and mountain slopes as important winter range. Typically, noxious weed infestations are characterized by increased runoff and higher rates of erosion. This sedimentation can negatively affect water quality, aquatic organisms, and all species dependent on water quality.

Herbicides

Direct impacts on wildlife would manifest from the potential exposure to various herbicides and associated chemicals through several routes. Wildlife could come in direct contact with herbicides either internally through ingestion of plants or in a highly diluted form in drinking water;

topically through contact with vegetation or direct spraying; or inhalation through breathing direct spray or evaporated herbicide. It must be noted that Alternative C (No Action Alternative) would only use a subset of these including picloram, 2,4-D, glyphosate, and dicamba, and, in specal vegetation projects including fire restoration areas, chlorsulfuron, metsulfuron, and clopyralid.

Human health and ecological risk assessments for the application of herbicides to control noxious weeds and other unwanted vegetation have been prepared for the Forest Service (USFS 1995d; USFS 1996c,d; USFS 1997c; USFS 1998b,c; USFS 1999b-e; USFS 2000c; USFS 2001f; USFS 2002; USFS 2003b,d; USFS 2004a-f; USFS 2005a) The Human Health Risks section of this chapter presents information and discussion on these subjects as they relate to human health. However, that discussion applies generally to wildlife, particularly since toxicity testing is carried out on laboratory animals and not on human subjects.

These risk assessments evaluate the potential for impacts on terrestrial wildlife from exposure to herbicides. There are difficulties (uncertainties) in assessing possible risks because toxicity testing is often performed on laboratory animals, which may not be representative of free-ranging wild animals, or only a few wildlife species are tested. Also, the controlled exposures in the laboratory may not resemble the conditions under which wildlife might be exposed. Possible routes of exposure of terrestrial wildlife to herbicides include direct contact (spray), ingestion of contaminated food items and water, grooming, or indirect contact with contaminated vegetation or substrate. Another limitation is that testing on wildlife species generally includes fewer toxicological endpoints, and lifetime exposure studies are usually not available (Kendall et al. 2001; USFS 1999b)

Given these limitations, ecological risk assessments typically employ exposure estimates that yield conservative assessments of possible risk (i.e., overestimate the potential exposure) (Kendall *et al.* 2001; USFS 1992). The available risk assessments for all considered herbicides generally conclude that under recommended application rates and conditions, the potential risks to individual wildlife are far below toxic levels.

According to a 1992 risk assessment (USFS 1992), estimated exposures exceed high risk only under extreme assumptions for one species, the long tail vole, during the use of 2,4-D, dicamba, and triclopyr. The wildlife risk assessment was considered to overstate potential risks from pesticide exposure because many of the assumptions used were quite conservative. For instance, no degradation of herbicides was assumed to occur and all sprayed herbicide was assumed to be biologically available. Doses were calculated based upon multiple exposure routes including oral, dermal, and through inhalation. Typical dose estimates for all herbicides and carriers/additives were below USEPA low risk criterion (less than 1/5 LD_{50}) for all species. Extreme case exposure analysis resulted in moderate to high risk (e.g., moderate to high likelyhood of adverse effects on wildlife populations or communities) of toxic effects for several species from several herbicides or carriers/additives. The risk assessment concluded that the low probability of extreme exposures and rapid degradation of the herbicides in the environment preclude the possibility of significant adverse effects on wildlife populations or communities.

At the highest anticipated application rate (8 oz. per acre) and under conservative assumptions of exposure, sulfometuron methyl may cause short-term and probably transient changes in the blood in mammals that consume vegetation primarily. Nonetheless, the possibility of adverse reproductive effects in some potentially sensitive species cannot be dismissed. These qualifications and uncertainties cannot be resolved with the available data (USFS 1998c). The Helena NF anticipates applying the chemical at an application rate of 2 oz. per acre or less. Small mammals consuming vegetation treated with triclopyr immediately after application could suffer impaired kidney function (USFS 2003b). These extreme-exposure cases are unlikely and there are no available data to determine their feasibility. Another extreme scenario suggested that birds might suffer reproductive effects and possibly overt signs of toxicity, if granules of hexazinone were consumed immediately following application. Again, the plausibility of that type of risk is questionable (USFS 1997c).

Field studies attempt to address exposures to organisms outside the highly controlled environment of a laboratory. The complexity of natural systems confounds interpretations of cause-and-effect relationships in wildlife and human health studies and is exemplified by the subject areas of carcinogenic effects of herbicides (Blair 1996; Ecobichon 2001) and endocrine disruption (Rogers and Kavlock 2001; Carey and Bryant 1995). While some of these effects have been either associated or identified with members of the general chemical group of "pesticides", the chemicals typically implicated are fat-soluble insecticides or other chemicals unrelated to the herbicides being considered for this application (Blair 1996). There is little evidence to suggest that the application of the proposed herbicides at the anticipated rates of application would induce such effects (USFS 1995d; USFS 1996c,d; USFS 1997c; USFS 1998b,c; USFS 1999b-e; USFS 2000c; USFS 2001f; USFS 2002; USFS 2003b,d; USFS 2004a-f; USFS 2005a) .

Of wildlife species, amphibians are potentially the most sensitive to herbicides because of their complex life cycles and more permeable skin. Almost all amphibians require moisture to complete their life cycle, and most are aquatic in their egg or larval stages. Hall and Henry (1992) summarized the status of studies to assess the effects of pesticides on reptiles and amphibians. They concluded that too little is known to determine if safety standards for other kinds of vertebrates are or are not adequate for reptiles and amphibians.

Carey and Bryant (1995) discussed a number of pathways through which amphibians could be impacted by environmental contaminants. They state "while a variety of results have been obtained (concerning amphibian tolerance levels of various environmental toxicants) because of the number of species, life stages, and techniques used, the literature suggests that adult and larval amphibians are not necessarily more sensitive to chemicals than other land or aquatic vertebrates." They caution, however, that toxicants need not be directly lethal to impact amphibians. Sub-lethal concentrations of some contaminants may increase susceptibility of larvae to disease; increase predation of larvae by impacting swimming ability, or by retarding growth rates. In particular, they point out that "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."

The potential for herbicides to act as hormonally active agents and cause endocrine disruption in humans has been discussed under the Human Health Risks section of this chapter. Recently, Vincent *et al.* (2001) observed elevated serum testosterone and leuteinizing hormone (LH) levels in forest pesticide applicators (spraying 2,4-D) at the height of the application season. While these hormone levels were not of clinical concern and the sample size was small, the results suggest that 2,4-D may have potential to interact with the endocrine system. Triazine herbicides can affect the reproductive system by interfering with androgen synthesis (Thomas and Thomas 2001). A recent study (Hayes *et al.* 2002) reported that atrazine, also a triazine herbicide, can inhibit testosterone and induce estrogen secretion in frogs, and affect sexual development. Reported effective doses (≥ 1 ppb) were below the EPA drinking water standard (3 ppb) for atrazine. However, it is not clear if similar effects are induced by hexazinone (see below), which is also a triazine herbicide.

These recent studies raise suspicion regarding the potential for some herbicides to be hormonally active. However, there is currently no evidence indicating that the herbicides considered for application would pose risks to wildlife at the recommended application rates and expected exposure levels. It should also be noted that the Forest Service would use an adaptive management approach for managing weeds. New information regarding herbicides and their effects would be used to reduce effects should they become evident.

Picloram

Picloram is the active ingredient in a number of herbicide formulations including Tordon®, Grazon®, and Pathway®. Tordon K®, Tordon 22K®, and Grazon PC® are picloram salt formulations and inert ingredients, primarily water and dispersing agents. Tordon RTU® and Grazon P+D® include picloram and 2,4-D salts as well as inert ingredients (Tu *et al.* 2001, Infoventures 1995i). Picloram can stay active in soil for relatively long periods of time, maintaining toxicity to plants for up to three years. The half-life can vary from one month to three years (Tu *et al.* 2001) though long-term buildup in soil generally does not occur. Carbon dioxide is the major end product of breakdown of picloram (Infoventures 1995i).

Picloram is almost non-toxic to birds, relatively non-toxic to bees, and low in toxicity to mammals. Mammals excrete most picloram residues unchanged and it does not bioaccumulate in animal tissue. Formulated products are generally less toxic than picloram (Infoventures 1995i).

Tu *et al.* (2001) and Infoventures (1995i) report an acute oral LD50 for rats for picloram of greater than 4,000 milligrams per kilogram (mg/kg). LD50s were reported to be greater than 2,500 and 5,000 mg/kg for mallard ducks and the bobwhite quail, respectively. The acute dermal LD50 in rabbits was reported to be greater than 2,000 mg/kg. In laboratory test with rabbits, picloram was not shown to be a skin irritant, but was a moderate eye irritant. Weight loss and liver damage in mammals has been reported following long-term exposure to high concentrations of picloram. Picloram is classified as a Class E carcinogen, a compound having evidence of non-carcinogenicity (Felsot 2001). Picloram showed no evidence of birth defects in rats or rabbits, and it was negative in two tests for mutagenicity (Infoventures 1995i).

Male mice receiving picloram at dietary doses of 1,000 to 2,000 mg/kg/day over 32 days showed no clinical signs of toxicity or changes in blood chemistry, but females did show decreased body weight and increased liver weights. Liver effects were also seen in rats at very high doses of 3,000 mg/kg/day over an exposure period of 90 days, and above 225 mg/kg/day for 90 days. Dogs, sheep, and beef cattle fed low levels of picloram for a month experienced no toxic effects. The ester and triisopropanolamine salt showed low toxicity in animal tests (OSU 1996d). Based on these studies, picloram does not appear to cause genetic damage or birth defects, has little or no effect on fertility and reproduction, and is not carcinogenic (Infoventures 1995i, Felsot 2001).

There have been some concerns expressed that picloram acts synergistically with 2,4-D or other ingredients to cause chronic effects on wildlife. There is some evidence that high concentrations of picloram and 2,4-D esters (fat soluble) (note: 2,4-D proposed for use by the Forest is an amine formulation, which is water soluble) have an additive, but not synergistic, effect, as they can accumulate in the body. Picloram and 2,4-D are both rapidly excreted in an unchanged form by mammals, reducing the risk of their interaction. In one study, a test group of sheep was fed a single dose of picloram (72 mg/kg) and 2,4-D (267 mg/kg) and others were fed a mixture of 7.2 mg/kg of picloram and 27 mg/kg 2,4-D for 30 days. There was no evidence of toxicity in any of these sheep (Dow 2001).

No adverse effects on endocrine activity have resulted from numerous studies conducted on mammals and birds to determine picloram toxicity values. The evidence indicates that the endocrine system in birds and mammals is not affected by exposure to picloram at expected environmental concentrations (DOW 2001).

One byproduct in the manufacture of picloram is hexachlorobenzene (HCB). As there has been some concern that HCB is carcinogenic, the USEPA has required that there be a maximum concentration of 100 ppb in picloram. The manufacturer of Tordon has set its own limit at 50 ppb (50 micrograms per liter of formulation). In practice, the formulation is further diluted by a factor of 350 for spraying (Felsot 2001). As a result, residues of picloram after spraying do not contain more HCB than background levels (Felsot 2001).

2,4-D

The formulation proposed for use in this application is the amine salt. 2,4-D is not considered persistent in soil. It may remain active for up to six weeks, though it ultimately metabolizes into harmless products (Infoventures 1995k). The average half-life of 2,4-D is 10 days in soil and less than 10 days in water, dependent upon other factors (e.g., temperature, soil condition) (Tu *et al.* 2001). The toxicity of 2,4-D varies by form of the chemical and organism. In fish, ester formulations tend to be more toxic, while amine salts are practically non-toxic. In birds, 2,4-D ranges from being virtually non-toxic in its butyl ester form to moderately toxic as an amine salt. Mammals are moderately sensitive to exposure. It is relatively non-toxic to bees. Most LD50 values for 2,4-D range from 300-1000 mg/kg, though sensitivity varies greatly between animal groups and chemical form (Infoventures 1995k, Ecobichon 2001, Tu *et al.* 2001).

Studies in rats suggested 2,4-D was not cancer causing, though liver damage was seen at relatively low dosages. Pregnant rats showed no evidence of birth defects, though fetuses showed evidence of toxic effects. No effect on reproduction or fertility has been demonstrated in rats and 2,4-D did not cause genetic defects in most studies (Infoventures 1995b). While an association between 2,4-D exposure and canine malignant lymphoma has been reported (Hayes *et al.* 1991), a causal mechanism was not identified. In a recent review of 2,4-D epidemiology and toxicology, Garabrant and Philbert (2002) concluded that the evidence that 2,4-D might be carcinogenic was "scant."

Risk to browsing wildlife, however, appears to be low, as do risks to forging raptors. A study in Oregon after aerial spraying found concentrations on forest browse plants to be below those able to cause effects in mammals (Tu *et al.* 2001). Acid and salt formulations of 2,4-D have been shown in laboratory studies on rabbits to be eye irritants (Infoventures 1995k). In humans, 2,4-D has been found to rapidly distribute within the body with the greatest concentrations appearing in the kidneys and liver (Tu *et al.* 2001), which may also be the case for wildlife species.

Glyphosate

Glyphosate itself is an acid, but is commonly used in isopropylamine salt form. When applied to foliage it is quickly absorbed by the leaves and rapidly moves through the plant. It acts by preventing the plant from producing an essential amino acid. Glyphosate is metabolized by some plants, while others do not break it down. Glyphosate would remain in soil unchanged for a varying length of time depending on soil texture and organic matter content. Half-life of glyphosate is reported to be from 3 to 130 days (Infoventures 1995a). Soil microorganisms break down glyphosate and the surfactant used in Roundup to carbon dioxide.

Glyphosate is reported to be non-toxic, with a reported oral LD_{50} of 5,600 mg/kg in the rat, and over 10,000 mg/kg in mice rabbits, and goats (OSU 1996f). Toxicity of technical grade acid of glyphosate and Roundup® are nearly the same. The oral LD_{50} for the trimethylsulfonium salt is reported to be about 750 mg/kg in rats, which indicates moderate toxicity (OSU 1996f). Acute dermal LD50 for glyphosate and isopropylamine salt are reported to be >5,000 mg/kg, and the dermal LD50 for the trimethlysulfonium salt are reported to be >2,000 mg/kg.

Studies of glyphosate lasting up to two years have been conducted with rats, mice, dogs, and rabbits, and with few exceptions no effects were observed (OSU 1996f, Infoventures 1995a, USFS 1996d). Some test have shown reproductive effects may occur at high doses (over 150 mg/kg/day), but there have been little to no reports of mutagenic, developmental, or carcinogenic effects. In humans, Glyphosate has been classified as a mild to moderate irritant to the skin and eyes, and although there are no data indicating that it causes sensitization in either animals or humans (USFS 1996d).

Hexazinone

Hexazinone is a triazine herbicide that acts by inhibiting photosynthesis. It is generally chemically stable, highly soluble in water, and relatively insoluble in various organic solvents. It has been reported that half of the applied dose is lost in soil after one to six months depending on climate and soil type (OSU 1996g). Hexazinone is broken down by soil microbes and sunlight. Hexazinone does not evaporate to any appreciable extent, and it can leach through the soil to the root zone.

Hexazinone has a low order of acute toxicity; however, it can cause serious and irreversible eye damage. In rats, the LD_{50} was reported at 1,690 mg/kg (OSU 1996g). Other LD_{50} reported for hexazinone are 860 mg/kg for guinea pigs and 3,400 mg/kg for beagle dogs. The LD_{50} for rabbits is reported to be greater than 5,278 mg/kg.

Studies of chronic toxicity of hexazinone in mammals show it to have a low order of chronic toxicity. Rats given moderate doses of hexazinone in their food for two weeks showed no evidence of cumulative toxicity (OSU, 1996g). Rats and dogs fed high doses of the compound for 90 days showed only slight decreased body weights. Very high doses did not appear to effect hamsters, and caused only increased liver weights in mice. It is generally not considered to be a reproductive, mutagenic, or carcinogenic compound based on chronic toxicological studies. Consumption of hexazinone granules by birds immediately after application could lead to reproductive effects or overt toxic effects. However, the plausibility of this risk is questionable, since there are no data indicating birds consume hexazinone granules (USFS 1997c).

Chlorsulfuron

Chlorsulfuron is absorbed by the leaves and roots and acts by preventing the plant from producing an essential amino acid. It is generally active in soil, and has a greater affinity to adsorb to soils having a higher organic content. It tends to leach in permeable soils, with leaching being reduced in soils having a pH of less than 6. Chlorsulfuron is degraded by soil microbes. The half-life has been reported from one month in slight acidic soils to three months in alkaline soils (Infoventures 1995c). It does not easily evaporate, and it is relatively soluble in water.

Chlorsulfuron has a low order of acute toxicity; with oral LD50 levels in the male and female rat, bobwhite quail, and mallard duck reported to be >5,000 mg/kg (Infoventures 1995c). The acute dermal LD50 has been reported to be >3,400 mg/kg. It is considered to be a mild irritant to the skin and a moderate eye irritant.

Chlorsulfuron is not considered to be a reproductive, mutagenic, or carcinogenic compound. Infoventures (1995c) reports that rats fed up to 5,000 ppm per day for up to two years did not show evidence of carcinogenicity. Teratology studies of rats and rabbits showed no evidence of developmental effects. A three-generation study in rats show slight decreased fertility at the highest does of 2,500 ppm, but no decrease in fertility was observed at doses up to 500 ppm. In their mutagenic tests, Chlorsulfuron did not cause genetic damage.

Dicamba

Dicamba is the active ingredient in Banvel® formulations. It is moderately persistent in soil, with a half-life of 1 to 6 weeks. Breakdown is slower with low soil moisture and low temperatures. The main metabolite of dicamba breakdown in soil is 3,6-dichlorosalicylic acid (Infoventures 1995e).

Dicamba is slightly toxic to mammals, non-toxic to birds, non-toxic to bees, and does not bioaccumulate. Based on results of animal studies dicamba does not cause birth defects, cancer, or genetic damage (Infoventures 1995e). Exposure to dicamba has been associated with reproductive and possibly neurotoxic effects in laboratory animals (USFS 1996c). However, ecological risk assessment suggests no plausible or substantial effects to terrestrial or aquatic animals (USFS 1996c). Concentrated solutions of dicamba have been shown to cause eye irritation in rabbits, which is a common test species for ocular effects. The extent to which actual formulations may cause dermal or ocular irritation during normal use cannot be determined from the available data, however. In addition, moderate dermal sensitization was observed in guinea pigs after contact with a 10 percent solution of dicamba (USFS 1996c).

The manufacturing process for dicamba has the potential to result in trace amounts of 2,7-dichlorodibenzo-p-dioxin as a contaminant. It may be present in concentrations up to 50 parts per billion (ppb). The dioxin isomer, 2,3,7,8-tetra-chlorodibenzo-p-dioxin has not been found at the limit of detection (2 ppb) and is not expected as an impurity in dicamba (Pesticide Management Education Program 1983).

Sulfometuron methyl

Sulfometuron methyl is a broad spectrum urea herbicide that works by blocking cell division in the active growing regions of the stem and root tips. It is generally active in soil, and is broken down by microbes, hydrolysis, and sunlight. It has been reported that half of the compound degraded within 30 days in silt loam soils (OSU 1996h) reports a field half-life for sulfometuron methyl in the range of 20 to 28 days. It is more strongly adsorbed to acidic soils and soils with a high organic content than to alkaline soils or soils with low organic content. Sulfometuron methyl is practically insoluble in water, and it mainly decomposes to carbon dioxide (Infoventures 1995j).

Sulfometuron methyl is a slightly toxic compound. The oral toxicity of this compound is very low, reported to have oral LD_{50} levels in rats of >5,000 mg/kg (OSU 1996h). Acute toxicity LD_{50} values for the bobwhite quail and mallard duck were reported to be <5,000 mg/kg, respectively (Infoventures 1995j). The acute dermal LD_{50} has been reported to be >2,000 mg/kg in female rabbits, and >8,000 mg/kg in male rabbits. It is considered to be a mild irritant to the skin and a moderate eye irritant.

Some immunological toxic effects have been reported with chronic exposure to sulfometuron methyl in test animals. Dogs have experienced reduced red-blood cell counts and increased liver weights at exposures of 25 mg/kg/day for a year (OSU 1996h). USFS (1998c) also reported reduced red-blood cell counts and increased liver weights at does of 50 mg/kg/day. While there is some concern of reproductive and teratogenic effects from exposure to sulfometuron methyl in laboratory animals, the results of the studies are somewhat unclear (USFS 1998c). Infoventures (1995j) and OSU (1996h) report that sulfometuron methyl is unlikely to pose a mutagenic, carcinogenic or reproductive risk to animals and humans.

Metsulfuron methyl

Commercial formulations of metsulfuron methyl (Escort®, Ally®) contain 60 percent metsulfuron methyl and 40 percent inert ingredients. Metsulfuron is water-soluble and remains in the soil unchanged for varying lengths of time, depending on soil type and moisture availability. The half-life can range from 120 to 180 days. Soil microorganisms and chemical hydrolysis break it down (USFS 2000b, Infoventures 1995h).

Metsulfuron methyl is practically non-toxic to birds, mammals, invertebrates, and bees (USFS 2000b). Acute oral LD_{50} was greater than 5000 mg/kg in rats and 2000 in mallard ducks; acute dermal LD50 was greater than 2000 mg/kg in rabbits (Infoventures 1995h). Based upon the results of animal studies, metsulfuron methyl is not classified as a carcinogen, mutagen, teratogen, or reproductive inhibitor (Infoventures 1995h, USFS 2000b). The primary adverse effect from exposure to metsulfuron methyl appears to be weight loss (USFS 2000b).

Clopyralid methyl

Commercial formulations of clopyralid such as Reclaim®, Stinger®, and Transline® contain approximately 41 percent clopyralid, and 59 percent inert ingredients (water, isopropyl alcohol, and a surfactant) (USFS 1999c). It may be persistent in soils with low microorganism content. The half-life can range from 15 to 287 days depending upon soil type and climatic conditions (Infoventures 1995d).

Clopyralid is relatively non-toxic to birds, mammals and bees (USFS 1999c). It does not bioaccumulate in animal tissue. The acute oral toxicity in rats was LD_{50} greater than 4300 mg/kg (relatively non-toxic). In rabbits, clopyralid had a dermal LD_{50} of greater than 2000 mg/kg (relatively non-toxic). Clopyralid caused slight skin irritation and eye irritation in rabbits. Rats showed no adverse effects after four hours of exposure to concentrations of 1.3 mg/L in air (Infoventures 1995d).

Clopyralid showed no evidence of oncogenicity in a two year feeding study in mice or rats at the highest dose tested. It showed no evidence of developmental toxicity in mice and rabbits at the highest dosage tested. No effects on reproduction were observed in study of two generations of rats at the highest dose tested. No evidence of mutagenicity was observed in a number of laboratory studies on mice and rats. Based on the results of these animal studies, clopyralid is not classified as a carcinogen, teratogen, mutagen, or reproductive inhibitor (Infoventures 1995d).

Technical grade clopyralid methyl is contaminated with hexachlorobenzene and pentachlorobenzene at average concentrations of < 2.5 ppm and <0.3 ppm, respectively (USFS 1999c.). Hexachlorobenzene is potentially carcinogenic. However, because of the small proportion of hexachlorobenzene in clopyralid, the amount released into the environment from USFS programs contributes little to the background levels of hexachlorobenzene in the environment (USFS 1999c).

Triclopyr

Triclopyr is a pyridine and works by disturbing plant growth. It is absorbed by green bark, leaves, and roots and moves to the meristem (growth region) of the plant. It is active in soil, and is rapidly broken down by microbes, particularly in warm climates. The average half-life of the compound in soils is 46 days, with a range of 30 to 90 days (Infoventures, 1995b) in natural soil and aquatic environments, the ester and amine salt formations convert to the acid, which is neutralized to a non-toxic salt.

Triclopyr is a slightly toxic compound. The oral LD50 levels in rats have been reported in the range of 630 to 2,055 mg/kg (OSU 1996a, 2003b). Acute toxicity LD50 values for mammals are reported to be 310 to 713 mg/kg, and ducks were reported to have an oral LD_{50} of 1,698 mg/kg (Infoventures, 1995b). The acute dermal LD_{50} has been reported to be >2,000 mg/kg in rabbits. Triclopyr is considered to be a slight irritant to the skin and eye.

Studies summarized in OSU (1996a), Infoventures (1995b) and USFS (1996d) indicated that triclopyr does not pose a carcinogenic, mutagenic, reproductive, developmental risk to animals or humans at doses anticipated for this project. However, the most recent SERA risk assessment (USFS 2003b), found the EPA's Carcinogenicity Peer Review Committee (CPRC) classified triclopyr as a Group D chemical (not classifiable as to human carcinogenicity). This decision was based on increases in mammary tumors in both the female rat and mouse, and adrenal pheochromocytomas in the male rat, which the majority of the CPRC believed to be only marginal. Overall the majority of the CPRC felt that the animal evidence was marginal (not entirely negative, but yet not convincing). Therefore, the consensus of the CPRC was to classify triclopyr as a Group D chemical, based on what was considered only marginal response and the absence of additional support from structural analogs or genotoxicity (USEPA 1998).

Imazapyr

Imazapyr is absorbed by the leaves and roots, and moves rapidly through the plant. It acts by accumulating in the meristem region and disrupting protein synthesis by interfering with cell growth and DNA synthesis. Unlike most other herbicides proposed for use by the forest, it can remain active in soil for six months to two years. (Infoventures 1995g) It has a strong affinity to bind to soils and is commonly found in the top few inches of the soil. As such, it has a low potential for leaching to groundwater, but may reach surface water during storm events over recently treated land. Imazapyr is broken down by sunlight and microorganisms. Very little is lost by evaporation.

Imazapyr is practically non-toxic to mammals and birds (Infoventures 1995g; USFS 1999e). In birds, the LD_{50} was reported to <2,150 mg/kg and in mammals between 4,800 and 5,000 mg/kg (Infoventures, 1995g). Imazapyr has not been found to be mutagenic and there has been no evidence to support developmental effects. Imazapyr can cause irritant effects in the skin and eyes (USFS 1999e). The EPA has classified imazapyr as a Class E compound, one having evidence of non-carcinogenicity. Under typical and conservative worst-case exposure assumptions, the evidence suggests that no adverse effects would be expected from the application of imazapyr (USFS 1999e).

Imazapic

Imazapic is essentially non-toxic to terrestrial mammals, birds, amphibians, aquatic invertebrates, and insects (Tu *et al.* 2001, USFS 2001f)). It has a half-life of seven to 150 days, depending on soil type and climatic conditions. It is degraded primarily by soil microbial metabolism. It does not bioaccumulate in animals, as it is rapidly excreted in urine and feces (Tu *et al.* 2001).

The oral LD50 of imazapic is greater than 5,000 mg/kg for rats and 2,150 mg/kg for bobwhite quail, indicating relative non-toxicity by ingestion. The LD50 for honeybees is greater than 100 mg/bee, indicating that imazapic is non-toxic to bees. Imazapic is non-irritating to eyes and skin, even in direct applications. The inhalation toxicity is very low. Chronic consumption in rats for two years and in mice for 18 months elicited no adverse effects at the highest doses administered. Chronic consumption by dogs for one year caused minimal effects (Tu *et al.* 2001, USFS 2001f).

Imazapic may be mixed with other herbicides such as picloram or 2,4-D. Combining imazapic with other herbicides should not increase the toxicological risk over that of either herbicide when used alone (Tu *et al.* 2001).

Inert Ingredients

Herbicide manufacturers add inert ingredients (or "other ingredients") to enhance the action of the active ingredient. Inert ingredients may include carriers, surfactants, preservatives, dyes, and anti-foaming agents among other chemicals. Inert refers to any ingredient that is not intended to affect the target species and does not convey any information regarding the toxicity of the chemical (USEPA 2003). Many manufacturers consider the inerts in their herbicide formulations to be proprietary and do not list specific chemicals. "The lack of disclosure of specific inert ingredients indicates that none of the inerts present at a concentration of 0.1% or greater is classified as hazardous" (USFS 2001f). Listed inert ingredients for the herbicides formulations being considered include water, ethanol, isopropanol, isopropanolamine, kerosene, polyglycol 26-2, and polyoxyethylamine (USFS 1995d; USFS 1996c,d; USFS 1997c; USFS 1998b,c; USFS 1999b-e; USFS 2000c; USFS 2001f; USFS 2002; USFS 2003b,d; USFS 2004a-f; USFS 2005a). None of these chemicals are listed as Level 1 or Level 2 compounds (i.e., "Inert Ingredients of Toxicological Concern" or "Potentially Toxic Inert Ingredients", respectively) (USEPA 2003). Although there is some concern regarding the toxicity of polyoxyethylamine (POEA), a surfactant included in a formulation of glyphosate (Ecobichon 2001; USFS 1996d), there is no anticipated increase in toxicity of the glyphosate formulation as a result of POEA (USFS 1996d).

Phase II®

A risk analysis for Phase II®, the only additive/surfactant proposed for use on portions of the Forest (see Chapter 2), has not been performed. A MSDS exists for Phase II®, which provides a brief overview of the properties and effects of the chemical formulation; however, the information provided references human impacts and not those for wildlife. Although there is limited information available about the effects of this chemical formulation, by applying Phase II® at the recommended application rate of 1-4 pints per 100 gallons, the toxicity of the formulation would be well below levels that could impact wildlife.

Summary

These risk assessment studies point to the potential for the proposed herbicides to cause a number of impacts including impaired kidney function, reproductive problems, eye irritation, and non-target plant impacts. Establishing effects thresholds is usually performed on rabbits and rats and then potential impacts on various other species are inferred. The problem with this type of analysis is that specific thresholds for a particular species are never truly quantified. Therefore, any data compiled that states exact toxicities of a given herbicide on a group of animals must be weighed in relation to the physiological similarities of the species in question and the species used in the testing. In addition, the concentrations used in testing are typically comprised of at least 50 percent chemical. When actually implementing an herbicide application plan, concentrations come nowhere near these levels. Formulations of the proposed herbicides would likely be anywhere from tens to thousands of times below those resulting in impacts on animals, and often, concentrations would be similar to those experienced as background levels.

Although there remains considerable uncertainty relative to potential herbicide effects, aquatic organisms, including eggs and larvae of amphibians, could be directly exposed to herbicide formulations in water as well and could be impacted. The degree of exposure however, would be extremely low based on recommended application rates already far below levels where impacts begin to surface. In addition, further dilution of the formulation by the water it enters would result in concentrations several hundred, or thousand times below scientifically established tolerance levels.

- To determine the degree of impact on wildlife from herbicides, several factors need to be considered.
- Twelve herbicides are being considered for use. Each may have a different impact on different species or groups of species;
- The proposed application rate of herbicide applied to an area;
- The persistence of the herbicide in the environment; and,
- The geographic extent of the proposed application.

Although there has been some concern regarding the synergistic effects associated with interactions between various chemicals (including herbicides), no evidence of synergistic effects with other chemicals has been demonstrated for any of these herbicides. No chronic effects analyses on terrestrial animals had been performed for glyphosate or triclopyr (Infoventures 1995a and b), nor have any recent studies involving chronic toxicity to wildlife been conducted. Various herbicide formulations have the potential to cause eye and skin irritation in the context of splash or spill scenario. The potential for eye and skin irritation to wildlife from normal application, while still possible, is expected to be less than that described above due to the reduced concentration of herbicide in a spray scenario when compared to a spill or splash scenario.

A risk analysis of various herbicides to terrestrial wildlife species prepared for the USFS (USFS 1992) considered toxicity, potential dosage through various routes (ingestion, inhalation, dermal), and length of exposure to a number of vertebrate wildlife species and concluded that potential risks for most wildlife species are low for most herbicides and surfactants using recommended application rates. Risk was moderate to high for only a few species and a few herbicides under extreme situations that would not occur under typical application scenarios.

Considering that most of the proposed herbicides are either non-toxic or of low toxicity to birds, mammals, and insects, none of those tested have been proven to cause cancer, birth defects, genetic defects, or problems with fertility or reproduction. There is no evidence of synergistic effects or hormone disruption from any of these chemicals. Considering that the dosages after dilution with water are far below (often thousands of times below) concentrations of these chemicals that have demonstrated any level of acute or chronic toxicity in tests performed, it is very unlikely that any birds, mammals, or insects would be affected herbicide use following recommended application rate procedures (Infoventures 1995a-k). Triclopyr, while considered a slightly toxic compound does not pose a carcinogenic, mutagenic, reproductive, developmental risk to animals or humans at doses anticipated for this project (OSU 1996a; Infoventures 1995b; USFS 2003b).

The herbicides being considered for use have shown low to no toxicity for most animal groups, including insects, and EPMs (**Table 2-4**) are in place to minimize herbicide delivery into aquatic habitats. Therefore, it is unlikely that the proposed herbicide use would be toxic to amphibians.

Based on lack of data and uncertainty relative to herbicide effects on amphibians, there is the potential for an un-quantifiable negative impact on amphibians from herbicide application. However, because the extent and distribution of proposed treatment areas is relatively small, and if impacts from herbicides do occur on a local basis, amphibian populations as a whole are not expected to be negatively affected.

Table 4-5 provides a summary table of the potential ecological effects of the 12 herbicides and Phase Surfactant discussed above.

Effects on Vegetation Structure from Herbicides

Direct and indirect impacts on vegetation structure depend on the specific treatment used, including the particular herbicide, the rate of application, and the season of application. Direct impacts of herbicide application would be a change in composition of weeds, other forbs, grasses, and shrubs in treatment areas. As discussed in the *Vegetation* section of this Chapter, non-target plants could be damaged by unintentional application, drift, or residual soil activity of herbicides. These short-term impacts to plant composition and community diversity would likely be offset within as little as three years, as native forbs recover. There would be no long-term loss of species diversity of native vegetation due to the proposed treatments, and species composition under most treatments is expected to resemble native plant assemblages within three years (Rice *et al.* 1997a). For additional discussion relative to vegetation, see *Vegetation* in this chapter.

EFFECTS COMMON TO ALTERNATIVES A AND B

Increased Human Activity and Noise

Human disturbance would increase in treatment localities, generally of short duration. Use of helicopters under Alternative A would increase disturbance from noise due to over-flights along access corridors to and from treatment areas and in the treatment areas themselves. Portions of three days of disturbance in each treatment area would occur due to preparation, application, and monitoring activities.

Disturbance from vehicles, including trucks, off-highway-vehicles, and humans on horseback or foot would increase under both alternatives A and B during the periods of treatment if either Alternative were implemented. Ground application under Alternative B would result in an estimated three to five times the duration of disturbance than Alternative A.

TABLE 4-5
Effects of Each of the 12 Herbicides and Phase Surfactant

Herbicide	Carcinogen (Cancer)	Teratogen (Birth Defects)	Mutagen (Genetic Damage)	Reproductive Inhibitor	Skin Irritant	Eye Irritant	Bio-Accumulate	Toxicity To Birds	Toxicity To Bees	Toxicity To Mammals	Target Plants
Picloram	No	No	No	No	Mild	Moderate	No	Almost non-toxic	Relatively non-toxic	Low	Broadleaf plants, brush, conifers and broadleaf trees
2,4-D	Not tumor causing; kidney damage at low doses	No	No	No	Mild to Moderate	Corrosive	No	Non to moderate based on form	Relatively non-toxic	Moderate	Broadleaf weeds, grasses and other monocots, woody plants, aquatic weeds, and non-flowering plants
Dicamba	No	No	No	Little to No	Mild	Corrosive	No	Non-toxic	Non-toxic	Slight	Broadleaf weeds, brush and vines
Metsulfuron methyl	No	No	No	No	Moderate	Moderate	No	Non-toxic	Non-toxic	Non-toxic	Brush and woody plants, annual and perennial broadleaf weeds, and annual grassy weeds
Glyphosate	Not enough information to determine	No	No	No	Mild	Mild to Moderate	No	Non-toxic	Non-toxic	Non-toxic	Grasses, herbaceous plants, brush, some broadleaf trees and shrubs, and some conifers.
Hexazinone	No	No	No	No	Mild	Corrosive	No	Non-toxic	Relatively non-toxic	Non-toxic	Broadleaf weeds, grasses, and woody plants
Sulfometuron methyl	No	No	No	Observed at maternally toxic doses	Mild	Moderate	No	Slight	No Info Available	Slight	Grasses and broadleaf weeds
Triclopyr	No	No	Not enough informatio n to determine	No	Mild to Moderate	Mild to Moderate	No	Very Low	Non-toxic	Slight	Woody plants and broadleaf weeds
Clopyralid methyl	No	No	No	No	Mild	Moderate	No	Low	Non-toxic	Low	Brush and weed species, broadleaf plants, thistle
Chlorsulfuron	No	No	No	No	Mild	Moderate	No	Non-toxic	Non-toxic	Non-toxic	Broadleaf weeds and some annual grass weeds
Imazapic	No	No	No	No	Non-irritating	Non-irritating	No	Non-toxic	Non-toxic	Non-toxic	Annual and perennial boadleaves and grasses
Phase (Surfactant)	Not listed by NTP, IARP, or ACGIH	Unknown	Unknown	Unknown	No, from MSDS	Yes, from MSDS	Unknown	Unknown	Unknown	Specific levels unknown	Used as an additive/surfactant in herbicide formulations
Imazapyr	Not enough information to determine	No	No	Not enough information to determine	Moderate	Moderate	No	Non-toxic	Low	Non-toxic	Grass and broadleaved weeds, brush, vines, many deciduous trees

Source: Various – see previous herbicide-specific discussions for references.

Effects of noise on wild animals can be classified as those affecting auditory physiology and sensory perception, those affecting behavior, and those affecting populations (Bowles 1995). Noise levels are expected to marginally increase with helicopter activity around the subject treatment areas for a very short period of time. As a result of increased human activity and noise from operation vehicles and activities, some animals might be locally displaced near treatment areas during the period of treatment activity; however, due to the brief duration of the exposure, they would likely quickly resume their normal behavior after treatment were complete. Fluctuation noise levels may elevate heart rate, catecholamine levels, and corticosteroid levels in wild animals, but these elevated levels are generally of short duration, and animals often habituate to these disturbances over time. Short-term increases in these measures do not correlate well with actual stress experienced by animals (Bowles 1995). Disturbance associated displacement, if it occurred, would reduce the risk of herbicide exposure of displaced individuals. Along access corridors to multiple spatially similar treatment areas, the coming and going of weed treatment vehicles, personnel, equipment, and helicopters (under Alternative A) may displace wildlife for a longer period (on the order of weeks rather than days), however duration of disturbance would be much less than for areas aerial treated when compared to ground-based methods. Typically, the duration of traffic along these corridors would be limited to a few days and once complete, wildlife would return to these areas.

There is a potential for negative impacts on nesting raptors including goshawks, peregrine falcons, red-tailed hawks, golden eagles, and bald eagles fromhelicopters or other disturbance during nesting, though implementation of EPMs as described in Chapter 2 (e.g., helicopters would avoid by ¼ mile, known raptor nesting territories when flying to and from treatment sites and timing) would reduce this potential.

Grazing

Sheep and goat grazing would decrease the negative consequences of noxious weed infestations on wildlife although the livestock introduced to control weed populations would likely include some native plants in their diet. Sheep and goat grazing may displace some wildlife during the treatment period and could reduce forage in the treatment area for the treatment year.

Biocontrol

Biocontrol proposed on the Forest would decrease the negative impacts of weed infestation on wildlife by utilizing insects to impact the specific weed species they target. It is anticipated that there would be minimal or no direct or indirect effect on wildlife across the Forest from the introduction of insects as part of a biocontrol method of treatment.

Handpulling

Handpulling across the Forest would result in minimal impact on wildlife. Increased human activity in target treatment areas would occur, and result in short-term local avoidance of these areas by some wildlife species.

EFFECTS ON INDIVIDUALS OR GROUPS OF SPECIES

ALTERNATIVE A

Management Indicator Species

Based on habitat distribution and use, and its proximity to proposed treatment areas, the majority of MIS would be at low risk of coming in contact with herbicides.

Elk, Bighorn Sheep, and Mule Deer

The condition of winter range on the Forest is generally considered key for ungulate populations and winter ranges are often at high risk to invasion by weeds. Because various treatment areas occur on both summer and winter ranges across the Helena NF, implementing Alternative A would positively impact elk, bighorn sheep, and mule deer in the long-term due to the improvement of forage availability and the associated increase of carrying capacity (Rice *et al.* 1997a) post-treatment, primarily on winter range. As discussed in Chapter 3, approximately 80 percent of mapped weed acres lie within mapped winter range in the Belt, Blackfoot, and Elkhorn landscapes; and approximately 50 percent lie within mapped winter range in the Divide Landscape (PF-*Wildlife*).

It is possible that elk, bighorn sheep, and mule deer may consume vegetation that has been treated with herbicide, but due to their size and the extremely low toxicity of the herbicides when the proposed application rates are used, there is little potential for direct impacts. Also EPMs would be implemented that treat ungulate winter ranges during the summer months only. Direct and indirect negative effects on elk, bighorn sheep, and mule deer populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above.

Noise and other disturbances from aerial applications by helicopter may disturb these ungulate populations for a short time (one to three days), though these impacts would not persist. The greatest negative impacts on elk, bighorn sheep, and mule deer could occur to females if they are disturbed during or shortly after calving during May and June.

In order to minimize disturbances to these ungulate populations, winter range sites would be treated while the elk, sheep, and deer are occupying their summer ranges. Likewise summer range sites would be treated either in early spring or late fall to avoid disturbing the majority of these animals. Where these ranges overlap (e.g., for some deer populations), the potential for weed treatment activities to disturb the animals during the treatment period would exist.

Bighorn sheep would experience no effect as a result of treatment operations due to their preference of summer habitats that are remote, rocky, and generally above intense weed infestation areas. In those higher elevation areas that have weed infestations and are also preferred by the bighorn sheep, noise and visual harassment impacts from helicopters may occur, though these would be short-term (one day).

Grazing, biocontrols, and handpulling would have little to no effect on elk, bighorn sheep, or mule deer populations. In the short-term, grazing of goats and sheep may compete for suitable forage in very limited areas, though the expected increase in long-term forage production in those areas treated would offset any small scale impacts to non-target vegetation. To avoid the potential spread of disease, grazing by domestic sheep would not occur within known wild sheep range. Biocontrol insects proposed for use on the Forest are so highly specialized to target noxious weed species of interest they would not negatively impact ungulate populations.

Marten

Alternative A would treat approximately 915 acres of the 192,783 acres of modeled martin habitat across the Forest, representing less than one percent of marten habitat. The likelihood therefore, of marten inhabiting areas proposed for treatment is low. Marten generally avoid open grassland areas and areas with open tree canopies. Marten typically select continuous blocks of mature cover that are comprised of mesic late-successional spruce/fir and lodgepole pine stands, particularly those with complex cover near the ground (USFS 1999a). In addition, marten use riparian areas for foraging and travel. Based on the proposed riparian aerial spray buffers around open water and the fact that noxious weeds typically do not dominate in potential marten habitat (see *Affected Environment*), negative impacts to marten are likely to be minimal.

Direct and indirect negative effects on marten populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above. In areas that are proposed for grazing, biocontrols, or handpulling, impacts to pine marten would not occur.

Pileated Woodpecker

Alternative A would treat 1,637 acres (less than one percent) of the 174,980 acres of modeled pileated woodpecker habitat on the Forest. Impacts to pileated woodpeckers from herbicide exposure would therefore, not likely occur. Negative impacts on pileated woodpeckers from increased human activity, noise, and weed treatment operations under Alternative A are also unlikely due to the paucity of activity proposed within modeled habitat. Because the weed treatment operations would be of short duration (one to three days every three years), pileated woodpeckers would likely resume their natural behavior within one day of any disturbance.

Direct and indirect negative effects on pileated woodpecker populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above. In areas that are proposed for grazing, biocontrols, or handpulling, no effect on pileated woodpeckers would occur.

Hairy Woodpecker

Alternative A would treat approximately 5,123 acres (approximately two percent) of noxious weeds within the 289,984 acres of modeled hairy woodpecker habitat. Because hairy woodpeckers would not typically occur on proposed treatment sites, they are unlikely to be impacted by the implementation of Alternative A. Negative effects on hairy woodpeckers from increased human activity, noise, and weed treatment operations under Alternative A are also unlikely. In the event that weed treatment operations occur on suitable habitat (e.g., in recently burned areas), their ability to flee disturbances would minimize effects. In addition, treatment operations would be of short duration (one to three days every three years) and minimal; therefore, hairy woodpeckers would quickly resume their natural behavior.

Direct and indirect negative effects on hairy woodpecker populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above.

In areas that are proposed for grazing, biocontrols, or handpulling, no effect on hairy woodpeckers would occur.

Northern Goshawk, Bald Eagle, and Grizzly Bear

Each of these species is addressed in the *Threatened, Endangered, Proposed, and Sensitive Species* section below.

Threatened, Endangered, Proposed, and Sensitive Species

Grizzly Bear

Due to expansion of grizzly bears into previously unoccupied areas, effects to grizzly bears associated with implementation of the Helena National Forest Plan needed to be analyzed. Subsequently, consultation with the U.S. Fish and Wildlife Service was initiated to determine the effects of the environmental baseline on grizzly bears. We anticipate receiving a Biological Opinion in spring of 2006. Therefore, this determination is based on the actions described for the Weed EIS only.

Grizzly bears may be affected but are not likely to be adversely affected by the implementation of Alternative A due to use of the existing roads. It is possible that grizzly bears may consume vegetation that has been treated with herbicide, but due to their size and the extremely low toxicity of the herbicides when the proposed application rates are used, there would be no potential for direct impacts.

Direct and indirect negative effects on grizzly bear populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above.

Alternative A would likely maintain or improve the forage base for grizzlies. Grizzlies tend to eat carrion after emerging in the spring and the potential for increased carrying capacity and forage base for ungulate species would indirectly benefit the grizzly bear during the spring.

Alternative A would not result in the construction of new roads or change the current management of open or closed roads; therefore, increased segmentation of grizzly habitat and an increase in open road density across the forest would not occur.

In areas that are proposed for biological control or handpulling, no effect on the grizzly bear would occur.

Gray Wolf

Gray wolves may be impacted, but are not likely to be adversely affected by the implementation of Alternative A. Because wolves depend heavily on ungulate species for prey, they would likely experience a positive indirect effect from the implementation of Alternative A. Because the noxious weed control program under Alternative A would increase the forage base and carrying capacity for ungulates, wolves would likely experience an increase in their prey base.

Direct and indirect negative effects on gray wolf populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above.

In areas that are proposed for grazing treatments, it is possible that the wolves may take grazing animals as prey. In order to avoid this scenario, an EPM that requires coordination with USFWS would be implemented.

In areas that are proposed for biological control or handpulling, no effect on gray wolves would occur.

Bald Eagle

Altenative A may impact bald eagles, but are not likely to adversely affect them. As discussed in the *Affected Environment*, bald eagle activity on most areas of the Forest is probably limited to overflights, rest stops at scattered perch sites, and foraging on carrion – particularly in spring and fall (USFS 1998a). Bald eagles may occasionally forage on carrion, particularly big game, within some of the proposed treatment areas. None of the proposed herbicides have any detrimental effects on mammals or birds, other than the potential for most herbicides to cause eye irritation in test animals. There is uncertainty as to the potential of 2,4-D to accumulate in fish. A risk assessment (USFS1998b) reported two studies that suggested that 2,4-D may have limited or low potential to bioconcentrate. However, another study evaluated in that risk assessment found no evidence of bioaccumulation of 2,4-D in game fish following high rates of application directly to a lake. It is possible that bald eagles may consume contaminated prey, although the impact of this would be negligible due to the extremely low toxicities of the herbicides when applied at standard application rates, low bioaccumulation potential, and the wide ranging foraging behavior of eagles and other raptors that would likely result in little risk of exposure. Implementation of EPMs under Alternative A would prevent herbicides from entering water and moving downstream from the treatment areas. Therefore, it is unlikely that bald eagles would ingest any herbicides or residues, and little likelihood of there being any negative impact on eagle health. The potential for or the extent of eye irritation impacts to individual eagles is difficult to assess due to uncertainties relative to potential exposure during spray operations. EPMs relative to spray and disturbance buffers around occupied eagle nests would likely minimize the potential for direct spry exposure of eagles. Direct and indirect negative effects on bald eagle populations attributable to herbicide exposure are expected to be minimal. Negative effects on bald eagle habitat are also expected to be minimal.

Negative impacts on bald eagles from increased human activity, noise, and weed treatment operations under Alternative A are unlikely. In the event that weed treatment operations occur on habitat used by the bald eagle, their ability to flee disturbances would likely minimize effects. In addition, treatment operations would be of short duration; therefore, bald eagles would quickly resume their natural behavior.

Direct and indirect negative effects on bald eagle populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above.

In areas that are proposed for grazing, biocontrols, or handpulling, no effect on the bald eagle would occur.

Canada Lynx

Lynx may be impacted by the implementation of Alternative A, but they are not likely to be adversely affected. Alternative A would treat approximately 2,675 acres of the 419,337 acres of modeled lynx habitat on the Forest, representing less than one percent of modeled habitat. Therefore, lynx are unlikely to occupy many of the areas proposed for treatment. Treatment operations could cause brief localized disturbance to snowshoe hare and other small mammal populations on which the lynx relies; however, lynx presence at these sites is unlikely and thus, the lynx would be minimally impacted. Implementation of Alternative A would likely maintain or increase the lynx prey base, where treatment occurred within lynx habitat, and result in a positive impact in the long-term. The potential for non-target vegetation, specifically shrubs, to be impacted in some areas, is discussed in the *Vegetation* section, could indirectly impact local snowshoe hare habitat use. Based on the relative proportion of lynx habitat compared to proposed treatment areas, the likelihood of impact to lynx across the Forest due to indirect impacts to local hare populations would be immeasurable.

Alternative A would not result in the construction of new roads or change the current management of open or closed roads; therefore, impacts associated with segmentation of lynx habitat or an increase in open road density across the forest would not occur. Alternative A is not expected to change existing lynx habitat. An increase in human activity and disturbance associated with the proposed project may temporarily disturb lynx, though most proposed treatment areas are at elevations below preferred lynx habitat. A disturbance created by a spray truck on a road, or a mule/applicator on a trail is well within the existing, current level of disturbance.

Direct and indirect negative effects on lynx populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above. In areas that are proposed for grazing, biological control, or handpulling, no effect on the lynx would occur.

Black-backed Woodpecker

Individual black-backed woodpeckers or their habitat may be impacted by Alternative A, but it will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species. Habitat modeling by the Cohesive Strategy Team, estimated approximately 37,000 acres of black-backed woodpecker habitat on the Forest in the Belts LA associated with the wildfires of 2000. The Snow Talon fire in 2003 created an approximate 16,700 acres of black-backed woodpecker habitat. Alternative A proposes weed treatments in both of these fire areas as well as other areas of the Forest that might provide black-backed woodpecker habitat (i.e. areas of insect outbreaks).

Ideal habitat on the Forest for the black-backed woodpecker is typically associated with fire-disturbed locations. The fact that these burned areas are also prone to invasion from noxious weed species results in the possibility for impacts on them. Although some treatment areas overlap with black-backed woodpecker habitat, the ability of these birds to flee disturbance from weed control operations would reduce the potential for effects to this species. In addition, weed control operations would generally be of short duration; therefore, black-backed woodpeckers would quickly resume their natural behavior.

Direct and indirect negative effects on black-backed woodpecker populations attributable to herbicide exposure are expected to be minimal. The potential for eye irritation from direct spray of herbicide is possible, though there remains uncertainty as to the severity and duration of the impact, should direct spray occur. See *Effects of Herbicides on Wildlife* above.

In areas that are proposed for grazing, biocontrols, or handpulling, no impact to black-backed woodpeckers would occur.

Boreal Toad

Individual boreal toads or their habitat may be impacted by Alternative A, but it will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species. Boreal toads are found in a variety of habitats from valley bottoms to high elevations on the Helena NF. They breed in lakes, ponds, and slow streams with a preference for shallow areas with mud bottoms. Recent research indicates that amphibians are susceptible to certain chemicals depending on formulation and application rates (pp. 4-7 and 4-9 USFS 2003b, p. 4-20 USFS 2003c, p. 4-6 USFS 2004f, Relyea 2005, p. 4-7 USFS 2004b, Bull and Wales 2001, DiTomaso et al. 2004). By following recommended application rates for herbicides and by implementing riparian aerial spray buffers around open water resources (see EPMs), the likelihood of direct negative impacts on boreal toads under Alternative A would be negligible.

Indirect impacts, if any, would be the result of exposure of eggs and larvae to waterborne chemical residues resulting from herbicide spraying. However, herbicide application would follow application guidelines, which are well below tolerance levels for most species (Infoventures 1995a-k). In addition, efforts would be made to keep all herbicides out of water (as described in

Chapter 2). If herbicides were introduced into water resources, any potential residues would be diluted even further; therefore, while there remains some uncertainty relative to herbicide impacts to amphibians, adverse effects on boreal toads, eggs, or larvae are expected to be minimal.

Spot treatment up to the water's edge would likely further reduce potential for impacts on the boreal toad. Although the potential for impacts on individuals exist, the boreal toad population as a whole would not be affected.

In areas that are proposed for grazing, biocontrols, or handpulling, no effect on boreal toads would occur.

Fisher

Alternative A is not expected to have any impacts on Fishers. Fishers are rare on the Helena NF. Fisher habitat primarily consists of continuous stands of mature and old-growth grand fir, cedar, and hemlock stands below 6,300 feet in elevation. They usually inhabit forested lands within 1,000 feet of riparian areas which they use extensively for foraging, resting, and as travel corridors.

The likelihood of fisher inhabiting areas proposed for treatment is low. Because of the implementation of a riparian aerial spray buffer around open water under Alternative A, and the fact that noxious weed species typically do not dominate landscapes preferred by the fisher, negative impacts on the fisher are not expected.

Direct and indirect negative effects on fisher populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above.

In areas that are proposed for grazing, biocontrols, or handpulling, no impact on fishers would occur.

Flammulated Owl

Individual flammulated owls or their habitat may be impacted by Alternative A but it will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population of species. Modeling of flammulated owl habitat indicates that approximately 66,241 acres of potential flammulated owl habitat is present on the Helena NF. Weed treatments overlap with approximately 2,164 acres of potential flammulated owl habitat Forest-wide (approximately 3 percent of total flammulated owl habitat). Disturbance to flammulated owls is expected to be minimal given that most owls will be holed up in their nests during noxious weed treatments. However, some disturbance is anticipated given the overlap of weed treatments with potential owl habitat.

Direct and indirect negative effects on flammulated owl populations attributable to herbicide exposure are not expected. See *Effects of Herbicides on Wildlife* above.

In areas that are proposed for grazing, biocontrols, or handpulling, no effect on flammulated owls would occur.

Northern Leopard Frog

Individual northern leopard frogs or their habitat may be impacted by Alternative A, but it will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species. Northern leopard frogs are found in or near non-forest habitats, inhabiting dense sedge, wet-meadow, or cattail marshes. Under Alternative A, these areas would be protected by the imposition of a riparian aerial spray buffer around open water resources.

Recent research indicates that amphibians, in some cases northern leopard frogs, are susceptible to certain chemicals depending on formulation and application rates (pp. 4-7 and 4-9 USFS 2003b, p. 4-20 USFS 2003c, p. 4-6 USFS 2004f,Relyea 2005, p. 4-7 USFS 2004b, Bull and Wales 2001, DiTomaso et al. 2004). By following recommended application rates for herbicides and by implementing riparian aerial spray buffers around open water resources (see EPMs), the likelihood of direct negative impacts on adult boreal toads under Alternative A would be negligible.

Indirect impacts, if any, would be the result of exposure of eggs and larvae to waterborne chemical residues resulting from herbicide spraying. However, herbicide application would follow application guidelines, which are well below tolerance levels for most species (Infoventures 1995a-k). Moreover, as described in Chapter 2, efforts would be made to keep all herbicides out of water. If herbicides were introduced into water resources, any potential residues would be diluted even further; therefore, no adverse effects on leopard frogs, eggs, or larvae are anticipated.

Spot treatment up to the water's edge would likely further reduce potential for impacts on the leopard frog by minimizing overspray and drift. Although the potential for impacts on individuals exist, the leopard frog population as a whole would not be affected.

In areas that are proposed for grazing, biocontrols, or handpulling, no effect on leopard frogs would occur.

Plains Spadefoot Toad

Individual spadefoot toads or their habitat may be impacted by Alternative A but it will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population of species. It is very unlikely that Plains spadefoot toad would be affected by weed treatments given their unlikely status on the Helena NF. However, because surveys have not been conducted recently and because this species is suspected to occur on the Helena NF, there may be impacts.

There is a small chance that increased traffic on roads during weed treatment activities could disturb or even kill individual toads particularly during migration to breeding areas (Bull and Wales 2001, Beebee and Griffiths 2005). There is some evidence that amphibians, particularly eggs and juvenile forms, may be particularly susceptible to some environmental toxins at very low levels, including some herbicides (Cary and Bryant 1995; Hayes et al. 2002.)

With use of the aquatic formulations only of glysophate and other protective measures identified in the EMPs (see EPMs), the likelihood of direct negative impacts on spadefoot toads is low.

Northern Bog Lemming

Individual northern bog lemmings or their habitat may be impacted by Alternative A, but it will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species. Across the Helena NF, only marginal fragments of suitable habitat for the bog lemming are present (USFS 1998a). Where they do exist, the implementation of a riparian aerial spray buffer around water (including wetlands and bogs) would likely prevent the lemmings from being directly impacted. There is a possibility that the lemmings could eat tainted leaf material shortly after treatment activities; however, the number of individuals likely to do so are limited and thus, impacts of implementing Alternative A would be minimal.

Direct and indirect negative effects on northern bog lemming populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above.

In areas that are proposed for grazing, biocontrols, or handpulling, no effect on northern bog lemmings would occur.

Peregrine Falcon

Individual peregrine falcons or their habitat may be impacted by Alternative A, but it will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species. Peregrine falcon eyries are found primarily on cliffs near water. They typically select waterfowl and other birds as prey.

For peregrine falcon, the implementation of Alternative A may indirectly maintain or improve their forage base. In peregrine falcon habitat areas with weed infestations, increased human activity, noise, and visual harassment impacts from helicopters may occur, though these would generally be extremely short-term (one to three days). Their ability to flee disturbance activities associated with weed control operations would minimize potential for effects such as direct spraying; however, if peregrine falcons are repeatedly disturbed, they may abandon the nest. The potential for eye irritation if falcons come into direct contact with spray would exist, though the likelihood of direct spray to adults is expected to be low. The potential for direct spray to nestlings would be low as well, due to implementation of EPMs as described in Chapter 2.

Direct and indirect negative effects on peregrine falcon populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above. In areas proposed for grazing, biocontrols, or handpulling, no effect on peregrine falcons would occur.

Townsend's Big-eared Bat

Alternative A is not expected to have any impacts on Townsend's big-eared bat. On the Helena NF, big-eared bats are most closely associated with caves, cliffs, and rock outcrops of sedimentary origin (often limestone); however, they are extremely rare. They also make use of abandoned mine adits, as well as hollowed trees and snags in old-growth forests. They are extremely sensitive to human presence at sites where they are roosting or caring for young.

Townsend's big-eared bats are insectivorous, feeding primarily on small moths typically higher in the forest canopy than most bats; although they occasionally glean beetles, flies, and insects from leaves. It is possible that the bats may prey upon spray-tainted insects; although, due to the extremely low toxicities of herbicides when applied at recommended rates, Townsend's big-eared bat would not be affected. Moreover, direct exposure from herbicides is not likely based on this animal's nocturnal lifestyle and the fact that they roost in protected areas generally associated with mine adits, caves, trees, and outcrops.

Direct and indirect negative effects on Townsend's big-eared bat populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above.

In areas proposed for grazing, biocontrols, or handpulling, no impact to Townsend's big-eared bat would occur.

Wolverine

Alternative A is not expected to have any impacts on wolverines. Wolverines are solitary animals, ranging widely over a variety of habitats. Wolverine home ranges can be as large as 150 square miles in Montana. Isolation from human impacts and a diverse prey base seem to be the most important habitat components. Wolverines feed primarily on rodents and carrion, although they are opportunists, and would consume berries, insects, fish, birds, and eggs when available. Wolverines seldom eat vegetation.

Due to the elusive nature of wolverines, it is not expected they would be impacted by weed control activities. In areas proposed for treatment under Alternative A, ability of wolverine to flee disturbance would minimize negative impacts. Because a large part of wolverine diet consists of rodents, and due to the fact that rodents would likely experience a mid-term increase in habitat and forage, it is likely wolverines would experience an increased prey base. It is unlikely that weed treatment activities would disturb wolverine den sites, since so little mapped weed infestations overlap with potential wolverine denning habitat (i.e., less than 1 percent) and the timing of maternal denning (late winter and early spring) is generally before weed treatment would commence. Because wolverines do not typically consume vegetation, they would not be impacted by short-term reduction in vegetative forage.

Direct and indirect negative effects on wolverine populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above. In areas proposed for grazing, biocontrols, or handpulling, no impact to wolverines would occur.

Northern Goshawk

Individual northern goshawks or their habitat may be impacted by Alternative A, but it will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species. Alternative A would treat approximately 2,341 acres (approximately one percent) of weeds within the 288,210 acres of the Forest's modeled goshawk habitat. Northern goshawks are associated with old-growth mixed conifer and deciduous woodland, often in mountainous terrain. Its nesting habitat is typified by a dense overstory of large trees and an open understory of grass and shrubs, often near clearings. Because most lower to mid-elevations on the Forest are suitable habitat for goshawks, and because weed treatment operations are proposed on lands that are suitable goshawk habitat, disturbance would be minimized by employing appropriate EPMs (see Chapter 2) during treatment activities in or near occupied goshawk habitat. Disturbance from aerial application that could cause goshawks to abandon their nests would not occur. Because of the relatively low percentage of goshawk habitat that would be treated and the implementation of EPMs, the effects on goshawks from implementing Alternative A would be minimal.

Direct and indirect negative effects on northern goshawk populations attributable to herbicide exposure are expected to be minimal. See *Effects of Herbicides on Wildlife* above. The potential for eye irritation if goshawks come into direct contact with spray would exist, though the likelihood of direct spray to adults is expected to be low. The potential for direct spray to nestlings would be low as well, due to implementation of EPMs as described in Chapter 2.

In areas that are proposed for grazing, biocontrols, or handpulling, no effect on northern goshawks would occur.

Birds

Avian species including raptors, game birds and waterfowl, landbirds, and neotropical migratory species would experience minimal effects from the implementation of Alternative A. Although the primary foods taken by these various avian species on the Forest are quite variable, no direct effect is anticipated as a result of proposed treatments operations. Indirect effects to birds associated with impacts to non-target vegetation (shrubs, small trees) may occur, which could locally impact bird habitat at least for the one to three year period before re-establishment

Implementation of Alternative A would maintain or improve most landbird and game bird foraging opportunities as an indirect positive effect. Because increased forage for landbirds and game birds would result under Alternative A, those raptor species that prey upon them would also experience an indirect positive effect. Very few waterfowl nest on the Helena NF. With the implementation of the riparian aerial spray buffer around all water, impacts on these species are not likely. In addition, all avian species are capable of fleeing disturbances, which would further reduce negative effects on them, including the potential for eye irritation resulting from direct spray; therefore, the effects of weed treatment activities are not likely to negatively impact most avian species.

Minimal direct or indirect negative effects on avian populations attributable to herbicide exposure are expected. See *Effects of Herbicides on Wildlife* above.

Grazing, biocontrols, and handpulling would have little to no effect on most avian species. Grazing of goats and sheep may cause brief disturbance to landbird species such as grouse, and may cause local reduction in non-target vegetation due to non-selective grazing; however, improvements to habitat used by these species would occur in the long-term, as additional habitat with the necessary structure and diversity would be created. Biocontrol across the Forest would specifically target the noxious weed species of interest. Because most avian species do not typically forage on the target weed species as a primary browse, little competition would occur and no effect would result. Handpulling on the Forest would contribute a minimal impact through disturbance to birds as crews are mobilized to subject infestation sites. While crews are treating infestations, avian species would tend to abandon the area; once infestations are treated, most avian species would quickly return.

Reptiles and Amphibians

Herbicides, when properly applied, should have little to no impact to amphibians (USFS 2003b, USFS 2004, USFS 2004). Amphibian species including long-toed salamander, Rocky Mountain tailed frog, boreal toad, Pacific chorus frog, Columbia spotted frog, and the leopard frog would not be adversely impacted by Alternative A. Several species are affiliated with riverine or riparian habitats including Rocky Mountain tailed frog, boreal toad, northern leopard frog, and the spotted frog. Herbicide treatments are unlikely to directly affect adults, as dosages would be extremely low at standard application rates and of short duration. With the proper recommended application rate of herbicides and the implementation of the riparian aerial spray buffer around open water resources, the likelihood of direct negative impacts on adult amphibian species is unlikely.

Indirect impacts, if any, would be the result of exposure of eggs and larvae to waterborne chemical residues resulting from herbicide spraying, as there remain uncertainties with regard to the potential impacts of herbicides on eggs or larvae. However, herbicide application would follow application guidelines, which are well below tolerance levels for most species (Infoventures 1995a-k; Tu *et al.* 2001). Moreover, efforts would be made to keep all herbicides out of water (e.g., riparian spray buffer to minimize risk of spray drift, hand application via spot treatment within riparian spray buffers). If herbicides were introduced into water resources, any potential residues would be diluted. While no adverse effects on amphibian species are anticipated, there may still be impacts to local populations due to unknown impacts to eggs or larvae. Impacts that affect Forest-wide amphibian populations are not anticipated.

Reptile species including western skink, northern alligator lizard, common garter snake, western terrestrial garter snake, racer, rubber boa, western rattlesnake, and gopher snake would not likely be impacted by the implementation of Alternative A. Reptiles unlike amphibians are not directly tied to water resources and are known to inhabit a rather wide variety of habitat types. Many reptiles utilize rodent and insect species, as well as grasses and forbs for food. Reptile species that inhabit the Forest may be negatively impacted by the spread of noxious weeds, and therefore implementation of Alternative A would maintain or improve their forage base. The potential mid-term increase in the amount of suitable habitat for rodent species would result in an improved prey base for carnivorous reptiles including snakes. Omnivorous reptiles would likely experience a mid-term increase in their forage base due to the replacement of noxious weed dominated communities with native vegetation.

In areas that are proposed for grazing, biocontrols, or handpulling, no effect on reptiles or amphibians would occur.

ALTERNATIVE B

Implementing Alternative B would eliminate aerial spraying of proposed treatment areas. Generally, this would limit the effects of noise and visual harassment on wildlife from helicopter use and would, in instances of difficult access or in areas with safety concerns for ground based treatment, likely cause specific weed populations to expand, migrate, and continue to cause land degradation, increased runoff and erosion, and loss of habitat and forage availability across the Forest.

Elimination of aerial spraying would reduce the probability of direct herbicide application to some wildlife, and reduce the potential for aerosol ingestion or inhalation of herbicide by some wildlife. It would also reduce the possibility of herbicide application outside of proposed treatment areas due to potential drift from helicopters. Wildlife living in areas to be ground treated would still be exposed to herbicide on vegetation, through skin contact and/or ingestion, as well as increased disturbance from human and vehicle activity; however, due to the extremely low toxicity of the herbicides when applied at the recommended application rate, no effect would result. For specific effects on wildlife, please see *Effects of Herbicides on Wildlife* section above.

Implementation of Alternative B would decrease the already low risk of impacts on some species of wildlife from contact with herbicides and from disturbance from helicopters. Indirect negative impacts include potential loss of prey base for bald eagle, grizzly bear, gray wolf, lynx, wolverine, northern goshawk, and peregrine falcon as weed infestations spread in untreated areas. Those species that depend on native vegetation as suitable forage would also be affected by the implementation of this alternative.

Overall, under Alternative B, there would be effective weed treatment on approximately 19,000 acres of currently infested areas. Because treatments methods are all ground-based, the duration of human disturbance associated with mobilization, treatment, and monitoring would be greater on those areas proposed for aerial treatment (approximately 6,600 acres) under

Alternative A. See also the Biological Evaluation and Wildlife Specialist Report (Project File).

ALTERNATIVE C

Under Alternative C no additional control of noxious weed populations beyond the current annual control program of treating approximately 16,000 acres would occur. Impacts to wildlife would include those negative impacts associated with continuing loss of grass and forb cover, forage quantity and quality, and vegetative diversity in the approximately 6,600 infested areas that would not be treated by Alternative C. Less human disturbance from noise, vehicles, and ground personnel associated with weed treatment would occur than for either Alternative A or B.

If Alternative C were implemented, changes in vegetation composition in infested areas not proposed for treatment would be long-term, and would negatively impact most wildlife species. Approximately 3,150 acres of untreated winter range of elk, mule deer, and bighorn sheep would continue to decline in condition, decreasing the carrying capacity, and ultimately causing a decline in populations of these species. The indirect effects of ungulate population declines would in turn cause a decrease in populations of predatory carnivores that depend on ungulates for prey.

Some small mammal populations, particularly those inhabiting grasslands and meadows (e.g., voles), would be reduced as weedy species reduce grass and forbs cover and composition, and forage base. In some instances, small mammal species composition changes as native vegetation is replaced by weeds. Numerous studies demonstrate reduced numbers and/or diversity in birds, reptiles, small mammals, and insects in stands of non-native plant species (Asher 1998). Boreal toads utilize upland habitats for part of the year; therefore, they could be negatively impacted by the spread of noxious weeds and the loss of grass and forbs cover and diversity as well. Avian populations would be negatively impacted, including many neotropical migrant species dependent on grasslands, meadows, and shrub for nesting and foraging. Habitat for grouse, particularly brood habitat, would be reduced, potentially affecting grouse populations.

This alternative would allow weed infestations to intensify and spread on approximately 6,600 acres of weed-infested sites that would be treated under Alternative A, but not Alternative C. Loss of vegetative cover and species diversity in these areas would indirectly affect the species discussed above, as well as directly affect those species whose prey base may be reduced by an increase in weed infestations. Those species include gray wolf, bald eagle, black bear, grizzly bear, mountain lion, lynx, wolverine, peregrine falcon, and northern goshawk.

Predators of all affected wildlife would also be impacted negatively. These predators include gray wolf, bobcat, red fox, bears, lynx, weasels, owls, hawks, eagles, and falcons. Predators would be negatively impacted by the spread of noxious weeds based on their utilization of ungulates and small mammals for prey, and ungulate carrion in spring. With the lack of an intensified treatment program, infestations would continue to increase and spread thereby reducing carrying capacity and lowering forage production and ungulate populations that would indirectly affect predators. See also Biological Evaluation and Wildlife Specialist Report (Project File).

CUMULATIVE EFFECTS

The cumulative effects analysis area is the project area. Cumulative impacts common to Alternatives A and B would include the negative impacts of herbicide exposure (minimal for most or all species) combined with exposure to other environmental impacts and contaminants such as non-quantified but potentially negative impacts from herbicide use on private or state land. Additionally, other activities with the potential to disturb wildlife (road and trail construction, timber management, wildfire suppression) could result in a cumulative or additive impact to those direct and indirect impacts described above.

Other past activities that have impacted wildlife on the Forest include widespread fires in the early part of the twentieth century, followed by nearly 100 years of fire suppression, which has changed the structure and distribution of vegetation on the Helena NF; trapping and poisoning, which directly reduced specific species numbers; timber harvest and road building especially in the second half of the twentieth century; livestock grazing throughout much of the Forest; and the invasion of noxious weeds onto the Forest. Livestock grazing on wildlife summer and winter ranges has increased the probability of weed invasions in many areas through several avenues, including direct spread of seeds, decreasing vigor of some plants through localized overgrazing, and creating areas of bare or disturbed soil through hoof action. Past and ongoing activities that have occurred on private or other land off-Forest include development, forest fire ignition, fire suppression, and dispersed and developed recreation.

Recreational use of the Forest has also influenced the invasion and spread of weeds, as well as recreation related disturbance to wildlife. Projects recently implemented by the Forest which both negatively and positively impacted wildlife populations and/or habitats relative to this project include road closure projects, road obliteration projects, trail and road relocation, Off Highway Vehicle management, Burn Area Rehabilitation Projects, allotment management planning, forest thinning and underburning, vegetation management, and weed control.

Foreseeable future impacts on wildlife could result from increased recreation on public lands, including an increase in off-highway-vehicles such as snowmobiles and 4-wheelers, an increasing potential for catastrophic fire, suppression activities associated with fire, and continued spread of noxious weeds.

Increased disturbance from traffic associated with weed treatment operations in Alternatives A and B would add to traffic throughout the Forest and on adjacent land.

Implementation of Alternatives A or B would reduce cumulative negative effects of weed invasions on wildlife inhabiting the Forest and adjacent property in the long-term (> three years). These reductions would include those currently ongoing and reasonably foreseeable impacts to wildlife habitat structure and composition (primarily in grasslands) and big game forage. Alternative A would have the greatest positive impact on long-term forage production and ecological health, followed by Alternative B.

Implementing Alternative C would not address negative impacts to wildlife from weed infestations on the Forest and adjacent properties relative to the approximately 6,600 acres of un-treated area. Weed infestations on the Forest not currently being treated would be allowed to spread under Alternative C. Long-term effects of expanded noxious weed communities would result in large tracts of degraded land with little to no native vegetation structure. Ungulate species would experience a reduced forage base and associated carrying capacity and may inevitably suffer population declines. The problems related to noxious weed infestations would intensify in the future and the increased erosion and runoff from a lack of ground cover would negatively impact water quality resulting in negative impacts on aquatic species and amphibians. Shrub, grass, and forbs structure would be lost from infestation sites leading to a reduction in suitable habitat for birds, small animals, and ungulate species on those acres not being treated as well as in areas resulting from spread of those weed infestations. Eventually, an irreversible negative effect would be reached beyond which species and habitat may be lost permanently.

CONSISTENCY WITH FOREST PLAN AND OTHER LAWS, REGULATIONS AND POLICIES

ALTERNATIVE A

Under Alternative A, all actions relating to wildlife effects are consistent with the Helena Forest Plan, National Forest Management Act, Migratory Bird Treaty Act, Endangered Species Act, and other laws, regulations, and policies. Implementation of Alternative A would assist in the recovery and improvement of habitat diversity and increase the quantity and quality of forage for ungulates, predators, small mammals, reptiles and amphibians, birds, as well as those species that depend on these animals for prey.

ALTERNATIVE B

Under Alternative B, all actions relating to wildlife effects are consistent with the Forest Plan and other laws, regulations, and policies. Implementation of Alternative B would aid in the recovery and improvement of habitat diversity and increase the quantity and quality of forage for ungulates, predators, small mammals, reptiles and amphibians, birds, as well as those species that depend on these animals for prey. Although not all infestations would be treated under this alternative, major habitat and forage base improvements would occur across most of the Forest which would be in line with the Helena Forest Plan, National Forest Management Act, Montana Weed Management Plan, Migratory Bird Treaty Act, Endangered Species Act, and other laws, regulations, and policies.

ALTERNATIVE C

Under Alternative C, noxious weed communities would be allowed to dominate and expand throughout many areas across the Forest. Specific goals in the Forest Plan to "maintain and improve habitat over time" for big game, grizzly bears, bald eagles, gray wolves, and peregrine falcons would not occur (FP pg. II/2) because efforts to "provide adequate browse, species diversity, and quantity to support current moose populations" would not occur (FP pg. II/19). In addition, maintenance or improvement of big game summer and winter ranges, visual quality objectives, wildlife and fisheries habitat, and general preservation of current suitable habitat and structure would not be initiated leading to a loss of resources that currently exist on the Forest. Therefore, Alternative C is less responsive to wildlife goals and objectives stated in the Helena Forest Plan.

FISHERIES AND AQUATIC RESOURCES

One of the primary means by which toxicological effects of specific contaminants on aquatic life are determined includes use of standardized laboratory bioassays. Sutter (1995), (as discussed in Munn and Gilliom 2001) identified several shortcomings of bioassays; in particular, their applicability to expected field conditions. However, bioassays remain a useful tool in quantifying toxicological effects of specific contaminants on aquatic life in a consistent, relatively reproducible manner (Munn and Gilliom 2001). The way the bioassay information is used, is to develop a "threshold level" at which it is unlikely a species will suffer any effects—this is called the No Observable Effect Level or NOEL.

The most frequently used tool to assist in determining acceptable level of risk is a risk assessment. Risk assessments evaluate the various avenues by which a species can be affected. Examples include effects on the animal in any life stage from possible toxic effects of a specific herbicide and effects on other non-target organisms that might be important to some portion of the life history or habitat.

Other important elements that come into play during a risk assessment for herbicide application include: how much chemical can reach the water; if it reaches the water, what would the concentration of the chemical be and how long would that concentration be maintained? There have been various approaches used to gauge this type of risk. Some models focus on the worst-case scenario for how much chemical can get into a waterbody. Additionally, the intermediate breakdown or transformation products (degradates) of herbicides may pose risk as do combinations of herbicides or other chemicals Gilliom et al 2005 pgs 73,80-82,85 and 111-112).

The maximum acceptable toxicant concentration (MATC) McKim (1977) cited in (Mayes *et al.* 1987) is an approach to determine theoretical threshold toxic levels. The USFWS followed up on this concept in developing a manual on Acute Toxicity where there is an attempt made to pick a grouping of species that provides protection for most other species most of the time (Mayer and Ellersieck 1986) Their findings suggested that 1/15th of the LC_{50} (lethal concentration) for rainbow trout provided protection for most other species 95 percent of the time and 1/25th of the rainbow trout LC_{50} provided protection for most other species 100 percent of the time. A different approach for risk was recommended by Norris *et al.* (1983). They recommended use of 1/10th of the LC_{50} as providing for an adequate safety margin. The USEPA has used a safety factor of 1/20 the LC_{50}, which they believe should not result in an unacceptable risk to endangered aquatic species (USFS 2001e). The National Academy of Sciences-National Academy of Engineering (1973) cited in Norris *et al.* (1983) specifically recommended 1/20th of the LC-50 for persistent chemicals.

Based on the need to provide high margins of safety for fish species listed under the Endangered Species Act and fish species currently classified as sensitive, 1/20th of 1.5 ppm picloram (one of the lowest 96 hour LC_{50} that could be found in the literature for cutthroat trout) has been selected for delivery modeling by the HNF. The approach taken by the HNF likely provides more protection than would the Environmental Protection Agency Approach outlined in Gilliom et al (2005 pg 97). Rationale for this conclusion follows below.

The USEPA's recent approach outlined in Gilliom et al (2005 pg 97) would restrict use of a pesticide (picloram used in the example below) in any given area such that risk for acute and chronic effects are minimized. For acute mortality risk the recent EPA approach (Gilliom et al 2005 pg 97) would use a 50% level of the 96 hour LC_{50} for fish. In the HNF case 50% of 1.5 parts per million (the 96 hour LC_{50} for cutthroat trout) or an acute risk threshold of 0.75 ppm that cannot be exceeded for more than one hour once every three years. For chronic effects the EPA approach is to use the No Effect Level or if that is unknown use the lowest concentration at which an effect has been demonstrated. Continuing with the Helena example using the EPA approach, the chronic risk would be a concentration of picloram that would not be allowed to exceed 35 parts per billion (ppb) in surface water over a 4 day average more than once every three years. The 35 parts per billion is the level at which lake trout were found to suffer some level of negative effect when exposed for 60 days). As compared to the EPA approach, the HNF modeling projects that concentrations will not exceed .07 parts per million (equates to 70 ppb) for a four to six hour period following the first rainstorm after herbicide application and then drop back to non-detectable levels. The USEPA acute risk level as described above would not likely even be approached. If specific individual modeling runs do show a projected exceedance limitations on the amount of herbicide to be applied in a 6th code hydrologic unit will be implemented or a different herbicide employed to ensure risk of an exceedance is nearly eliminated. These actions are specified as an Environmental Protective measure (EPM). Further, with regard to chronic effects, the average concentration of herbicide in surface water over 4 days would drop far below the threshold for any chronic effect risk as assessed by the USEPA methods detailed in Gilliom et al. (2005 pg 97).

In 2001, the Nez Perce National Forest prepared a Biological Assessment (USFS 2001e) for herbicide treatment of noxious weeds which used yet another approach to assess risk to aquatics. As part of the aquatic analysis for herbicide application, a risk quotient was calculated for each herbicide proposed for use. This risk quotient was calculated from a NOEL divided by an expected environmental concentration (EEC). The risk quotient provides a reference from which a worst-case scenario can be viewed. If the risk quotient is greater than 10, the level of concern is categorized a "low". If the risk quotient is between one and 10, the level of concern is "moderate." If the risk quotient is less than 1, then the level of concern is "high."

The level of concern (risk) analysis is based on direct application of the active ingredient of a chemical product to a pond containing one acre-foot of water. This illustrates an extreme case, which should not occur during implementation. The risk of a direct application is mitigated by selecting appropriate application techniques (hand application vs. aerial spray), applying buffers adjacent to water, taking into account such factors as chemical volatility, wind speed and direction, temperature, precipitation, ground slope or use of chemicals that are approved for direct application to water (USFS 2001b). In some cases it may be appropriate to limit how much chemical is applied in any given drainage if it is a high risk chemical for aquatic species. **Table 4-6** shows the risk analysis using the risk quotient method as identified in the Nez Perce National Forest Biological Assessment (USFS 2001b). Risk can be assessed based on the level of chemical considered to be reaching a stream as well as incorporating the chemical's toxicological effects. Using the approach described for the Nez Perce National Forest to assess the high risk chemicals, the HNF identified picloram as falling into this category.

SITE SPECIFIC APPROACH

To better quantify risk to fisheries from the proposed use of herbicides the Helena Forest used a more site specific approach that addressed how much herbicide was applied by 6th code hydrologic unit and then modeled the environmental fate of the herbicide and compared calculated concentrations of the herbicide projected to be present in the water to concentrations of the herbicide known to pose risk to fisheries. Of the 149 watersheds on the HNF, 105 would be receiving some form of herbicide treatment under the Proposed Action. These 105 watersheds were evaluated with a method developed to model picloram delivery via surface water runoff/overland flow to the aquatic system after application. This effort was undertaken to ensure that concentrations of picloram in streams would not reach levels that would result in acute toxicity and ensure that risk for any chronic effects are minimal.

Picloram was chosen as the chemical to model because of its toxicity to salmonids, its persistence in the environment and its mobility in some situations. Other herbicides proposed for use posed less overall risk for fish than did picloram. Consequently, by modeling the fate of picloram it was intuitively determined that risk for use of the other chemicals was addressed as well. Details of the methodology are found in Appendix C. Multiple treatment types (aerial, ground and mechanical) are proposed for these watersheds. Both runoff and infiltration conditions exist within these watersheds. To make the model representative to conditions on the HNF, the following assumptions were made (Walch and Stuart 2002):

- Picloram would not be used within 50 feet of a waterway.
- Delivery rate within 300 feet of aquatic systems equals 2% of chemical applied over a period of 6 hours.
- Delivery rate for all other treatment areas outside the 300 foot buffer equals 1% of chemical applied over a period of 24 hours.
- Flow during two treatment periods was

TABLE 4-6
Level Of Concern For Chemical Use Using The Risk Quotient Method

Chemical	1/20 Of LC_{50} (ppm)	EEC (ppm)	Risk Quotient	Level of Concern
Chlorsulfuron (Telar)	12.5	0.0690	181.27	Low
Clopyralid	5.2	0.1398	37.21	Low
2,4-D	12.5	0.3677	33.99	Low
Dicamba (Banvel)	50	0.2758	181.27	Low
Dicamba (Vanquish)	6.75	0.2758	24.47	Low
Triclopyr (Garlon)	26.1	1.8389	14.19	Low
Hexazinone (Velpar)	16	1.4711	10.88	Low
Metsulfuron methyl	7.5	0.0114	657.84	Low
Imazapic	5	0.0919	539.40	Low
Imazapyr	5	0.0919	539.40	Low
Picloram	0.075	0.0919	0.82	High
Triclopyr (Redeem)	26.1	1.2872	20.28	Low
Sulfometuron (Oust)	0.625	0.0172	36.34	Low
Glyphosate	4.3	1.4711	2.92	Moderate

Note: LC_{50} = Lethal Concentration where 50% mortality occurs ; EEC = expected environmental concentration; ppm = parts per million.

evaluated as follows:

1. A storm event with a two year recurrence interval (Q2) was used to simulate spring time flow and was calculated using a US Geologic Survey regression equation (Omang 1992). (Note: These calculations are based on a regression equation developed for ungaged sites in the Southwest Region of Montana, using variables for drainage area (National Forest System lands only) and percentage of drainage area above 6,000 feet elevation).

2. Fall flows were calculated by using mean monthly discharge in September that was exceeded 20% of the time (Q.20) (Parrett *et al.* 1989). (Note: The above calculations are based on a regression equation developed for the Upper Missouri River Basin, Montana, using variables for drainage area (National Forest System lands only) and mean annual precipitation).

➢ The model assumes that all acres within weed polygons will be treated at a rate of .25 pounds of picloram per acre. (Note: This may over-estimate the amount of herbicide to be used, especially in ground-based treatment. Where weeds are scattered, spot-spraying may result in treatment of a very small percentage of the acres in the polygon. Weed density is highly variable within an infestation and therefore difficult to measure or to portray on a map or in a database. Consequently, some margin of safety is already included at this point, but the magnitude of that margin of safety is unknown).

Modeling was done specific to picloram for treatment areas identified in each watershed and analyzed for the Alternatives A, B, and C. Detailed results of the analysis are presented in the Project File (PF-Fisheries).

In addition to effects of a specific herbicide to fish, there are additional risks for combinations of herbicides, various additives such as surfactants, drift reduction agents, dyes as well as "degradates" (breakdown or transformation products of herbicides). However, these additional risks are considered to be low for aquatic species. Westslope cutthroat trout were considered to be the most sensitive aquatic species with regard to potential for effects so by protecting them it was felt that other aquatic species were protected as well. With regard to bull and cutthroat trout, effects were considered discountable (Walch 2006). Discussion supporting this assessment of low risk for aquatics continues below.

As discussed above, there is some potential for an "additive negative effect" when two different chemicals have potential to be delivered to the same waters (Gilliom et al. 2005 page 73). From a national perspective Gilliom et al. (2005 page 73) found that undeveloped watersheds had mixtures of two or more herbicides 25% of the time. It is possible that there may be times when more than one herbicide is applied in any given watershed on the Forest or on non-federal in-holdings within the national forest boundary.

For herbicide applications on the Helena Forest, the risk for the "'additive effect" is projected to be low due the environmental protective measures that will be implemented, the very low amounts of herbicide likely to enter the stream due to use of EPMs limiting the amount applied in any given drainage, the conservative nature of the modeling procedure which likely overestimates the amount of chemical that will get to the stream, the dilution capability of the streams, and the relatively low toxicity to aquatic organisms of the herbicides proposed for use (as compared to insecticides).

A further complication with regard to use of pesticides of various types can come about when, in some cases, the breakdown products or "degradates" as discussed by Gilliom et al. (2005 pg 81) of some pesticides are more toxic to fish than the parent chemical. In most cases, degradates studied have been found to have similar or lower toxicities than their parent compound (Gilliom et al. 2005 page 81), but the authors cite findings demonstrating that 20% of the time studied degradates were more toxic than the parent pesticide.

The risk for degradates of herbicides proposed in this federal action having an effect on fish, when there is none projected for a specific parent herbicide proposed for use, is projected to be low. This low risk, although somewhat speculative, is a reasonable presumption given that the toxicity for salmonids of the herbicides proposed for use on the Helena Forest, other than picloram, is rated as low to moderate (see Table 4.5) Additionally, toxicity for many of the degradates is likely similar to that of the parent chemical based on preliminary discussions of concerns in Gilliom et al. (2005 pg 81) where the authors cite other literature indicating that 80% of the time the degradates evaluated had no more toxicity than the parent chemical. Further, even if the degradates were to be three to 10 times more toxic as discussed as occurring with a small percentage of some chemicals (Gilliom et al. 2005 page 81), the potential for negative impacts to bull or westslope cutthroat trout is believed to be low since most of the chemicals proposed for use with the current federal action have less mobility and less persistence than picloram and therefore are less likely to enter the water when applied following the Environmental Protective Measures detailed in Table 2-4. However, a few of the herbicides proposed for use do have either high mobility and/or elevated persistence (individual herbicide discussions Vering's 2004 and Walch 2006). It is the low toxicity of these other relatively mobile herbicides and small amounts applied in any given 6th code hydrologic unit that provides at least as much as protection for those chemicals and their degradates as assessed for picloram applications. Further, as brought out before, the duration of exposure to the low concentrations of herbicides in streams would likely be no more than 4 to 6 hours; the same or a lesser exposure is expected for degradates. In the case of picloram, the projected estimates of parent chemical that could get in water for the proposed federal action may be an over-estimate based on the conservative environmental fate assumptions used. Consequently, the concentrations of the parent chemical in water are likely to be lower than concentrations of chemical necessary under extended exposures to have an effect (chronic type effects). This is especially true given that exposure times of fish to picloram and its degradates will likely be no more than 4 to 6 hours several times over the course of a year.

Using picloram as an example and Woodward's (1979) work on westslope cutthroat trout (WCT), reduction in growth effects to the species were found after 24 days of periodic exposure at the 0.41 ppm levels of picloram which is nearly 6 times higher than the 0.07 maximum concentration allowed to be present in streams for a 4 to 6 hour period and used for planning purposes as a threshold in the HNF analysis. Intuitively, the degradates of picloram would likely need to be at least 6 times more toxic than the parent herbicide and have an exposure duration of many days to result in more risk than the parent chemical being used. Thus, it seems reasonable to conclude that risk for degradates to have more than discountable effects to bull or WCT is low.

DIRECT AND INDIRECT EFFECTS

There is some risk for direct and indirect effects to occur to various aquatic resources as a result of herbicide treatments or lack of herbicide treatment. Those effects or risk of those effects are discussed in depth throughout the rest of this section.

ALL ALTERNATIVES

Herbicides

The risk for various pesticides, including herbicides, to affect aquatic species has been a concern for many years and has been evaluated to varying degrees by companies, various agencies, and independent researchers. For an herbicide to affect aquatic species, the chemical and any associated additives must get into the water. Herbicide applications can result in surface water contamination by a variety of means as discussed below.

The primary means by which the various pesticides, including herbicides, get into streams is through delivery of storm runoff to surface water (Gilliom et al. 2005 pg 27), but also occurs through infiltration into ground water (Gilliom et al. 2005 pg 28), drift during aerial spray operations, and accidental spillage. Transport of pesticide to streams is largely a function of timing of precipitation and runoff/drainage relative to pesticide application (Gilliom et al. 2005 pg. 27). Once in the water, the risk for affecting aquatic organisms will vary depending on many factors. Some of the important factors include: the species present and its sensitivity to the chemical, life stage of the species, the concentration and toxicity of the parent herbicide and its degradates (Gilliom et al. 2005 page 81and 85), adjuvants (Gilliom et al. 2005 pg 22), additive effects from other pesticides that may also be present in the water (Gilliom et al 2005 pgs 111-112), frequency of exposure, and duration of exposure to the chemical. Other factors such as temperature and pH can have influence as well.

Attempts to assess risk of pesticide applications (including herbicides) to aquatic species have been undertaken over past decades by various authors through toxicity studies and environmental fate studies. An important element in assessing risks to water quality from pesticide application is the amount of pesticide applied per land use area such as pounds per acre (Gilliom et al. 2005 page 24).

Of the chemicals proposed for use in all alternatives, picloram is the only one to have a risk quotient that was categorized as "high." The risk quotient for glyphosate is "moderate" while all others are "low" (see **Table 4-6** above). Risk of using picloram has been evaluated closely via literature review, and conservative direct modeling identified a very low probability of adverse toxic effects on fish as detailed in the sections below. Therefore, direct impacts on aquatic organisms would be even less by using chemicals with low to moderate risk quotients.

The potential effects of picloram from acute and chronic exposure have been widely discussed, and some dated data and research exist on the topic (see discussion of picloram in the literature review section). Available data on toxicity have been collected under laboratory conditions which rarely consider other environmental variables such as temperature, wind, photo-degradation, soil permeability, precipitation frequency and intensity, local geochemical influences, stream volume (dilution factor) or water quality (Munn and Gilliom 2001).

Based on the available studies and the EPMs (**Table 2-4**) planned, it is extremely unlikely that the lowest known acute toxicities levels for any aquatic species would ever be reached in streams. Risks to aquatic species from chronic exposure are also unlikely, but somewhat less certain. Woodward (1976) documented chronic exposure effects in lake trout fry with very low concentrations of picloram (closely related species to bull trout) after 60 days of continuous exposure. In application settings that are expected to occur on the HNF it is very unlikely that aquatic organisms in streams would be subjected to anywhere near 60 days of continuous exposure to a herbicide. The more likely exposure is projected to be a four to six hour exposure at concentrations less than 0.07 mg/L.

Chronic effects on growth were noted for cutthroat trout during a 60 day test where exposure to fish occurred periodically over a 24 day period at very low levels that varied from 0.79 mg/L down to 0.076 mg/L (Woodward 1979). It is unlikely that there would be any chronic exposure effects on aquatic species from this project; given exposures of a few hours on a few days over the course of a year at levels likely to be well below 0.075 mg/L as opposed to a 24 to 60 day continuous exposure at those levels.

With mitigation measures in place, modeling efforts undertaken to limit the likely concentration of picloram in surface waters to below .075 mg/L, and the probability that the time of exposure to herbicide would be very short (4 to 6 hours), it is concluded that the risk for any chronic effects on fish species would be minimal.

Sediment

Implementation of all alternatives would likely result in some short term increased erosion and sedimentation due to removal of weeds over relatively large patches of ground in some cases. There is slight potential for some negative effect on fish habitat from this additional sediment delivery over the short term. However, given that streamside buffers are in place and generally only spot spraying with ground based equipment is occurring within buffers as discussed in the EPMs (Table 2-4) , it is likely the sediment filtering capability of the buffers will not be seriously compromised and most sediment should be filtered out before reaching surface water. Additionally, any elevated sediment impacts should be temporary and associated with significant runoff events. It is projected that as weeds are removed and desirable species restored, there will be less erosion and sediment delivery than was occurring with the weeds present.

Aquatic Macro-invertebrates

Another means by which fish can be affected is via effects to food sources such as aquatic invertebrates due to potential contamination of the water with sediment, herbicide, its degradates, and any additives such as surfactants, drift reduction agents, and dyes.

Generally, macroinvertebrate species adapted to highly variable stream environments are better able to tolerate change than those in more stable lake and pond environments (Mackie 1998). How macroinvertebrate species respond to pollutants can vary. The level of impact to an aquatic system is dependent on the chemical and physical properties of the pollutant and the ability of a given species to tolerate an impact (Nimmo 1985). Since the timing of chemical releases and water conditions relative to the distribution and life cycles of organisms determines the potential exposure and, correspondingly, the biological effects of exposure, the effect of herbicides is more difficult to track. The effect on benthic (stream bottom) species is determined primarily by the amount in the water and substrate. The composition and toxicity change rapidly and continuously as individual compounds are transported through the aquatic system and dispersed and degraded at differing rates by physical, chemical, and biological processes (Nimmo 1985). The rates of these weathering processes and population recolonization vary depending on temperature, currents, wind, concentrations of suspended and dissolved components of the receiving water, sediment sorption, and biological activity. Based on the very low projected levels of herbicide to be found in surface waters and the toxicity studies reviewed, the conclusion is that it is extremely unlikely that there would be any effect on aquatic invertebrates, including TES species.

As discussed throughout this effects section and in the fisheries Biological Assessment/Biological Evaluation (BA/BE) (Walch 2006), the risk for herbicide, degradate, or additive contamination levels that would affect any life stage of fish, including bull or WCT is discountable due to the environmental protective measures (Table 2-4) that will be implemented including the modeling procedures used to limit the amount of chemical applied in any given drainage. The overall result will ensure that concentrations of the herbicides would likely never approach and almost certainly would not exceed 0.075 ppm in streams. Any effects to growth and survival of WCT or other fish by chemical contamination affecting aquatic insects used as food is believed to be unlikely. Review of toxicology information generally shows that aquatic insects and other aquatic invertebrates are more resistant to the various herbicides than WCT. Consequently, reducing risk for acute or chronic effects to WCT by ensuring that chemical concentrations are kept to less than 0.075 ppm and exposure time is of short duration, there should be an extra margin of safety for aquatic invertebrates used as food. With regard to the potential for sediment to affect aquatic invertebrate production the amount of sediment delivered to the stream as a function of reduced ground cover from weed treatment will likely be low as the sediment filtering capacity of buffer zones will be maintained and over time as the native vegetation recovers ground cover should improve and sediment delivery should be reduced to at least some degree from current levels. Intuitively it follows that there is an extremely low potential for affecting fish growth or survival as related to herbicide effects or sediment on their food source.

Surfactant/Dyes/Drift Reduction Agents

Information is limited on the types of surfactants used and the toxicity of surfactants. Surfactants are proposed for use with the same EPMs (Table 2-4) as picloram. The surfactant currently used by the Helena NF is Phase II®, which is a non-ionic surfactant that is vegetable-based (rapeseed oil) and contains organosilicone. The components used in the formulation of Phase II® do not indicate aquatic toxicological concerns. However, the toxicity of the silicone based surfactants planned for use such as Phase II have had limited testing conducted on aquatic species. A project file memo (Walch 2003a and 2003b) details concerns with use of surfactants that may have high toxicity for aquatics. However, as pointed out by a project file note from Rice (2003a) the updated Material Safety Data Sheet (MSDS-2003) does not specifically restrict applications of Phase II around water. Another factor that would likely result in a lower concentration of the adjuvant in surface waters as compared to the herbicide (if delivery to surface water were to occur) is the fact that only a small amount of adjuvant is added to the herbicide and consequently the adjuvant is already diluted substantially. If runoff were to deliver the herbicide adjuvant mixture to the stream the adjuvant would be diluted to a greater degree than the parent herbicide. Risk from use of adjuvant is further reduced as the environmental protective measures specify that if chemicals other than Phase II are planned for use as additives to the herbicide formulation, only chemicals generally recognized as safe or which are a low priority for testing by the U.S. EPA will be considered (EPM in Table 2-4). Lastly, to provide a further margin of safety for aquatic species, surfactants will not be used within riparian areas as specified in the environmental protective measures in Table 2-4.

The likelihood that surfactant would reach surface water at great enough concentration to affect fish is analyzed through the modeling effort for each 6th code hydrologic unit along with herbicides as adjuvant (tank mix additive aid or modify the action of the mixture). Some surfactants are labeled for use in and around water including: Activate Plus®, LI-700®, Preference®, R-11®, Widespread®, and X-77®.

As mentioned earlier, there may be times when other chemicals such as drift reduction agents or dyes are mixed with the herbicide. The drift reduction agents may be used to ensure that drift of herbicide from targeted areas during aerial spray operations is minimized and dyes are sometimes used during ground applications to assist operators and prevent over-application. As with surfactants the environmental protective measures (Table 2-4) discussed in relation to drift reduction agents and dyes should ensure that risk for fish is minimal and likely even less than the risk modeled for picloram applications.

Runoff

Most herbicides are applied in liquid formulations and are sprayed on the foliage of the target vegetation. Rarely, soils may be a major receptor and contamination can occur by herbicides leaching through the soils to groundwater and ultimately reaching the aquatic environment. This method of introduction usually poses the least amount of risk to the aquatic environment because chemicals typically disappear from the ground surface by either plant uptake of the chemical, volatilization, natural decomposition of the active ingredients or adsorption of the herbicide by soil particles. The half-lives of the proposed chemicals once they have been applied to the soil indicated picloram has a half-life in soil that ranges from 20 to 277 days, significantly more than any of the other proposed chemicals. Environmental Protection Measures to reduce effects from picloram use are found in **Table 2-4**.

Point source impacts such as leaks, spills, improper storage, handling, or rinsing of containers are often the result of most pesticide related surface and groundwater contamination. An environmental protection measure has been included in Chapter 2 of the EIS to avoid this, and, therefore, risk from an accidental spill of herbicide into a water body is considered very low.

The most likely mode of pesticide entry to the aquatic system is through delivery of overland flow from precipitation events to surface waters (Gilliom et al 2005 pg 27). Risks vary depending on soil composition and the timing and intensity of the precipitation events after application. Risks tend to be lower on well-vegetated forests and rangeland where soil infiltration is greater than precipitation. Herbicide delivery to surface waters can also occur as a function of runoff from burned areas, logged areas, roads, grazed areas, and other disturbed areas on forest lands. With regard to risk of herbicide delivery to surface waters from burned landscapes, denuded and compacted soil typically provides increased potential for surface runoff. The magnitude of accelerated erosion is expected to be substantially less by the second year after a fire, because soil erosion would slow somewhat once the erosion rills break through the soil hydrophobic layer (DeBano *et al.* 1998), and as vegetation recovery provides increased soil cover. Recovery of soil hydrologic function is also expected to occur within two to seven years following the fire.

Table 4-7 identifies those watersheds where the modeling identified exceedences of the safety factor for picloram in surface water. Measures taken to mitigate these exceedences and produce "no impact" or "a very low probability of adverse toxic effect on fish" are identified below. Of those watersheds where exceedences occur, the HNF fisheries biologist indicated that only the following watersheds **do not** contain fish: Cave Gulch, Favorite Gulch, Grizzly-Orofino, Oregon Gulch and Middle Crow Tributaries. Results of picloram modeling for all alternatives on the 105 watersheds are found in Appendix D of the Aquatic Specialist's Report in the Project File (PF-Fisheries).

Due to the predicted exceedences, an environmental protection measure was developed to eliminate the potential impacts. Treatment schedules for these drainages would be adjusted (treated in spring, acres reduced, increased timeframe, alternative herbicide) per the *Environmental Protection Measures*. These measures would mitigate these exceedences and produce "no impact" or "a very low probability of adverse toxic effect on fish."

TABLE 4-7
6th Code HUCs Exceeding the Picloram Modeling Safety Factor

Stream Name	Alt. A*	Alt. B*	Alt. C*
Cave Gulch & others	X	X	X
Chicken Creek Area	X	X	
Favorite Gulch	X	X	X
Grizzly-Orofino	X	X	X
Lower Beaver	X	X	X
Lower Crow	X	X	X
Lower Trout	X	X	X
Magpie	X		
McClellan	X	X	X
Middle Beaver	X	X	X
Middle Crow Tributary	X	X	X
Missouri River Area	X	X	X
Moose Creek I	X	X	
Ophir Creek	X	X	X
Oregon Gulch	X	X	X
Spokane	X	X	X
Spotted Dog East	X	X	
Upper Little Blackfoot River	X	X	
White Gulch	X	X	X
TOTAL	19	18	14

Note:
* See Appendix D of the Aquaitcs Report in the project file for complete model results.
Highlighted HUCs do not contain fish.

ALTERNATIVES A AND B

Grazing

Goats or sheep would be used for weed control. Grazing would be high intensity, short duration and would be intensively managed. Livestock would be herded or fenced to prevent bank trampling and to keep the animals out of the stream channel. The herding and/or fencing should reduce the potential for short-term sedimentation, nutrient loading or disruption of in-stream habitat. However it is not possible to state that there would be no impact. There is potential for only minor effects on fish habitat from this activity due to the emphasis to use herding and fencing to avoid impacts to riparian habitats highly susceptible to being damaged by grazing.

Handpulling

Handpulling weed treatments at the level proposed would have no direct or indirect effect on fish due to few acres of treatment spread across the Forest.

Adaptive Management Strategy

An EPM has been included in **Table 2-4** establishing yearly application limits for picloram usage. As long as these limits are not exceeded, future herbicide treatments under the Adaptive Management Strategy would have the same effects as those described for herbicide treatments above and below. Initially, aerial application of herbicides would be prevented within 300 feet of water bodies and, therefore, drift of chemicals would not be expected to cause adverse impacts on water resources. This assumes that application would not occur during times when there is significant wind and/or precipitation during or immediately after application. Aerial application would be evaluated with drift cards and reduced to a minimum of 100 feet if monitoring demonstrates no drift is occurring. This would allow for faster and sometimes more efficient treatment of weeds in the riparian aerial spray buffer.

ALTERNATIVE A

Aerial treatment over a total of 11,074 acres would be expected to cover about 80 percent of the treatment area, with the remaining 20 percent of missed areas to be ground treated the following year. Follow-up aerial and/or ground treatment would be implemented during subsequent years, as necessary, to effectively control the weeds. Not all of the 22,668 acres proposed for treatment in Alternative A would be treated during the first year; at least three years would be used for initial treatment of all areas. As depicted in Table 4-7 there are 19 6th code hydrologic units where the amount of picloram initially modeled to be applied resulted in an exceedance to the 0.075 mg/l or parts per million modeling threshold. As specified in the EPMs (Table 2-4) additional site specific restrictions will take place to limit the amount, type or timing of herbicide applied in any of these 19 drainages to ensure the threshold concentration levels for ensuring risk for fish is not exceeded. These measures include, but are not limited to: reducing the amount applied in any given year, changing season of application, or changing the type of herbicide proposed. Additionally, because the modeling effort assumed that each treatment polygon was fully infested with weeds the entire acreage within the polygon was modeled as sprayed. Consequently, it is possible that once review for a given spray proposal are conducted on the ground, the area that will be treated will likely be less and the amount of herbicide actually required would not result in a modeled exceedance. In those situations the proposal would be able to proceed.

Drift

Under Alternative A, direct effects on aquatic organisms from noxious weed management are primarily associated with the herbicide application on (resulting from direct aerial spray or drift) and/or around streams and associated riparian areas, lakes or wetlands. The extent to which direct effects occur is a function of the toxic characteristics of herbicides, concentration to which the organism is exposed, duration of exposure and the susceptibility of the animal to the chemical toxins (Virginia Cooperative Extension 1996).

Aerial spraying near aquatic zones has the potential to expose aquatic organisms to contaminants either through direct application or drift. Mobilization in ephemeral steam channels can also be an issue because ephemeral stream channels are often difficult to recognize from the air and may be sprayed inadvertently (USFS, 2001b). Under Alternative A, aerial treatments have specific mitigations (buffer zones) that provide for closely monitored herbicide application adjacent to riparian areas as specified in the Environmental Protection Measures in Chapter 2 (**Table 2-4**).

If any herbicide drift from aerial application reaches a stream or other water body, the small amount of herbicide in the drift would be diluted to non-detectable concentrations. Studies show that little or no herbicide drift occurs beyond 100 feet from the aerial release area when applied during proper conditions (Felsot 2001). Monitoring efforts at the Mormon Ridge and Sawmill RNA spray projects, including sampling of herbicide drift patterns and water chemistry, suggest that risk to water resources is minimal as long as environmental protection measures are followed (USFS 2001c).

Under Alternative A, with EPMs in place, herbicide treatment of weeds is designed to have a very low probability of adverse toxic effect on fish.

ALTERNATIVE B

All direct and indirect effects from restoration, biological agents, and ground application of herbicides to control noxious weeds would remain the same as described for all alternatives. Not aerial applying herbicides on 3784 acres in the HNF would directly and indirectly affect the aquatic environment as detailed under the No Action Alternative in those areas left untreated.

Elimination of aerial spraying would eliminate the probability of accidental direct herbicide application to aquatic habitats, and reduce the potential for aerosol drift into riparian areas and aquatic habitats but not completely eliminate it since drift can be a component of ground application. Weed infestations on areas proposed for treatment under Alternative A that would not be treated under this alternative would remain, would likely increase in density in many areas, and would likely spread to adjacent areas. The negative impacts of expanding weed infestation on aquatic habitats are discussed below in Alternative C, but are somewhat less because there are more acres of weeds treated in this Alternative.

As depicted in Table 4-7 there are 18 6th code hydrologic units where the amount of picloram initially modeled to be applied resulted in an exceedance to the 0.075 mg/l or parts per million modeling threshold. As specified in the EPMs (Table 2-4) additional site specific restrictions will take place to limit the amount, type or timing of herbicide applied in any of these 18 drainages to ensure the threshold concentration levels for ensuring risk for fish is not exceeded. These measures include, but are not limited to: reducing the amount applied in any given year, changing season of application, or changing the type of herbicide proposed. Additionally, because the modeling effort assumed that each treatment polygon was fully infested with weeds the entire acreage within the polygon was modeled as sprayed. Consequently, it is possible that once review for a given spray proposal are conducted on the ground, the area that will be treated will likely be less and the amount of herbicide actually required would not result in a modeled exceedance. In those situations the proposal would be able to proceed.

ALTERNATIVE C

Under the No Action Alternative, existing weed management programs (including herbicide treatment) would remain in place and no additional treatment of weeds associated with the Proposed Action (or alternatives) would occur.

Without the proposed treatment, noxious weeds would continue to spread where weed treatment does not occur (about a third of the currently infested area). Adverse impacts that may result in these areas include: (1) increased runoff, erosion, and sedimentation due to less overall vegetation density and diversity; (2) reduction in stream bank stability where weeds invade along stream channels and eliminate riparian vegetation cover; (3) increased surface water temperature because of reduced canopy cover; and/or (4) less organic matter that enters surface water.

Invasive weeds can reduce infiltration and increase runoff and sediment production because weeds lower basal cover and allow crusting of exposed soil (Lacey *et al.* 1989). Tap-rooted weeds can reduce infiltration because they do not have the dense, fine root system of grasses. Water runoff was 56 percent higher and sediment yield was 192 percent higher on spotted knapweed plots compared to bunchgrass plots during a simulated rainfall period (Lacey *et al.* 1989). These conditions would have long-term adverse effects on water resources in the vicinity of proposed treatment areas.

Increases in sediment could directly affect aquatic organisms in several ways. Bull trout, westslope cutthroat trout, Yellowstone cutthroat trout, as well as many of the other aquatic species, require habitat with little sediment. Suspended sediment can directly affect respiration of these species and an increase in embeddedness can reduce potential spawning habitat. Sediment increases can also negatively affect prey species (macroinvertebrates). Reduction in the populations of these prey-base species can be amplified through other species higher up the food chain.

A potential benefit of Alternative C, as well as Alternative B, would be a reduction in the volume of herbicide chemicals added to the environment as compared to the Proposed Action. Implementing Alternative C would limit the type of chemicals used to picloram, 2,4-D, glyphosate and dicamba. Only a small amount of glyphosate would be used, in very specific applications (e.g. parking areas) and dicamba has not been used in recent years (pelleted formulation used in past on only portions of the HNF). The following herbicides are used as part of specific projects, including the 2000 fire areas: chlorsulfuron (Telar), metsulfuron (Escort), and clopyralid.

Fourteen 6th HUC watersheds show exceedences of the safety factor for piclroam in Alternative C (**Table 4-7**). This is likely a function of the assumptions made in the modeling. Monitoring records from 2000 and 2001 for White's, Magpie, and Cave Gulch watersheds were reviewed and actual herbicide use was compared to thresholds established. In these three drainages, the total acres treated were less than half the maximum infiltration acres thresholds established. This indicates that treatment acres are overestimated in the HNF model. This overestimation is due to the modeling assumption that each polygon is fully infested with weeds and all acres within the polygon would be sprayed. Based on the inspectors' and weed coordinators' knowledge of the area, it is very unlikely that the combination of infiltration and runoff acres treated was above the threshold. Drainages and years reviewed were selected because they were within the fire restoration areas, where weed treatment funding was the highest in the history of the HNF and treatment was very aggressive. However, as with alternatives A and B, EPMs (Table 2-4) would be implemented restricting the amount or type of herbicide to be sprayed should the exceedances still be modeled to occur once acres to be sprayed are adjusted for what is actually present on the ground.

CUMULATIVE EFFECTS

Cumulative Effects are addressed in two different ways due to requirements of consultation on listed species versus National Environmental Policy Act (NEPA) requirements. Bull trout consultation requires cumulative effects consist only of future actions that are likely to occur on non-Federal lands. For NEPA actions cumulative effects that need to be considered include effects from all past, present, and future foreseeable Federal and non-Federal actions.

The primary way other Federal activities could be related to effects on fish from herbicide application would be a function of ground disturbing activities that would add to the slight increases in sedimentation that may occur in some cases from herbicide application. This report addresses the NEPA related aspects of cumulative effects to fish. The specific information needed for consultation is within the analysis below.

The cumulative effects analysis area includes the entire HNF and streams on private lands in close proximity to the Forest in portions of the Blackfoot, Upper Missouri, Smith, Dearborn, and Little Blackfoot portion of the Upper Clark Fork 4th code hydrologic units.

The types of activities that can result in cumulative effects include, but are not limited to, past activities, new proposals and ongoing actions involving: salvage timber harvest, green tree timber harvest, log hauling on unpaved county and private roads, livestock grazing, placer and hard-rock mining, highway construction, construction or maintenance of power transmission corridors, maintenance of irrigation diversions, maintenance of existing communication lines, crop production, herbicide application for weed control, road and highway maintenance, general travel management, construction of new or improvement of existing developed recreational sites or fishery and watershed enhancement projects. Tables 4.1 and 4.2 include a listing of projects that are currently foreseeable while Appendix G includes information on past activities.

As pointed out in the aquatic habitat section, many watersheds on the HNF are already in less than optimum condition due at least partly to negative cumulative effects that have occurred from past activities and sometimes ongoing activities. For example, upon reviewing habitat baseline ratings for each of 18 habitat parameters in each of the fourteen 6th code hydrologic units in the Little Blackfoot River drainages (252 total) 48% were functioning at unacceptable risk, 55% functioning at risk, and 6% functioning appropriately (USFS 2000). For the entire Blackfoot River 4th code unit 40% of habitat baseline ratings were functioning at unacceptable risk, 47% functioning at risk, and 13% functioning appropriately (USFS 2000b). An additional summarization of the effects of various past activities on fishery resources can be found in tables within Appendix G.

In some cases, the ongoing activities or conditions present from past activities continue to result in localized negative effects on fish. However, in regard to salmonids, there are numerous completed and ongoing efforts on Federal lands that are aimed at improving habitat on salmonid streams and increasing distribution of native salmonids throughout their historic range. Some types of activities that have occurred, or are occurring, within the cumulative effects analysis area include: cutthroat trout expansion, stream channel construction, removal of non-native species, improved fish passage, removal of non-native brook trout, stream channel fencing, and mine waste removal.

As it is very difficult to be aware of all activities planned on non-federal lands, it is anticipated that a variety of new activities, of the types discussed earlier, may occur in the future on non-Federal lands with effects on fish ranging from no effect, minor negative effects up to adverse effects depending on the type of activity, magnitude of the activity and where and when the activity is occurring. Many laws and regulations are in place to help reduce the potential for negative effects from activities conducted by all parties and it is likely that many of the activities would result in no effect or only minor negative short-term effects. Additionally, some non-Federal activities will be occurring in the cumulative effects area that will be targeted specifically for improving conditions for westslope cutthroat trout and bull trout from existing levels over the long term. Extensive efforts to improve habitat for bull trout and westslope cutthroat trout have been completed, are ongoing or are planned on private lands in the Blackfoot River drainage. Other activities on non-Federal lands are occurring east of the Continental Divide as well, with efforts focused mostly on westslope cutthroat trout habitat.

The summation of all cumulative effects on fish populations and habitat quality in the analysis area described above are impossible to predict quantitatively as there is a lack of coordinated long range planning of activities between the various Federal, state and county agencies and private landowners. With the variety of regulations, laws, and agreements in place to maintain water quality and fish habitat, along with numerous efforts underway to restore and improve salmonid habitat, it is likely that the overall cumulative effects will be positive for fish in many drainages even with some of the negative effects that will likely continue from ongoing or past actions.

Finally, addressing the current proposed action in terms of risk for it adding to other cumulative effects, the current proposed action does have a very slight potential to result in waters leaving the forest with very minor levels of herbicide in them or very slight increases in sediment as discussed throughout other parts of this document and addressed further by the alternatives below. However, as weeds are controlled to some degree over time, the potential for the weed control activities as proposed in Alternatives A or B to add in a negative way to other cumulative effects is extremely low and certainly would not lead to an impact on any local fish population such that its viability would be at risk. Specific discussion relating to the herbicide aspect of cumulative effects is addressed below for each alternative.

ALTERNATIVES A AND B

Noxious weed control via herbicide application is likely on land adjacent to HNF lands. Information regarding to what extent this is occurring is limited. Several local agencies were contacted in an attempt to determine the level and location of picloram usage within watersheds in the cumulative effects analysis area. Data are not available on where, how much or when picloram is used, except in very limited areas. In all cases, information available was only partial information, which precluded a meaningful quantitative analysis of potential cumulative concentrations of picloram within any of the watersheds in the cumulative effects analysis area.

Environmental protection measures are in place to assure that direct and indirect impacts from herbicide use are minimized and that waters leaving HNF lands are of a quality to protect threatened, endangered and sensitive aquatic species. Herbicide practices on other lands must also meet acceptable levels of water quality protection. Treatment on private lands will likely occur in the valley bottoms where soil conditions are more conducive to infiltration than runoff. If runoff were to occur, much of the private treatments occur low in the HUCs, where streamflow would likely be greater, allowing for faster dilution than those locations being treated in the headwaters. However, cumulatively, there is a very slight risk that HNF and adjacent land practices may exceed those thresholds proposed by the HNF for short periods of time. It should be noted that with the EPM measures in place and limitations on the amount of chemical applied by drainage, as determined through the modeling effort, risk for an exceedance of the 0.075 ppm threshold for picloram is extremely low. Consequently there is very low potential for cumulative effects specifically related to herbicide levels in streams.

Increased erosion and sedimentation in burned areas may increase on a short-term basis due to implementation of Alternatives A and B along with its resulting effect on fish habitat. However, these impacts appear to be temporary and based on significant runoff events. Conditions may be such that weeds are removed and desirable species restored with limited sedimentation or other water quality issues.

For Alternatives A and B, the amount of sedimentation to streams that would occur as a function of herbicide application and add to other Forest or non-Federal ground disturbing activities, is considered to be short term and minor. However, if the other proposed activities were to result in significant sediment delivery that would be of concern to fisheries on its own, then the additional minor sediment delivery that might occur in some cases from weed control could be of concern. Since the magnitude of sediment delivery associated with future Federal and non-fedderal actions is currently unknown, it will be necessary for the environmental review of those new activities to address risk for cumulative effects of any herbicide ongoing activities that would be occurring simultaneously with the effects of the other proposal. Generally speaking, efforts are undertaken to ensure that the long-term sediment production of any Forest Service project is either less or no more than current levels. Thus, the risk for negative cumulative effects related to sediment effects due to weed control is low. If it were to occur, effects to fish are predicted to be minor due to the small amount of additional sediment delivery and limited duration until desirable vegetation recovers.

ALTERNATIVE C

Neilson (1999) indicated the ecological risks of alternatives that do not include herbicide treatment can be severe. These alternatives would allow weeds to continue to spread in affected areas. Neilson (1999) also indicated that a process of successional degradation is emerging where tap rooted weed species such as knapweed are being replaced over time by rhizomatous weeds such as sulfur cinquefoil, then to leafy spurge and Dalmatian toadflax communities. As this process occurs, weed control options become more narrow. With the expansion of weed infestations risk for negative ecological impacts increases including loss of desirable plant species and diversity. The ability of the landscape to retain water becomes reduced causing additional runoff and potential sediment delivery to the streams.

As weed infestations become severe, it becomes more difficult to restore natural or near natural conditions. Conditions arise where, instead of using relatively low applications of low toxicity herbicides, more intensive applications at higher concentrations of more toxic herbicides may be necessary to control later stages of weed infestations. When this occurs, the risk for negative effects to the aquatic environment also increases.

Implementation of Alternative C (No Action) would perpetuate the impact of past and present conditions and could lead to a cumulative effect of long-term erosion from weed dominated landscapes and elevated sediment levels in some streams.

CONSISTENCY WITH FOREST PLAN AND OTHER LAWS, REGULATIONS AND POLICIES

All alternatives and the their effects relating to fish and aquatic resource are consistent with the Helena Forest Plan and INFISH amendment, National Forest Management Act, Endangered Species Act, and other laws, regulations, and policies. Impacts on fish would be minimal in all alternatives and Threatened, Endangered and Sensitive Species habitat would be protected.

VEGETATION

DIRECT AND INDIRECT EFFECTS

Effects of Herbicides

Desired effects of herbicide application include suppressing, containing, or eradicating noxious weeds, resulting in an increase in native plant abundance and vigor, creating more weed-resistant plant communities by decreasing growth, seed production, and competitiveness of susceptible noxious weeds (Bussan and Dyer 1999). Selective control of noxious weeds, while allowing non-target species to survive and proliferate, can be accomplished by applying appropriate herbicides (e.g., selective to different types of plants, with varying lengths of residual activity) at appropriate rates, when non-target species are dormant and not susceptible to herbicide effects, and through avoiding contact with non-target species (Bussan & Dyer 1999). Effects of herbicides on species of noxious weeds are addressed in more detail in the project file (PF-Vegetation).

Although herbicides have the potential to affect both noxious weeds and desirable species, there are differences in susceptibility among species (Rice & Toney 1996). Some plants (both noxious weeds and non-target species) metabolize herbicides, which reduces toxic effects. Some species also do not readily absorb herbicides through foliage and roots. For herbicides to be effective, they must be taken into the plant and impair physiological processes (Bussan and Dyer 1999).

Herbicides are usually classified based on their chemical structure or mode of action and are taken up by plant roots or through foliage and transported within the plant through the vascular system. Herbicides kill or stress plants by inhibiting enzymes involved in photosynthesis, respiration, and other physiological processes (Bussan & Dyer 1999).

Plants that have similar growth forms (e.g., leaf structure and root systems) and genetic composition often are similarly affected by herbicides; consequently, herbicides have the potential to adversely affect noxious weeds and non-target native species that have similar growth forms, genetic makeup, and life history characteristics (Rice & Toney 1996). **Table 4-8** lists non-target species affected by four widely used herbicides and their relative susceptibility to herbicide treatment. In general, most herbicides proposed for use on the Forest (with the exception of glyphosate) have a higher potential to affect broad-leaf plants (dicots) than grasses and sedges (monocots) (Rice & Toney 1997, Bussan & Dyer 1999, Brown etal 2002). Therefore, non-target broad-leaf species would have a higher potential to be adversely affected by herbicide application than non-target grasses and sedges. Broadcast application of herbicides to native plant communities could in the short-term, reduce dominance and diversity of native broad-leaf herbaceous species and shrubs, thus allowing grasses and sedges to increase as a result of decreased competition (Tomkins and Grant 1977).

Non-target plants could be damaged by unintentional application or drift of herbicide away from the application site, exposing non-target plants to toxic levels of herbicide. Felsot (2001) found that in most cases, off-site effects of herbicide volatilization and drift are usually limited to 100 feet. Using herbicides according to label instructions (as proposed for all alternatives) would avoid damage to non-target plants by avoiding spray drift or unintended application of herbicides to native plants. Use of herbicides with low volatilization potential near sensitive areas (e.g., sensitive plant habitats, wetlands, and gardens) would reduce the risk of spray drift

TABLE 4-8
Non-Target Plant Susceptibility to Picloram, Dicamba, 2,4-D, and Clopyralid

Plant	Picloram	Dicamba	2,4-D	Clopyralid
Douglas-fir	MS	S	I-R	R
Lodgepole pine	MS	--	--	--
Spruce (spp.)	I	I-R	I-R	--
Juniper (spp.)	MS-S	S-I	R	--
Willow (spp.)	S	S-I	S	--
Cottonwood (spp.)	S	S	S-I	--
Alder (spp.)	S	S	S-I	--
Ponderosa pine	MS-S	--	R-MS	R
Quaking aspen	S	S	S-I	
Big sagebrush	R	S	S-I	
Fringed sage	S	S	S	
Mountain mahogany	S	S	I	
Rubber rabbitbrush	S	S-I	S	
Serviceberry	--	--	S-I	R
Shrubby cinquefoil	MS-S	S	S-I	
Kinnikinnik	R	--	R	R
Bitterbrush	S	S	S	--
Snowberry	MS	S	S-I	R
Lupine (spp.)	S	S	S-I	R
Geranium (spp.)	S	S	S-I	R
Clover (spp.)	S	--	S	
Bluegrass (spp.)	R	R	R	R
Western wheatgrass	R	R	R	R
Bluebunch wheatgrass	R	R	R	R
Idaho fescue	R	R	R	R
Rough fescue	R	R	R	R
Yarrow	I	--	I	I
Blue aster	S	--	S	S
Hairy golden aster	S	--	S	S
Arrowleaf balsamroot	R	--	R	R
Fleabane (spp.)	R	--	R	R
Ballhead sandwort	S	--	S	S
Weedy milkvetch	S	--	S	S
Nine-leaf lomatium	S	--	S	S
Douglas knotweed	S	--	S	S
Deptford pink	S	--	S	S
Nodding onion	R	--	R	R
Pussytoes	R	--	R	R
Blue-eyed Mary	R	--	R	R
Wild strawberry	R	--	R	R
Penstemon	R	--	R	R

[1] Scientific names can be found in Appendix B.

Notes: R-resistant, MS-moderately susceptible, S-susceptible, I-severely injured. Care must be taken in interpreting results because herbicide applications rates, timing of application, and phenology of plants vary with treatments

Sources: Rice and Toney 1996.

(Felsot 2001).

Non-target plants also have potential to be affected by residual activity of herbicides remaining in soil. Some herbicides are short-lived and become detoxified in a few days or weeks, whereas others (e.g., picloram) can remain active in soil for years (Bussan & Dyer 1999).

Herbicides with short periods of toxicity generally have little effect on spring- and early summer-flowering species, when applied in fall (Rice & Toney 1999). Many native Montana broadleaf plants flower and set seeds in spring and summer and are dormant in fall.

When plants are dormant, they are not as susceptible to herbicides (Rice & Toney 1996).

Typically, many noxious weeds have vigorous periods of growth in spring and fall when temperatures cool and precipitation increases. Noxious weeds are most susceptible to effects of herbicides when they are actively growing (Duncan etal 2001, Sheley 1999). Fall application of herbicides can selectively kill weeds that re-initiate growth in fall, while not affecting native species that are dormant after spring and summer growth (Rice & Toney 1996).

Herbicide Effects on Community Diversity

Effects of herbicides on community diversity have been studied in western Montana grasslands and grassland/forest ecotones (Rice *et al.* 1997a; Rice and Toney 1998; Rice *et al.* 1992) and on the Helena NF (Brown *et al.* 2002). Rice *et al.* (1992) found that herbicide treatments (picloram, 1 pint per acre; clopyralid, 2/3 pints per acre; and 2,4-D, 1pound per acre, mixed with clopyralid, 0.19 pounds per acre) caused short-term depressions in community diversity. Suppression of the competitively dominant noxious weeds released resources to support the growth of native plant species. Plant species that are relatively tolerant to herbicides (e.g., grasses and sedges) expanded following the first year of spraying. Plants affected by the herbicide responded to increased resources in subsequent growing seasons as the herbicide levels declined in the soil (Rice *et al.* 1992).

Weed treatments (Tordon, 0.5 pounds per acre and a mixture of Tordon and Plateau 0.94 pounds per acre) to control Dalmatian toadflax in ponderosa pine and Douglas-fir habitat types that had burned on the Helena NF (Brown *et al.* 2002) reduced the density and diversity of non-target forbs and shrubs, but did not affect grasses. Common shrubs in the ponderosa pine and Douglas-fir habitat types in the area treated included snowberry and buffaloberry. Species of forbs affected by herbicide treatment are not identified by Brown *et al.* (2002).

In general, as forest community moisture regimes increase, density and biomass of grasses and upland sedges decrease, while density and biomass of broadleaf forbs and shrubs increase (Pfister etal 1977). Wetter forest community types (e.g. aspen, moist Douglas-fir, and spruce/fir) tend to have a higher proportion of broadleaf forbs, shrubs, and mosses; consequently, application of herbicides (triclopyr and glyphosate, 1,3-2.5 quartz per acre) to plant communities with higher moisture regimes would have the potential to kill or impair more component broad-leaf species and mosses (Newmaster *et al.* 1999). Currently, there are no proposed weed treatment areas in aspen communities or moist/wet forest types likely to harbor a diversity of forbs and mosses, potentially sensitive to herbicides. In the drier forest communities, herbicides would shift dominance to grasses and sedges, whereas, in moister forest communities, resistant shrubs and resistant forbs would probably increase (Lacey etal 1989).

Although not thoroughly researched, some studies indicate that herbicide treatments can affect species diversity of non-vascular plants (bryophytes and lichens) and ferns in some communities. Bryophytes are small spore-producing, nonvascular, plants that include mosses, liverworts, and hornworts. They are often the first plants to colonize habitats, especially harsh habitats, and are important in nutrient cycling, moisture retention, soil stabilization, and seedling establishment. Studies have shown that some mosses are sensitive to herbicides and other species are relatively tolerant (Newmaster etal 1999).

Newmaster *et al.* (1999) found that treatments of boreal forest vegetation with triclopyr and glyphosate (1.3-2.5 quartz per acre) caused a decrease in bryophyte abundance and species richness. Bryophytes most sensitive to herbicide treatments were species growing on shaded, relatively moist sites, under a forest canopy. Bryophytes least sensitive were invasive, drought-tolerant species growing on dry soil (e.g., *Ceratodon purpureus*, *Pohlia nutans*, *Bryum caespiticium*, *Polytrichum juniperinum*, and *Marchantia polymorpha*). Populations of bryophytes most affected by herbicide treatment did not fully recover species abundance and diversity for at least five years following treatment (Newmaster and Bell 2002).

Lichens responded to herbicide treatments (triclopyr and glyphosate, 1.3-2.5 quartz per acre) similarly to bryophytes in studies conducted on boreal forest vegetation (Newmaster and Bell 2002). Species abundance and diversity decreased for lichens under a forest canopy but had little effect on species growing on relatively dry soils. Some species increased in abundance after herbicide treatments. Species that increased after herbicide treatments are colonizers of mineral soil and other disturbed habitats (e.g., *Peltigera canina* and several *Cladonia* species).

Herbicides (i.e., glyphosate and triclopyr) applied to pteridophytes (i.e., ferns and fern-allies) resulted in reductions in species diversity and abundance (i.e., canopy cover). Effects of herbicide treatments were detected for at least five years following application (Newmaster and Bell 2002). Susceptibility to toxic effects of herbicides on bracken fern was rated negligible for 2,4-D, moderate for picloram, and high for dicamba and glyphosate, although no application rates were stated (BLM 1985).

Field observations of herbicide effects on a prairie population of a rare moonwort (*Botrychium* sp.) in Fergus County, Montana indicate that this fern was adversely affected as a non-target species by roadside weed control with herbicides (Elliott, pers. obs.). Herbicide application in June of 2002 caused developing plants to turn yellow, cease growth, and apparently die within one week of herbicide application. Observation of this population in June of 2003 indicated that the effects from last year's exposure to herbicide had minimal long-term effects. Botrychium plants on the treated site were growing normally, including production of sporangia.

EFFECTS COMMON TO ALL ALTERNATIVES

The properties of herbicides proposed for use are described in the project file (PF-Vegetation). Only picloram, 2,4-D, dicamba, clopyralid, and glyphosate would be applied with Alternative C; however, the general effects of herbicides addressed in the following sections also apply to these herbicides. It is assumed that application rates for all herbicides (**Table 2-6**) would be the same for all alternatives.

Grasslands

Noxious weeds present on the Forest have a high potential to invade grasslands, especially grasslands that have had the soil disturbed from overgrazing, roads, and other factors (Olson 1999). The lack of a forest overstory and the bunchgrass structure of native grasslands on the Forest render them susceptible to weed invasion and infestation.

Spotted knapweed (10,455 acres) and Dalmatian toadflax (7,358 acres) are the most widespread and frequent (highest acreage infested) weeds. They proliferate and are often intermixed in disturbed grasslands. Most areas treated through aerial application and ground-based broadcast treatments would target these species and less common Canada thistle (3,545 acres) and leafy spurge (851 acres).

Herbicides shown to be effective and proposed for use to control spotted knapweed are picloram (1 pint per acre), 2,4-D (1quart per acre), and clopyralid (2 quarts per acre) (Duncan etal 2001). Proposed treatments of Dalmatian toadflax would include application of picloram (0.5 -1 quart per acre), imazapic (8-10 ounces per acre), chlorsulfuron (1.5 ounces per acre), and 2,4-D (1 quart per acre). This range of herbicides and application rates also would be used to control other noxious weeds on the Forest.

Noxious weeds that require the highest levels of herbicide application for effective control appear to be leafy spurge and Dalmatian toadflax (Sheley etal 1999, Brown etal 2002). Effects of herbicide treatment of these species represent the worst-case example of potential effects of weed treatment on non-target plants. The herbicide that appears to pose the most risk to non-target plants is picloram, when applied at rates of 1 quart per acre or higher (Brown etal 2002).

Montana studies (Rice and Toney 1996) have shown with applications of picloram (1 pint per acre), clopyralid (0.66 pint per acre) or a mixture of the two (Curtail, 2 quarts per acre) have short-term effects on some native species. Over the three-year study, seven native forbs decreased and two increased after treatment. Initial decreases in native forbs cover recovered to pre-spraying levels after three years.

Effective treatment of Dalmatian toadflax can require higher rates of herbicide application (2 quarts per acre of Tordon 22K®). Studies by Brown *et al.* (2002) on the Helena NF found that picloram (1 pint per acre) and a mixture of picloram and imazapic, applied together in fall to control Dalmatian toadflax, substantially reduced non-target forbs and shrubs. Proposed application rates of picloram and imazapic for treatment of Dalmatian toadflax also would likely reduce biomass and species diversity of non-target forbs and shrubs. The duration of the reduction is not known, but studies are ongoing to assess this effect as well as the efficacy of control for target species.

Other studies on the Forest (Winfield 2003) indicate that picloram (0.5 pints per acre) and chlorsulfuron (0.094 pounds per acre) both are effective in controlling Dalmatian toadflax when applied in fall. Monitoring data suggest that these two herbicides, when applied in fall, are 99 percent effective in controlling Dalmatian toadflax (Winfield 2003). The relatively low concentration of picloram used in this study would pose a negligible risk to non-target species. Based on label information for Telar®, provided by DuPont, application rates of 1 to 3 ounces per acre would adversely affect non-target species such as aster, bedstraw, common cinquefoil, yarrow, red clover, wild onion, and some members of the carrot family (*Apiaceae*). The proposed application rate of chlorsulfuron (Telar®, 1.5 ounces per acre) is lower than the rate recommended (2 to 3 ounces per acre) by Dupont, the manufacturer of Telar® (chlorsulfuron), for the control of Dalmatian toadflax.

Treatment of spotted knapweed and Dalmatian toadflax would have little or no effect on dominant grasses and grass-like plants when applied as proposed (Rice & Toney 1996, Rice & Toney 1998, Rice etal 1997). Grasses and grass-like plants account for nearly 40 percent of the plant species and most of the vegetation cover in these vegetation types (Mueggler and Stewart 1980). Most common species in grasslands (arrow-leaf balsamroot, fleabane, and pussytoes), dominated by Idaho fescue, rough fescue, western needlegrass and, bluebunch wheatgrass, would probably not experience long-term effects of herbicide treatments at proposed application rates (Rice & Toney 1997, Rice etal 1997).

Common species such as fringed sage, snakeweed, and dotted gayfeather, soft cinquefoil, American vetch, sticky geranium, and juniper (common, and creeping juniper) would likely be adversely affected by herbicide exposure (especially picloram at rates of 1 quart per acre or higher) if they were in active growth stages when exposed to herbicides (Rice & Toney 1996).

Mosses and lichens, adapted to dry site conditions, are present as ground cover in many grassland communities. Herbicide application would have little effect on mosses adapted to growth on dry sites, such as proposed for treatment on the Forest (Newmaster *et al.* 1999; BLM 1985). Although boreal mosses and lichens, adapted to moist forest habitat types are often sensitive to herbicide applications, mosses and lichens on dry sites are usually unaffected or increase in density and biomass after herbicide application. Few, if any, wet forest types supporting dense stands of boreal mosses would be treated with herbicides on the Forest.

Application of herbicides in late summer or fall when most native grasses and forbs are dormant or have low levels of physiological activity would substantially reduce adverse effects on non-target species (Rice etal 1997). If herbicides were applied in spring, it is likely that cool-season non-target plants would be initiating growth and would be susceptible to herbicides. Often plants are most susceptible to herbicide effects when they are rapidly developing (Rice & Toney 1998, Rice etal 1997). Herbicide effects on grasses from spring herbicide application would likely be short-term and would not reduce species diversity or biomass production (rice & Toney 1998, Bussan & Dyer 1999).

Adaptive management, based on results of monitoring, would involve seeking a balance between efficacies of noxious weed treatments, while avoiding impacts on non-target species.

Shrub Communities

Like grasslands, shrub communities have a high potential for noxious weed invasion and establishment. The same noxious weeds that invade grasslands are present in shrub communities. Herbicide application would be the same as proposed for treatment of noxious weeds in grasslands.

Non-target species that likely would be adversely affected over the short-term by herbicide treatments include low sagebrush, big sagebrush, shrubby cinquefoil, bitterbrush, and skunkbush sumac. Other dominant species such as bluebunch wheatgrass, rough fescue, and timber oatgrass would be resistant to herbicide effects, especially if herbicides were applied in fall when grasses are dormant (Rice & Toney 1998, Rice etal 1997). Spring application could reduce vigor and seed production of some grasses but the effect would be short-term and would not alter species diversity or biomass production (Rice & Toney 1998, Rice etal 1997).

Coniferous Trees

Noxious weeds present in coniferous forest habitat types (Douglas-fir and ponderosa pine) are the same species that have the potential to invade grasslands and shrublands. The density and vigor of noxious weed populations are inversely related to shading and competition from overstory trees, seedlings, and saplings. Most noxious weed infestations are in open forest stands that have low tree densities and cover because of moisture limitations (e.g., dry ponderosa pine and Douglas-fir habitat types), fire, logging, or road construction (Sheley).

Treatment of noxious weeds in forest stands would involve the use of the same herbicide and application rates as addressed in the previous sections on grasslands and shrublands; however, conifer forest with more than 30 percent overstory canopy cover would not be treated with herbicides through aerial application. Avoiding direct application to trees would reduce the risk of adversely affecting overstory trees. Ground-based, broadcast spraying and spot spraying would be the primary methods of applying herbicides to weed infestations on sites with more than 30 percent overstory canopy.

Seedlings and saplings of ponderosa pine and Douglas-fir would likely be exposed to herbicides through ground-based broadcast application because many logged areas, burned areas, and road margins with noxious weeds also have tree seedlings and saplings. Fire suppression over the last century has allowed Douglas-fir and ponderosa pine to proliferate in ponderosa and Douglas-fir habitat types and on meadows and other non-forested sites adjacent to forest communities. Reductions in pine and Douglas-fir seedlings and saplings on herbicide-treated sites would be a positive effect because it would slow the proliferation of trees that has occurred in absence of frequent, low-intensity fires.

Application of picloram to understory vegetation would pose a risk to ponderosa pine and Douglas-fir through leaching into the soil and root uptake by these trees (Tordon label). This risk could be avoided by not using picloram within the root zone of trees, as directed on the label. The use of other herbicides not as toxic to trees as picloram would minimize potential adverse effects (e.g., imazapic, chlorsulfuron, or 2,4-D for control of Dalmatian toadflax or use of clopyralid or 2,4-D to control spotted knapweed). Formulations of 2,4-D (1 quart per acre) generally do not affect ponderosa pine when applied in late summer and fall, following the cessation of height growth (Gratkowski 1977). Picloram, 2,4-D, imazapyr, chlorsulfuron, and clopyralid would have little or no effect on grasses or other herbaceous monocots. Most habitat indicator species belong to families that are susceptible to herbicides that would be applied at rates specified in **Table 2-6**. Species likely to be affected by herbicide treatment include heart-leaf arnica, yarrow, lupine, aster, violet, bitterbrush, wild rose, chokecherry, spirea, ninebark, virgin's bower, meadowrue, common snowberry, and twinflower (Rice & Toney 1996).

Other Habitats

No weed treatments are proposed in aspen stands, non-riparian wetlands, wet meadows, whitebark pine communities, or alpine areas, however, they may be treated under Adaptive Management (ground treatment with selective herbicide to minimize adverse effects) consequently. These habitats would not be affected by weed management alternatives. Riparian habitat would be treated to control several species, including Canada thistle, spotted knapweed, oxeye daisy and common tansy. Effects on non-target species in riparian areas could be minimized by spot-spraying and using herbicides licensed for use near water (e.g., 2,4-D amine).

Sensitive Species

Sensitive species that would have the greatest potential to be present in or near noxious weed infestations on the Forest are Austin's knotweed (Belts/Dry Range LA), long-styled thistle (Belts/Dry Range LA), and Missoula phlox (Continental Divide LA) (Barton and Crispin 2001 and 2002). Austin's knotweed typically grows on dry, rocky sites with sparse vegetation, usually bluebunch wheatgrass. Noxious weeds are not commonly found in populations of Austin's knotweed, but on one site, Dalmatian toadflax is dominant and threatens the population of Austin's knotweed and the site could support knapweed infestations.

Missoula phlox is most common in the Divide LLA in the vicinity of MacDonald Pass in grasslands and on rocky ridges. Dalmatian toadflax and spotted knapweed are present among and near populations of this species (Barton and Crispin 2002). Proposed herbicide applications to control weeds among populations of Missoula phlox would have the potential to adversely affect this species, especially when the plant is actively growing in spring and early summer. Weed treatments in fall, when the plant is dormant would reduce the potential for adverse herbicide effects. Spot spraying of weeds in and near populations of Missoula phlox would reduce the mortality risk to phlox.

Species present on the Forest, but not likely to be affected by weed control are pale sedge, peculiar moonwort, English sundew, linear-leaved sundew, small yellow ladies slipper, water bulrush, and Hall's rush. All of these species except Hall's rush and peculiar moonwort grow in fens that are not infested with noxious weeds. There would be no weed control in habitats harboring these species. Hall's rush, being a grass-like plant probably is not susceptible to most herbicides that are selective to broad-leaf species (e.g., picloram, 2,4-D, dicamba, and clopyralid).

Peculiar moonwort populations are not near any known locations of noxious weeds or proposed treatment areas; however, this species is known to occur in sagebrush grasslands and rough fescue grasslands and may be present more widely on the Forest than has been documented. Although no known populations of peculiar moonwort would be exposed to herbicides, some unknown populations may be present on sites that would be treated for noxious weeds. There is little data to indicate the effects of various herbicides on the peculiar moonwort if it were exposed to herbicide during noxious weed control activities.

If sensitive plants are adversely affected by weed control measures, individuals may be damaged or killed, but it is unlikely that the viability of local and regional populations would be affected to the extent that there would be an increased probability that the species would be listed as threatened or endangered under the ESA.

Prior to weed treatment, areas would be surveyed for the presence of sensitive species. If sensitive species are found, weed treatments to minimize impacts on sensitive plants would be implemented such as; applying herbicides that have very short residual activity when sensitive plants are dormant, applying herbicides using spot-spraying or wand application, sponge- or wipe-type application of herbicide and similar methods of application applied directly to the tissues of target weeds, and hand pulling or digging. Educating herbicide applicators to identify and avoid sensitive plants would help minimize inadvertent exposure to herbicides. Monitoring of herbicide applications in the vicinity of sensitive plants by a qualified botanist would also reduce the risk of exposing these species to herbicide application.

The 100-foot spray buffer around sensitive plant populations would also reduce herbicide-exposure risks. In this buffer, only methods of noxious weed control that protect individual plants would be used (e.g. spot-spraying, wand-application of herbicides, and handpulling).

Summary

Herbicide treatments would likely kill some individual plants and temporarily inhibit growth in others over the short-term (Rice and Toney 1996). Herbicide application would reduce density and biomass of some non-target species (mostly broad-leaf forbs and shrubs) and increase the density and biomass of resistant plants such as grasses and sedges. It is unlikely that species diversity (number of species in a community) would be affected (no non-target species would be eradicated), but the relative proportions of component species would likely be altered. The degree to which changes would occur in communities treated with herbicides would depend on numerous factors such as effectiveness in killing noxious weeds, timing of application, concentration of herbicide, weather conditions, and physiological status of plants.

Boreal mosses and lichens would be more sensitive to herbicide effects (Newmaster *et al.* 1999), but typically, noxious weeds are infrequent in moist forest habitat types that have a rich component of herbicide-sensitive mosses and lichens. There would be little risk to mosses and lichens from the proposed herbicide treatments.

Adverse effects on non-target plants would be reduced through spot-spraying of herbicides and applying herbicide in fall when many native species are dormant.

Effects of Mechanical Treatments

Mechanical treatment such as handpulling and digging would be used in limited areas where use of herbicides would conflict with other resource values (e.g. picnic areas, sensitive plant populations, and wetlands). Hand pulling on low-density knapweed infestations reduced soil disturbance and has been an effective management method on small areas (Marler 2000). Hand pulling and grubbing can be selective in terms of plants removed. A study conducted on the Lolo National Forest measured effects of mowing and hand pulling on spotted knapweed control and changes in the plant community. Hand pulling increased bare ground from 2.7 percent to 13.7 percent the year of treatment (Duncan etal 2001.).

In some situations, hand pulling would be implemented with light applications of herbicides. Species such as common burdock and spotted knapweed could be controlled with repeated treatments and monitoring (Lacey 1989, Duncan etal 2001). Hand pulling would have negligible effects on non-target species but would create small areas of bare soil that could be recolonized by noxious weeds. Hand pulling can inadvertently affect non-target species or sensitive species growing in close proximity to invasive weeds from trampling by pulling crews.

Mechanical treatments would reduce weed seed production for the season they are treated. Most noxious weed species are prolific seed producers and have the ability to regenerate and produce seed following removal of top growth. Handpulling as the sole method of eradicating noxious weeds is often ineffective because of the long-term viability of weeds in the soil. Residual seed in soil can also germinate and allow populations to maintain themselves and expand. Mechanical treatments would be combined with reseeding or other restoration efforts. Mechanical treatments in conjunction with other control techniques would help control noxious weeds as part of an integrated program.

Effects of Biocontrol

Biological control is the deliberate introduction of or manipulation of a pest's natural enemies with the goal of suppressing the pest population (Wilson and McCaffrey 1999). Because most noxious weeds were introduced from outside the United States, there are few insects, native pathogens, or grazing animals in the United States that can keep noxious weeds in check. In their native countries, noxious weeds are eaten or parasitized by insects, mites, nematodes, and host-specific pathogens that are not present in the United States.

The Forest has had an active bio-control program since 1991 to treat spotted knapweed, musk and Canada thistle, leafy spurge, common toadflax, and Dalmatian toadflax (Johnson, Diane personal communication 2004). Bio-control insects have been released throughout the Forest in areas best suited to target noxious weed species and inaccessible to motor vehicles. Some bio-control insects have quickly established and have made impacts on weed infestations. Others have been slow to become established due to climatic and other factors. Approximately, 3000 acres of the Forest has populations of bio-control insects.

Biological control on the Forest will involve the continued use of insects that exhibit a host-specific preference for noxious weeds and controlled grazing that targets specific weeds. Insects released for biological control would likely reduce vigor and reproductive potential for species such as leafy spurge, knapweed species, musk thistle, Canada thistle, Dalmatian and yellow toadflax. Species such as oxeye daisy, houndstongue, sulfur cinquefoil, and common tansy would not likely be amenable to control with biological control agents. To date effective biological control agents have not been found for these species.

Biological control projects are developed according to the following protocols (Wilson and McCaffrey 1999):

- Determine the extent of the weed problem and suitability for biological control.
- Survey the naturalized and native ranges of the weed for natural enemies and select candidates for biological control.
- Determine the feeding range of the potential biological control agent and their general suitability.
- Following a period of limited importation and quarantine, released approved agents into the field.
- Document the impact of the agent or their failure.

Biological control agents are extensively tested to ensure that they have a very narrow host range, and would not pose a serious threat to non-target plants. The testing process for a biological control agent is typically three to four years in duration and involves 50 to 75 test plant species with final approval by USDA, Animal Plant Health Inspection Service. Although extensive screening and testing reduces the potential for injury to native plants, biological control is not risk-free. Agents may attack plants closely related to the host weed. Private, state, and county entities release biological control agents on land adjacent to the Forest. Therefore, there is potential for movement and establishment of these agents on NFS land in the absence of intentional introductions by the Helena NF.

Biological controls proposed for use have been tested for their species specificity and would not likely have an appreciable effect on native vegetation or threatened or sensitive plants. Biological controls would contribute to long-term weed reductions, which would benefit native plant communities and threatened and sensitive plants.

Biological weed control is an evolving science. Researchers are still working to understand how plant-insect and plant-disease interactions and interrelationships influence weeds, biological control agents, and the environment. Impacts of biological control agents on target plants depend on 1) density of weeds compared to the density of the agent, 2) effect of the local biotic and abiotic conditions on the agent and on the weed; 3) plants' reproductive ability (seeds only or seeds and vegetative reproduction); 4) an agents ability to stress the plant each year and the plants ability to maintain and replace root reserves; 5) plants' ability to recover from the effects of the biocontrol agent; and 6) interactions of multiple biocontrol agents attacking a single weed species.

A weed infestation may increase in density and area faster than the newly released biocontrol agent populations; therefore, other control methods must be used in conjunction with the release of biocontrol agents. The perimeter of the infestation may be sprayed to keep the weed from spreading. As biocontrol agents increase in density and begin to occupy more area, herbicide use may be reduced to occasional spot treatments.

Timing of herbicide applications may be an extremely important factor in the interaction of biological control agents and the host plants. Herbicides would be applied when their effects on the host plants would not interfere with the life cycle of the biological control agents. Indirect effects of herbicide applications might become apparent if the sprayed weed dies or the foliage becomes unpalatable before the biocontrol agent has completed its development.

Biological control agents could potentially be released throughout the project area. Biological control agents can be used to enhance other treatments, or as priority treatments in areas that are not accessible. Use of bio-controls is intended to be flexible and allow the ability to respond to changing priorities or in light of new information regarding bio-controls or other treatment methods (i.e., adaptive management).

With biological controls, there is the potential for some biological control agents to attack non-target plants that are closely related to native species. Several introduced leafy spurge insects are able to develop on native spurges species and beetles imported to attack musk and plumeless thistle also feed on native species (Wilson and McCaffrey 1999; Beck 1999).

Plants most likely to be attacked by biological control agents are native thistles (including the sensitive long-styled thistle). Barton and Crispin (2001) reported that populations on the Forest of long-styled thistle contained larvae. They speculated that these larvae might have been biological control agents released to control noxious thistles.

Effects of Grazing

Goats and sheep grazing can effectively suppress reproduction and vigor of knapweeds, Dalmatian toadflax and leafy spurge (Sedivek et al. 1995, Lym et al. 1997) but not hounds tongue, common tansy, sulfur cinquefoil, and thistles. Grazing cannot eradicate noxious weeds but can help control weeds with repeated annual grazing at times of the year when noxious weeds are most palatable. With grazing some non-target species would also be eaten or trampled.

Sheep and goats prefer broadleaf herbs and have been used to control leafy spurge, Russian knapweed, and toadflax. Sheep can be useful in the control of spotted knapweed, and oxeye daisy (Tu *et al.* 2001). Sheep grazing negatively impacts spotted knapweed, but minimally affected the native grass community (Olson 1999b). Grazing would occur in grassland areas only, and would not affect other plant communities.

ALTERNATIVE A

Aerial herbicide application is less precise than ground application; consequently, there is a higher probability that in Alternative A, herbicides would adversely affect non-target plants outside the treatment area due to spray drift. Applying herbicide in fall when many native plants are dormant would reduce the risk to non-target plants. Using herbicide formulations at concentrations that have minimum toxicity to native species as proposed in Alternative A (Rice and Toney 1998) would also minimize adverse effects on non-target species.

Aerial applications to grasslands, shrublands, and open savannah-like forest would be most effective in treating noxious weed infestations because there would be few trees to intercept the herbicide. Aerial application directly to tree canopies (mature trees, seedlings, and saplings) would pose a risk of killing or weakening trees, especially during spring when they are actively growing. Application of herbicides to Douglas-fir and ponderosa pine may not directly kill the trees but could weaken them, increasing the risk of secondary infestations of insects and other forest pathogens.

When dominant noxious weeds are reduced in density and vigor, community diversity would increase as a result of increased dominance of desirable plants (often grasses). Species suppressed by noxious weeds would increase in size and vigor, and re-establishment of native plants from seeds dormant in soil and seed dispersal from adjacent undisturbed sites would likely take place.

The response of plant communities dominated by noxious weeds would depend on factors such as the proportion of native and other desirable species prior to weed treatment. Treatment of a monoculture of noxious weeds or weed-infested site with few native species may not result in the proliferation of suppressed desirable species because the composition of desirable species could be too low to exert dominance. It is likely that viable seeds of both desirable native species and noxious weeds would remain in the soil following weed treatment. On sites dominated by noxious weeds, it is likely that the highest proportion of seeds in the soil would be those of noxious weed species. Therefore, it is likely that seed germination and growth would occur in proportions similar to the composition of the plant community before weed treatment. Following treatment of a monoculture or near-monoculture of noxious weeds, desirable species may have to be seeded to establish a vigorous stand and prevent re-invasion by noxious weeds.

Alternative A would help re-establish native plant communities by removing dominant and aggressive noxious weeds. Native communities are more at risk from suppression and elimination by noxious weeds than to changes in community composition resulting from proposed herbicide treatments.

Some native plants would be killed by herbicide treatments, however, they would naturally reoccupy treated areas if re-invasion by noxious weeds was inhibited and adequate reproductive potential of desirable plants were maintained or established. The Forest plans to revegetate areas with low species diversity and foliar cover to avoid creating or maintaining conditions compatible with the proliferation of weeds.

Other Habitats

There are currently no weed infestations identified in aspen stands, wetlands, alpine areas, or other sensitive habitats, therefore, no weeds would be treated unless some are identified for treatment through the Adaptive Management Strategy. Hand pulling would not adversely affect aspen but could affect herbaceous understory species. Glyphosate, picloram, imazapyr, hexazinone, triclopyr, 2,4-D, and dicamba are commonly used to control aspen where they are not desired and would have detrimental effects on aspen.

Some weed infestations in riparian areas would be treated. To prevent adverse effects on non-target species several methods would be used, including using herbicides with short periods of residual activity, spot-spraying, or wand, sponge- or wipe-type application and similar methods, and hand pulling or digging.

Sensitive Species

Alternative A would have a greater potential to affect sensitive species because more acres would be treated; however, with pre-treatment plant surveys and implementation of EPMs (**Table 2-4**), adverse effects on sensitive species would be negligible. Alternative A would not decrease the viability of any sensitive species or lead to listing under the Endangered Species Act.

ALTERNATIVE B

Alternative B would include the use of herbicides, mechanical treatments, biological control agents, and grazing to manage noxious weeds. Differences between Alternative A and Alternative B are that no aerial application of herbicides would occur with Alternative B and all areas of weed infestations would not be treated under Alternative B.

General effects on vegetation would be the same as discussed for *Effects Common to All Alternatives*, but approximately 3,755 acres currently infested, would continue to be untreated. Weeds on these untreated areas would likely infest new areas that are steep, remote, or otherwise difficult to treat with ground-based control measures. Generally, untreated grasslands, shrublands, and the drier Douglas-fir and ponderosas pine communities would have the greatest potential to act as noxious weed reservoirs and spread weeds to surrounding areas. Noxious weeds are less competitive and invasive in the moister forest communities with higher tree canopy cover.

Other Habitats and Sensitive Species

The effects would be the same as those described for Alternative A.

ALTERNATIVE C

The No Action Alternative would continue to treat noxious weed infestations as in the past. Herbicides would be applied and other integrated weed management techniques (other than grazing) would be implemented. The No Action Alternative differs from other alternatives in types of herbicides used (more herbicides would be available for use with Alternative A and B), areas of weed infestation treated, and mode of application (aerial or ground-applied). With this alternative, herbicide use would be restricted to picloram, 2,4-D, dicamba, and clopyralid. Approximately 15,871 acres would be treated with integrated weed management. An additional 6,797 infested acres would not be treated.

Weeds on these untreated acres would increase in density and spread to adjacent areas currently not infested. Like Alternative B, untreated grasslands, shrublands and the drier tree-dominated communities would pose the greatest risk of acting as reservoirs and spreading noxious weeds to adjacent areas.

Some herbicides that have been effective in experimental treatments on the Forest (e.g., Telar® and Plateau®) would not be available for use with this alternative. These herbicides have been shown in experimental treatments to be effective in controlling Dalmatian toadflax, a difficult weed to eradicate. Picloram, also shown to be effective at controlling Dalmatian toadflax would be available for use with this alternative; however, picloram use poses a greater risk to ponderosa pine and Douglas-fir than do Telar® and Plateau®.

Alternative C would not include adaptive management techniques involving use of new herbicides, if future studies show that new herbicides are more effective and/or pose less risk to non-target plants.

Other Habitats

The effects would be the same as those described for Alternative A.

Sensitive Species

Without treatment of all infested areas, noxious weeds would continue to spread. Long-styled thistle, Austin's knotweed, and Missoula phlox, would be species most likely impacted without control of existing noxious weed populations. Currently, noxious weeds are invading populations of long-styled thistle, Austins' knotweed, and Missoula phlox. Areas with sensitive plants being invaded by noxious weeds may not be areas that would be sprayed under Alternative C. Inadvertent herbicide application to sensitive plants would continue to be a slight risk, outweighed by the risk posed by unchecked proliferations of noxious weeds.

CUMULATIVE EFFECTS

The cumulative effects analysis area is the project area. Cumulative effects on vegetation include potential for non-target exposure to herbicides from currently on-going weed treatment projects on the Forest and on private and other public land in the area, and ongoing spread of weeds. Other activities currently authorized and occurring on the Forest with the potential to impact vegetation include livestock grazing, timber harvest, trail and road maintenance activities, and recreation. Livestock grazing can result in local ground disturbance and increase the potential for weed invasion and spread. Timber management, including road, skid trail, and landing construction has the potential to introduce and facilitate spread of weeds. Recreation activities can be a vector of introduction and spread of weeds as well.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Implementation of Alternatives A or B with appropriate mitigation and site rehabilitation would result in no irreversible or irretrievable loss of native plant communities. Currently, native plant communities are more at risk from invasion and displacement by noxious weed populations. Implementing Alternative C could result in irretrievable impacts to native plant communities on some areas if noxious weeds spread from untreated areas and dominate large areas that cannot be treated under existing policies and methods of weed control. With Alternative C, weeds would continue to proliferate and control measures would not be sufficient to prevent continued expansion of weeds and associated losses in native plant community diversity and productivity.

CONSISTENCY WITH FOREST PLAN AND OTHER LAWS AND POLICIES

All alternatives would be consistent with direction in the Forest Plan.

WILDERNESS AND INVENTORIED ROADLESS AREAS

Of the wilderness attributes, unique characteristics, manageability, and boundaries would not be affected by implementation of any of the alternatives in wilderness areas, IRA, or unroaded areas.

DIRECT AND INDIRECT EFFECTS

ALTERNATIVE A

No aerial herbicide treatments would occur in wilderness. Areas identified for ground herbicide treatment within the Scapegoat Wilderness include about one acre of picloram and telar (one site), five acres of picloram, clopyralid and 2,4-D (five sites), 16 acres of picloram (eight sites), 39 acres of picloram and 2,4-D (five sites), one acre of picloram and escort (one site), five acres of picloram, clopyralid and 2,4-D (four sites), for a total of 68 acres of treatments on 24 sites. Herbicides would be applied with backpack or horse-mounted sprayers. There are currently no weeds mapped within the Gates of the Mountains Wilderness, although some do occur in adjacent areas and may move along trails into it. No biological controls would be released in wilderness or recommended wilderness. Herbicides would be applied with backpack or horse-mounted sprayers. Handpulling will be used where appropriate. Under the Adaptive Management Strategy, biological control may be released in IRAs, although none are currently proposed. About 30 acres of the Big Log IRA (recommended wilderness) would have grazing with sheep or goats. In IRAs, both aerial and ground herbicide applications would occur (**Table 4-9**).

Natural Integrity and Apparent Naturalness

Where weed treatment is effective, there would be short-term (two months) evidence, including dead or wilting plants and areas of disturbed soils where plants have been pulled up or grubbed out. Where plants are dead or dying, most people would not be able to relate what they are seeing to the use of herbicide because they would probably think the plants have reached the end of their normal life.

Alternative A would be the most aggressive and effective alternative in controlling weeds in the areas where most recreational activity occurs, mainly due to the most acres of weed control. Therefore, it would create the most improvements in natural integrity.

In wilderness, herbicides and handpulling would be used to treat the 68 acres of known infestations. Newly discovered infestations would be treated under the adaptive management strategy. The effects on natural integrity would be an overall improvement in the natural integrity of these areas because invading noxious weeds would be excluded from wilderness and replaced with native plants (see the *Vegetation* section). Herbicides would not remain in the environment beyond two to three years. Apparent naturalness of treatment areas would improve as the evidence of noxious weeds decreases and is replaced with native vegetation.

Herbicide treatment would decrease establishment and expansion of aggressive species in wilderness and IRAs, and reduce weed related impacts. The visual impact of spraying would be temporary and on most sites only last a few hours or less. Dying and wilting weed plants following herbicide treatment could be apparent. However, this appearance would be short-lived as surrounding vegetation would screen dead plants or blend in with native vegetation, as it grew dormant.

The effects of the adaptive management strategy would be increased acres treated with herbicides in wilderness and IRAs. The effects would be the same as for the proposed treatment areas.

No grazing to control weeds is proposed in wilderness areas. The 30 acres of grazing in the Big Log IRA is immediately adjacent to the boundary. No additional effects on natural integrity or apparent naturalness would occur from grazing activity because of the small scale and ongoing grazing. Under Adaptive Management, grazing for weed control may occur in the Jericho Mountain IRA.

Some people may notice areas where weeds were pulled or grazed, but it would likely not affect the apparent naturalness of the areas.

Remoteness and Solitude

Aerial spraying of herbicides within IRAs would reduce feelings of remoteness and solitude during the one to three days within each area required to accomplish the work. Aerial spraying would not occur in wilderness areas. Where weeds were pulled by hand, recreationists may happen upon a work crew and have a reduced feeling of solitude. Impacts would be very short-term (one day).

Mechanical treatments within the IRAs should result in minimal recreation effects of short duration. The use of wheeled vehicles would result in short-term visual impacts in the form of tracks created by laying down grasses. In dry years, these could remain visible throughout the season, while in wetter years; they could be "erased" by rains and regrowth before fall.

Grazing as a weed treatment method is only proposed where grazing activities are already occurring. Grazing would not occur in designated wilderness areas. There would be no additional effect on remoteness or solitude from grazing for weed control within proposed wilderness or IRAs.

TABLE 4-9
Alternative A Herbicide Treatments by IRA

IRA	LA	Aerial	Ground	Total
Anaconda Hill	Blackfoot	0	35	35
Bear-Marshall-Scapegoat-Swan	Blackfoot	32	94	126
Big Log	Belts/Dry Range	38	72	110
Camas Creek	Belts/Dry Range	14	1	15
Cayuse Mountain	Belts/Dry Range	120	48	168
Crater Mountain	Blackfoot	86	2	88
Devils Tower	Belts/Dry Range	35	119	154
Ellis Canyon	Belts/Dry Range	0	2	2
Grassy Mountain	Belts/Dry Range	0	13	13
Hellgate Gulch	Belts/Dry Range	81	96	177
Holter	Belts/Dry Range	0	26	26
Irish Gulch	Belts/Dry Range	0	66	66
Middleman Mountain-Hedges Mountain	Belts/Dry Range	906	122	1028
Mount Baldy	Belts/Dry Range	0	6	6
Nevada Mountain	Blackfoot/Continental Divide	94	12	106
Odgen Mountain	Blackfoot	96	3	99
Spectmen Creek	Blackfoot	16	0	16
Electric Peak	Blackfoot	0	79	79
Jericho Mountain	Continental Divide	0	0	0
Lazyman Mountain	Continental Divide	75	10	85
Total IRA Herbicide Treatment		1593	806	2399

*Trace

Primitive Recreation Opportunities

With aerial herbicide application, treated areas would be temporarily closed to public use, thus restricting the overall recreational opportunity during this time. Treatment would most likely occur during spring through fall and the public would be kept out of treatment areas for approximately 24 to 48 hours at a time, reducing opportunities for recreation during those periods. Ground application would require signing, so people are aware that herbicide treatment has occurred, however closures would not occur. Some people may choose to avoid these areas, reducing their opportunities for a short time.

Mechanical or grazing treatments, because of their limited extent, would only minimally affect opportunities for primitive recreation.

ALTERNATIVE B

There is no difference between Alternatives A and B for the effects on wilderness, because both alternatives have the same activities, including the adaptive management strategy. In IRAs, the acres with herbicide treatments would be reduced in Alternative B by approximately 980 acres (**Table 4-10**). This reduction is due to remoteness or worker safety on steep terrain with loose logs (burned areas, old clearcuts) or loose rocks. These areas would not be treated in Alternative B without aerial herbicide application.

TABLE 4-10
Alternative B Herbicide Treatments by IRA

IRA	LA	Total
Anaconda Hill	Blackfoot	35
Bear-Marshall-Scapegoat-Swan	Blackfoot	116
Big Log	Belts/Dry Range	88
Camas Creek	Belts/Dry Range	14
Cayuse Mtn.	Belts/Dry Range	147
Crater Mtn.	Blackfoot	74
Devils Tower	Belts/Dry Range	142
Ellis Canyon	Belts/Dry Range	2
Grassy Mtn.	Belts/Dry Range	13
Hellgate Gulch	Belts/Dry Range	122
Holter	Belts/Dry Range	26
Irish Gulch	Belts/Dry Range	66
Middleman Mtn-Hedges Mtn	Belts/Dry Range	259
Mount Baldy	Belts/Dry Range	6
Nevada Mtn.	Blackfoot/Continental Divide	73
Odgen Mtn.	Blackfoot	73
Spectmen Creek	Blackfoot	16
Electric Peak	Blackfoot	79
Jericho Mtn.	Continental Divide	0
Lazyman Mtn.	Continental Divide	67
Total IRA Herbicide Treatment		**1418**

Natural Integrity and Apparent Naturalness

In wilderness areas, the effects would be the same as Alternative A, since the treatments (herbicide and handpulling) would be the same.

In IRAs, fewer acres of noxious weeds would be treated than in Alternative A, with the result that natural integrity and apparent naturalness would not be improved on as many acres as Alternative A (2,399 acres vs. 1,418 acres in Alternative B). Weeds would continue to spread in areas where they are not treated. Approximately 600 of the 981 acres not treated with herbicides in Alternative B occur in the Middleman Mountain-Hedges Mountain IRA and are leafy spurge. With documented spread of leafy spurge over 100 percent per year since 1987 (PF-Purpose and Need), these 600 acres alone could exceed the existing infestation in the IRAs within four years, causing an overall decrease in natural integrity and apparent naturalness in the long-term.

Because Alternative B contains an adaptive management strategy to treat newly discovered weeds and to use improved technology, most new infestations would be treated as they are discovered. However, the areas where weeds would not be treated in Alternative B due to remoteness and worker safety are likely to impact IRAs harder than other areas because they are the most remote (after wilderness).

Remoteness and Solitude

In Alternative B, weed treatment would mostly be through ground application of herbicide, with some handpulling and grazing control. This alternative would have the longest duration of impacts on solitude, due to the increased number of days/personnel that would be required to accomplish the chore. It is estimated that during the initial treatment and follow-up for each area, 55 person days (5 acres/day/person, 4 times per treatment area) would be required to effectively treat weeds within wilderness areas, and 1,056 person days required for treatments within IRAs, within a six-year period.

The effects of handpulling and grazing control are the same as Alternative A.

Primitive Recreation Opportunities

Ground application would require signing, so people would be aware that herbicide treatment has occurred, however, closures would not occur. Some people may choose to avoid these areas, reducing their opportunities for a short time. Compared to Alternative A, there would be nearly twice the acres of ground application causing this effect.

Mechanical or grazing treatments, because of their limited extent, would only minimally affect opportunities for primitive recreation.

ALTERNATIVE C

Table 4-11 shows the acres of herbicide treatment in Inventoried Roadless Areas.

In wilderness, treatment would only occur at trailheads and portals (estimated to be less than three acres a year) allowing noxious weeds to spread unchecked at varying rates, depending on the weed species, competing vegetation, disturbance history, and presence of vectors. Under this alternative, in the long-term (more than 10 years), noxious weeds would eventually infest nearly all-suitable habitats within wilderness areas, including sites that are presently weed-free.

TABLE 4-11
Alternative C Herbicide Treatments by IRA

IRA	LA	Total
Anaconda Hill	Blackfoot	35
Bear-Marshall-Scapegoat-Swan	Blackfoot	110
Big Log	Belts/Dry Range	39
Camas Creek	Belts/Dry Range	13
Cayuse Mountain	Belts/Dry Range	154
Crater Mountain	Blackfoot	16
Devils Tower	Belts/Dry Range	152
Ellis Canyon	Belts/Dry Range	2
Grassy Mountain	Belts/Dry Range	13
Hellgate Gulch	Belts/Dry Range	138
Holter	Belts/Dry Range	26
Irish Gulch	Belts/Dry Range	66
Middleman Mountain-Hedges Mountain	Belts/Dry Range	201
Mount Baldy	Belts/Dry Range	6
Nevada Mountain	Blackfoot/Continental Divide	36
Odgen Mountain	Blackfoot	7
Spectmen Creek	Blackfoot	16
Electric Peak	Blackfoot	0
Jericho Mountain	Continental Divide	0
Lazyman Mountain	Continental Divide	8
Total IRA Herbicide Treatment		**1038**

Natural Integrity and Apparent Naturalness

In wilderness areas, unchecked spread of noxious weeds could result in the unavoidable deterioration of the natural condition of the wilderness and adjoining land diminishing the recreational and wilderness experience for some people. The negative effects noxious weeds would have on use of recreation sites and the wilderness would be greatest under this alternative. People who are aware of noxious weeds would notice their presence and the effect on natural habitats in wilderness areas.

In IRAs, fewer acres of noxious weeds would be treated (**Table 4-12**), with the result that natural integrity and apparent naturalness would not be improved on as many acres as Alternative A (2,399 acres vs. 1,031 acres in Alternative C). In areas where effective weed treatments occur, short-term effects would be the same as those described in Alternative A.

In IRAs, the number of infested areas that would go untreated is approximately 1,361 acres. This reduction in treated area is due to remoteness or worker safety on steep terrain with loose logs (burned areas, old clearcuts) or loose rocks, and no authority to treat newly discovered weed infestations. Noxious weeds would expand their populations and with them, their negative effects on native vegetation, thus reducing natural integrity and apparent naturalness of areas they take over.

Weeds would continue to spread in areas where they were not treated. Since acres treated in Alternative C would be less than half of the infested acres, gains in apparent naturalness and natural integrity would be exceeded by the reduction in the short-term. The extent of weed infestations in IRAs that would not be treated could exceed existing infestation within four years, causing an overall decrease in natural integrity and apparent naturalness in the long-term.

Remoteness and Solitude

In Alternative C, weed treatment would mostly be through ground application of herbicide, with some handpulling. Impacts on solitude would be about two-thirds of those described in Alternative B, due to the decreased number of days/personnel that would be required to accomplish the chore.

TABLE 4-12
Summary of Herbicide Treatments in IRAs by Alternative

	Alt. A			Alt. B	Alt. C
IRA	**Aerial**	**Ground**	**Total**	**Ground**	**Ground**
Anaconda Hill	0	35	35	35	35
Bear-Marshall-Scapegoat-Swan	32	94	126	116	110
Big Log	38	72	110	88	39
Camas Creek	14	1	15	14	13
Cayuse Mountain	120	48	168	147	154
Crater Mountain	86	2	88	74	16
Devils Tower	35	119	154	142	152
Ellis Canyon	0	2	2	2	2
Grassy Mountain	0	13	13	13	13
Hellgate Gulch	81	96	177	122	138
Holter	0	26	26	26	26
Irish Gulch	0	66	66	66	66
Middleman Mountain-Hedges Mountain	906	122	1028	259	201
Mount Baldy	0	6	6	6	6
Nevada Mountain	94	12	106	73	36
Odgen Mountain	96	3	99	73	7
Spectmen Creek	16	0	16	16	16
Electric Peak	0	79	79	79	0
Jericho Mountain	0	0	0	0	0
Lazyman Mountain	75	10	85	67	8
Total IRA Herbicide Treatment	**1593**	**806**	**2399**	**1418**	**1038**

The effects of handpulling and grazing control are the same as Alternative A.

CUMULATIVE EFFECTS

ALTERNATIVE A, B, AND C

The cumulative effects analysis area is the Wilderness and Inventoried Roadless Areas themselves. Activities considered in the cumulative effects analysis for wilderness areas and IRAs include: prescribed fire, ongoing grazing, motorized, and non-motorized recreation (trail riding, mountain biking, hiking, hunting, camping, swimming, boating) and wildfire. Reasonably foreseeable actions include future travel management decisions in the Belts/Dry Range, Blackfoot, and Continental Divide LAs. The purpose for these future decisions is to have a variety of motorized and administrative use, permitted use, and the access to private lands within the Forest boundary. These decisions will influence the risk of weeds spreading.

Natural Integrity and Apparent Naturalness

Cumulatively, increased use of IRAs by motorized vehicles, grazing, road construction (though limited), logging, and other ground disturbing activities would undoubtedly spread weeds further into wilderness areas and IRAs. Wildfire and generally increased recreational use of IRAs and wilderness areas would also cause weed populations to spread. Both natural disturbance and disturbances associated with human activity contribute to the establishment and spread of exotics in wilderness areas, including livestock use, trail use, camping and existing roads adjacent to wilderness. Natural disturbances, including gopher pockets, floods, storms, and fire also contribute to weed establishment and spread (Marler 2000).

Alternative A includes an adaptive management strategy, which would allow the treatment of weeds as they are discovered in wilderness and IRAs (see Chapter 2). Cumulatively, this alternative has the best chance of maintaining natural integrity and apparent naturalness by controlling weeds within those areas at this early and most effective stage.

Alternative B would be somewhat effective, since it contains the same adaptive management strategy. However, since aerial herbicide application would not be allowed, cumulatively, weed infestations would expand and new infestations would be established without effective treatment. When added to the direct and indirect effects, weed spread outside of effective treatment areas would reduce the natural integrity in wilderness and IRAs. Within five years, the acres infested with noxious weeds in these areas would exceed the current situation.

If currently infested areas are not treated, as in **Alternative C**, the cumulative effect of added disturbance with the aggressive spread of weed specie would result in a drastic reduction in appar naturalness and natural integrity of those areas within five years.

Remoteness and Solitude

In **Alternatives A and B**, additional disturbance and infestation acres would result in additional weed control activities (herbicide, mechanical and biological control) as described under the direct and indirect effects, as cumulative effects activities continue within wilderness and IRAs, with their associated effects on remoteness and solitude described under direct and indirect effects. However, these effects are expected to remain minor during the 12-year period of this project, affecting only a few more additional acres (and consequently) days after the initial treatment. It is anticipated that effective weed treatment at this time would reduce (although not eliminate) the need for weed treatments in the future in wilderness, proposed wilderness and IRAs.

Continued weed spread from cumulative activities, as would occur under **Alternative C** would result in reduce opportunities for remoteness and solitude as people choose to avoid areas of noxious weed spread. Opportunities could be reduced further, if, due to lack of action now, a larger scale treatment and/or closure is required later.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Under Alternative C, once weeds become well established in wilderness and inventoried roadless areas, eradication would probably never occur, resulting in an irreversible loss of natural integrity and apparent naturalness.

CONSISTENCY WITH FOREST PLANS AND OTHER LAWS AND POLICIES

All alternatives are consistent with management direction found in the Forest Plan, the Wilderness Act and proposed Roadless Area Conservation Rule. All alternatives are consistent with FSM 2109.14 (13.4) for pesticide use in wilderness areas as long as the Regional Forester approves the annual pesticide use plan.

WILD AND SCENIC RIVERS

DIRECT AND INDIRECT EFFECTS

ALTERNATIVES A AND B

Within eligible stream segments, both alternatives have the same activities. Ground herbicide application would occur on all 392 acres currently infested with weeds. In the Beaver Creek segment, 94 acres would also have biological controls. In the Missouri River corridor and about half of the infested area in the Beaver Creek corridor, grazing would be used to control weeds.

Herbicide Application

Herbicides would not have impact on outstandingly remarkable values of geology and recreation. Directly, wilting plants would be visible but it would not affect the outstandingly remarkable value of scenery. Indirectly, scenery would be improved as noxious weed populations decline and are replaced with native vegetation.

For these river segments, outstandingly remarkable value of wildlife includes elk, grizzly bear, wolves, bald eagles, cutthroat trout, and bull trout (NPS 2001). More detailed effects analysis on these species can be found in the Wildlife and Fish specialist's reports. In summary, herbicide, grazing, biological and mechanical controls of noxious weeds would not adversely affect wildlife, and would, in fact, improve wildlife habitat conditions (PF – Wildlife Specialist Report)

The outstandingly remarkable value of fish would not be directly affected by the proposed activity given the Environmental Protection Measures listed in Chapter 2 (see the *Fisheries and Aquatic Resources* section for more detail on the potential effects on fish). Indirectly, fish habitat would benefit from continued reductions of weed infestations, as native vegetation is restored.

Biological Control

Biological controls would have no effect on the outstandingly remarkable values. Outstanding Remarkable Values such as scenery, recreation, fisheries, wildlife and geology will not be affected by the use of insects for weed control and the biological control treatment areas are anticipated to be small areas that would have a negligible affect on the eligible stream segments (see the effects of Alternatives A and B for these resources).

Grazing

Grazing in the locations and as prescribed would have no impact on the outstandingly remarkable values of the Missouri River or Beaver Creek segments. No grazing would occur in the other river segments.

ALTERNATIVE C

Within eligible stream segments, Alternative C would include ground herbicide application on 377 of the 392 acres currently infested with weeds. In the Beaver Creek segment, 94 acres would also have biological controls. No grazing would be used to control weeds.

No additional weed treatments would occur. There would be no direct effect from this alternative. Indirectly, weeds would continue to spread within the segment, reducing outstandingly remarkable values of scenery, wildlife, and recreation in the Missouri River segment and wildlife in the Copper Creek segment. See the

Wildlife section for more description of how noxious weeds affect prey species for grizzly bear.

CUMULATIVE EFFECTS

ALTERNATIVES A AND B

The cumulative effects analysis area are the eligible river segments. The only direct or indirect effects identified for Alternative A and B are beneficial effects on the outstandingly remarkable values for each eligible segment. No cumulative effects activities were identified that would add to the beneficial effects.

ALTERNATIVE C

Cumulative effects include increased recreation (particularly in the Copper Creek segment with the Lewis and Clark bicentennial approaching in 2005) and past wildfire. Past wildfires (2003) in the Copper Creek segment will likely affect Outstandingly Remarkable Values to a small degree, particularly in the short term and probably increase the rate of weed spread, if new weed infestations are not treated under Alternative C. These activities would increase the spread of weeds, which, with less treatment, would further reduce the outstandingly remarkable values of scenery, recreation, and wildlife habitat. Dense infestations of noxious weeds can accelerate erosion (see the soils analysis), which, in the long-term, would reduce the outstandingly remarkable value of fish in all the river segments, particularly because of the close proximity of the weed infestations to the rivers themselves.

CONSISTENCY WITH FOREST PLAN, LAWS AND POLICIES

All Alternatives are consistent with the goals and objectives of the Helena NF Plan for eligible river segments to protect and maintain their potential classification.

RECREATION

DIRECT AND INDIRECT EFFECTS

ALTERNATIVES A AND B

Direct and indirect effects on recreation resulting from implementation would include short-term (one to seven days) encounters with herbicide treatment crews and visual impacts from wilting plants. Additional effects resulting from alternatives would be the protection of adjacent non-infested areas and preservation of intact plant communities, which would enhance the recreation experience. Concern over herbicides may cause some Forest users to choose to recreate in areas that have not been recently treated with herbicides. All weed treatment activities would be conducted in compliance with Helena Forest Travel Plan regulations, which allow for administrative use. When cross-country motorized travel is necessary to facilitate weed control, appropriate signs would be placed in the area of treatment. The use of wheeled vehicles would result in short-term visual impacts in the form of tracks created by laying down grasses. In dry years, these tracks could remain visible throughout the season while in wetter years they could be erased by rains and regrowth before fall.

All known weed infestations in dispersed sites, permitted use sites, special use sites, rental cabin sites and special use cabin sites would be treated in these alternatives.

Release of biological control agents would have no direct impacts on recreational opportunities because the insects would not be apparent to the public. If the treatment method is successful in reducing infestations of noxious weeds, it could have some positive indirect effects on recreational opportunities.

Under Alternative A and B, herbicide treatment would decrease establishment and expansion of aggressive species into non-infested areas and reduce weed-related impacts on recreation. The visual impact of spraying would be temporary and on most sites only last a few hours or less. Dying and wilting plants following herbicide treatment could be apparent. However, this appearance would be short-lived as surrounding vegetation would screen dead plants or blend with native vegetation, as it grew dormant.

Long-term improvements include an overall reduction of stiff plant stalks and sharp bristle and increases in the variety and amount of native flora. Treating noxious weeds would be an improvement in the overall recreational environment, including the desirability and enjoyment of recreational sites, although not all areas would benefit.

ALTERNATIVE C

All known weed infestations in dispersed sites, permitted use sites, special use sites, rental cabin sites and special use cabin sites would be treated in these alternatives.

Under the No Action Alternative the current weed control program would continue. Spread of noxious weeds could result in the unavoidable deterioration of the natural condition of adjoining land diminishing the recreational experience for some people. The negative effects noxious weeds would have on use of recreation sites would be greatest under this alternative.

Long-term effects of treating noxious weeds with this alternative would be the same as Alternative A; however, the acres of beneficial effects would be reduced.

CUMULATIVE EFFECTS

The cumulative effects analysis area is the project area. Cumulative effects from activities described at the beginning of this chapter would continue to impact recreation, affecting the location where and times when people can recreate at various locations across the Helena NF. Effects on recreation under any of the alternatives would be minor, short-term (one to seven days) displacement of recreational activities. While visitor displacement is the most likely direct effect of weed treatment, short-term (approximately one year) visual impacts from cross-country motorized travel are also possible.

CONSISTENCY WITH FOREST PLAN AND OTHERS LAWS AND POLICIES

All alternatives are consistent with the Forest Plan.

RESEARCH NATURAL AREAS

DIRECT AND INDIRECT EFFECTS

ALTERNATIVES A AND B

Within RNAs, these alternatives contain the same proposed weed treatment. Aerial application is excluded from RNAs (Chapter 2 – *Environmental Protection Measures*). Proposed activity within RNAs includes spot application of herbicide, totaling approximately five acres in the Granite Butte proposed RNA.

Weed treatment would protect the natural ecological composition of the RNAs, and protect their identified values for research. Weeds have been located adjacent to the RNAs and it is an effective treatment of those areas that would protect the RNAs from the risk of establishment of noxious and invasive weeds within them. Adaptive management activities proposed include the identification and treatment of weeds that may enter the RNAs through natural sources (e.g. wind, wildlife, fire). Effects of treating new locations would be the same as those already identified.

ALTERNATIVE C

The five acres of known weed infestation in the Granite Butte proposed RNA have already been treated and are covered under a previous decision for herbicide treatment. The difference between Alternative C and Alternatives A and B is that future weed spread into the RNAs would not be treated. Indirectly, this could lead to larger infestations, although currently, the risk is low.

CUMULATIVE EFFECTS

Under all alternatives, there were no identified activities within RNAs that would increase the risk of noxious weed spread, with the exception of wildfire. Cumulative effects may occur when weed-spreading activities occur next to RNAs. Under Alternatives A and B, ongoing, effective treatments of weeds would maintain the ecological integrity and research value of the areas. Under Alternative C, in the long-term, the lack of treatment of potential new infestations along with the likelihood that weeds would eventually spread from outside the RNAs into them poses a risk that the RNAs would lose their research value.

CONSISTENCY WITH LAWS AND POLICIES

Forest Plan Direction

All of the alternatives are consistent with the Forest Plan. All alternatives are consistent with direction in the Establishment Records by proposing specific control against target organisms, and by taking measures to control or eradicate these populations. In addition, this EIS satisfies the requirement to review the need for, and type of, noxious weed control on a case-specific basis and covered by an appropriate review under NEPA.

No alternative contains grazing as a weed control method within RNAs, which is consistent with the Forest Plan Management Area N-1 standard.

FSM 4063 – Research

Alternatives A and B would be consistent with Forest Service Manual 4063 by removing exotic plant or animal life. Alternative C would be consistent until a new weed infestation is discovered in an RNA, at which time additional NEPA would have to be completed.

CULTURAL RESOURCES

DIRECT AND INDIRECT EFFECTS

The project file (PF-Heritage) contains sites located during the records search that are within one of the treatment areas under any alternative.

ALTERNATIVES A, B AND C

Results of the records review are presented in **Table 4-13**. In addition to previously recorded cultural resources, there are areas slated for treatment that contain historic mining resources not yet recorded. A review of U. S. Geological Survey quadrangles indicates several areas in the Belts/Dry Range and Continental Divide LA treatment areas rich in historic mining resources.

Handpulling, livestock grazing, and mechanical weed control treatments could negatively affect

TABLE 4-13
Previously Recorded Cultural Resources Within Treatment Areas

Type of Site/Location	Alt A	Alt B	Alt C
Belts/Dry Range LA			
Sites Eligible	17	16	15
Sites Ineligible	24	23	22
Sites with Unknown Eligibility	8	8	8
Total Number of Cultural Resources	49	47	45
Elkhorn LA			
Sites Eligible	1	1	1
Sites Ineligible	5	5	5
Sites with Unknown Eligibility	0	0	0
Total Number of Cultural Resources	6	6	6
Blackfoot LA			
Sites Eligible	7	7	6
Sites Ineligible	3	3	3
Sites with Unknown Eligibility	2	2	2
Total Number of Cultural Resources	12	12	11
Continental Divide LA			
Sites Eligible	5	5	5
Sites Ineligible	4	4	4
Sites with Unknown Eligibility	7	7	6
Total Number of Cultural Resources	16	16	15
Total	**83**	**81**	**77**

historical resources through disturbance effects (Schiffer 1987, 121). Handpulling of weeds and mechanical treatments, for example, could potentially disturb subsurface components of cultural resources. Disturbance of the subsurface would destroy the archaeological context of the resource, reducing the resource's information potential. The disturbance caused by handpulling or mechanical treatment could result in modification of artifacts or the relocation of artifacts (Schiffer 1987, 121). For this reason, these treatments have been prohibited in sites known to be eligible for NRHP listing, or where eligibility is unknown or unresolved (see *Environmental Protection Measures* in Chapter 2 **Table 2-4**). This EPM would ensure that no sites are negatively affected by these treatments.

Driving ATV's across cultural resources for herbicide applications could also disturb the subsurface components of archaeological resources through the disturbance process known as surficial trampling (Schiffer 1987, 126). Surficial trampling could also result in the modification or relocation of artifacts. An EPM has been included in Chapter 2 to prohibit wheeled vehicle traffic across fragile ruins or other significant cultural site if the Forest archeologist deems it necessary. This would avoid impacts on these sites.

Biological control efforts such as the introduction of insects, and aerial application of herbicides would not have any effects on cultural resources.

CUMULATIVE EFFECTS

The cumulative effects analysis area is the project area. Cumulative effects of treatments on cultural resources known to be eligible for NRHP listing, or where eligibility is unknown or unresolved may be detrimental to the resource. These effects include degradation or removal of the integrity of the resource and potential to render the resource ineligible for the NRHP. Ongoing permitted grazing of livestock has potential for damage to heritage sites. Trampling of resources by cattle, as described above, could potentially modify or relocate artifacts. Cumulative effects of noxious weed removal and cattle grazing around heritage resources have not been fully explored by heritage resource managers. Removal of noxious weeds might improve visitor access to and enjoyment of historic mining resources. Removal of noxious weeds might increase cattle grazing across and adjacent to heritage resources, thereby increasing trampling effects. The removal or reduction of noxious weeds from heritage resources could also be an expression of good resource stewardship and could result in a reduction in unwanted destructive visitor impact.

CONSISTENCY WITH FOREST PLAN AND OTHERS LAWS AND POLICIES

The National Historic Preservation Act requires federal agencies to consider the potential impacts of undertakings on eligible resources. Avoiding disturbing treatments of the areas where these resources are located is in compliance with the National Historic Preservation Act.

SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Costs of the Weed Treatment Program

Table 4-14 presents the estimated cost and effectiveness of noxious weed control methods proposed. Estimated per acre costs were derived from experienced costs on the Helena NF, other forests in Region 1 (Bitterroot and Lolo), and the Missoula Field Office of the Bureau of Land Management (BLM). Strict comparisons between the costs are difficult because of the varying types of chemicals used, the varying types of terrain, distance from roads, and the density of weeds.

DIRECT AND INDIRECT EFFECTS

ALTERNATIVE A

A limited number of temporary, seasonal jobs would be created under Alternative A. Local service and retail trade may realize a slight increase in the purchase of goods and services during the short seasonal spraying event. With an average annual budget of $300,000, based on the average cost per acres of treatment, approximately 6,500

TABLE 4-14 Weed Control Methods and Costs		
Method	General Effectiveness	Cost/ Acre*
Ground application of herbicide – vehicle access	High	$24 – 115
Ground application – primarily vehicle access-some backpacking (current Helena NF method)	High	$62
Ground application of herbicide – backpack access	High	$125-350
Aerial application of herbicide	High	$18 – 24
Biologicals (40 insects per acre)	Low - High	$40*
Grazing	Low	$20-48
Handpulling	High for small infestations of taprooted weeds; low for high density infestation > 1 acres or rhizomatous.	$8,800

* Costs per acre for herbicide treatment and handpulling are dependent on the density of the weed infestation.

acres could be treated each year, allowing the Forest to complete initial treatment of the total acreage in 3 to 4 years (see **Table 4-15**).

ALTERNATIVE B

A limited number of temporary, seasonal jobs would be created under Alternative B. Local service and retail trade may see a slight increase in the purchase of goods and services during the short seasonal spraying event. With an average annual budget of $300,000, based on the average cost per acre of treatment, approximately 4,500 acres could be treated each year, allowing the Forest to complete initial treatment of the total acreage in 4 to 5 years (see **Table 4-16**). The extra time needed to complete initial treatment will result in accelerated expansion of weeds which would likely increase long-term treatment costs.

ALTERNATIVE C

No changes in the present weed management program on the Helena NF would occur under the No Action Alternative. With an average annual budget of $300,000, based on the average cost per

TABLE 4-15 Alternative A Costs			
Landscape Area/Treatment Type	Acres Treated	Cost per Acre	Total Cost*
Belts/Dry Range - Total	**9,903**		**$384,636 – 456,780**
Aerial	5,817	$18-24	$104,706 – 139,608
Ground	4,086	$62	$253,332
Grazing*	1,330	$20-48	$26,600 – 63,840
Elkhorn- Total	**1,792**		**$90,824 – 95,082**
Aerial	710	$18-24	$12,780 – 17,040
Ground	808	$62	$50,096
Ground/Biological	274	$102	$27,946
Continental Divide - Total	**5,645**		**$324,094 –334,806**
Aerial	1,664	$18-24	$29,952 – 39,936
Ground	2,811	$62	$174,282
Ground/Biological	1,170	$102	$119,340
Grazing*	26	$20-48	$520 – 1,248
Blackfoot- Total	**5,328**		**$202,956 – 220,326**
Aerial	2,895	$18-24	$52,110 – 69,480
Ground	2,433	$62	$150,846
Alternative A Total	**22,668**	**Average/acre**	**$1,002,510 = $44.23/ac- $1,106,994 = $48.84/ac**

* Grazing is also counted in "Ground" acres

** Total cost would be spread over the years necessary to provide initial treatment.

TABLE 4-16
Alternative B Costs

Landscape Area/Treatment Type	Acres Treated	Cost per Acre	Total Cost**
Ground	7,917	$62	$490,854
Grazing*	1,330	$20-48	$26,600 – 63,840
Belts/Dry Range - Total	**7,917**		**$517,454 – 554,694**
Ground	1,482	$62	$91,884
Ground/Biological	274	$102	$ 27,946
Elkhorn- Total	**1,756**		**$119,830**
Ground	4,132	$62	$256,184
Ground/Biological	1,170	$102	$119,340
Grazing*	26	$20-48	$520 – 1,248
Continental Divide - Total	**5,302**		**$376,534 – 377,262**
Ground	3,938	$62	$244,156
Blackfoot- Total	**3,938**		**$244,156**
Alternative B Total	**18,913**	**Average/acre**	**$1,257,974 = $66.51/ac** **$1,295,942 = $68.52/ac**

* Grazing is also counted in "Ground" acres

** Total cost would be spread over the years necessary to provide initial treatment.

acre of treatment, approximately 4,800 acres would be treated each year, allowing the Forest to complete initial treatment of the total acreage in 3 to 4 years (see **Table 4-17**). Alternative C would treat a relatively small portion of the weed infested acres on the Helena National Forest, allowing weeds to continue to spread. Although the cost of Alternative C is less than the other Alternatives because fewer acres are treated, it has the potential to be more expensive over the long term as weed infestations are likely to grow more severe and require more treatment.

TABLE 4-17
Alternative C Costs

Landscape Area/ Treatment Type	Acres Treated	Cost per Acre	Total Cost*
Belts/Dry Range - Total			$448,880
Ground	7,240	$62	$448,880
Elkhorn- Total			$91,326
Ground	1,473	$62	$91,326
Continental Divide - Total			$180,916
Ground	2,918	$62	$180,916
Blackfoot- Total			$262,880
Ground	4,240	$62	$262,880
Alternative C Costs	**15,871**		**$984,002**

* Total cost would be spread over the years necessary to provide initial treatment.

CUMULATIVE EFFECTS

The cumulative effects analysis area is the project area. Travel management decisions made at the project and Forest level may affect management access to weed treatment areas. If access is made more difficult, treatment costs per acre would increase. This would be most notable in Alternative B, which has the most ground treatment acres. Costs for Alternative A could increase slightly, depending on location of ground based weed treatments and changes in access. Effects of Alternative C would be less on an annual basis in comparison to Alternative B, since fewer acres would be affected by changes in access.

CONSISTENCY WITH FOREST PLAN, LAWS, AND POLICIES

By considering the cost of the proposed project and alternatives, the project is in compliance with the Forest Plan goal for economics. Forest Plan direction does not dictate that economic efficiency is the overriding consideration in selecting management actions.

Present and reasonably foreseeable activities that affect the economic issues are limited to the ongoing weed treatment activities on the Helena NF.

EO 12898 - Environmental Justice

No minority or low-income communities would be disproportionately impacted by any of the alternatives. Implementing any alternative would not alter opportunities for subsistence hunting by Native American tribes.

HUMAN HEALTH AND SAFETY

DIRECT AND INDIRECT EFFECTS

ALTERNATIVES A, B, AND C

Mechanical Treatments

Potential risks to human health from mechanical weed control methods are very low and include emissions from gasoline or diesel powered equipment and cuts, burns, allergies, and skin irritation from direct contact with plants by individuals doing the work.

Some invasive weed species can cause allergies and minor skin irritations in a few individuals. Some species of invasive weeds, such as thistles, cause minor scrapes and irritations, and there are other more serious complications that may result from hand pulling. There have also been claims (not medically supported) that hand pulling of knapweed may result in the formation of tumors on the hands. Highly allergic individuals can have serious complications when exposed to allergens (weeds or pollen), including constriction of the airway and anaphylactic shock, the significance of which should not be underestimated since forest workers would be working some distance from medical assistance.

Approximately 10 to 15 percent of the U.S. population suffers from allergy symptoms from invasive weed species such as knapweed. Allergies to weeds such as knapweed may complicate or trigger asthma. It may take up to two years after getting a person's allergies under control to see a benefit in reduced asthma symptoms (Nielsen 1999).

While there is some potential for health effects associated with mechanical treatment of weeds, required personal protective equipment (PPE) such as gloves, long sleeved shirts, boots, and safety glasses along with personal hygiene, would prevent injuries or irritations, and therefore, no human health effects are anticipated by mechanical removal of weeds.

Cultural Treatments

Potential human health risks associated with cultural control methods include exposure to dust and chaff during seeding operations. Allergic reactions can result from the exposure of seed/chaf when handling seeds; however, gloves, long sleeved shirts, boots, and other PPE, as needed, would prevent injuries or irritations. Therefore, no human health effects are anticipated by cultural control methods.

Biological Treatments

Biological treatments would result in no known risks to human health.

Herbicide Treatments

The following primary referenced literature was used to analyze potential human health risks associated with ground and aerial application of herbicides:

- The Risk Assessment for Herbicide Use in Forest Service Regions 1,2,3,4 and 10 and on Bonneville Power Administration Sites (USFS 1992) (referred to as RAHUFS). This analysis was developed for the Forest Service specifically to address human health issues raised by use of herbicides.
- Assessing the Safety of Herbicides for Vegetation Management in the Missoula Valley Region – A Question and Answer Guide to Human Health Issues, referred to as ASH (Felsot 2001).
- Risk Assessments completed by the Forest Service under contract with Syracuse Environmental Research Associates for 2,4-D,

picloram, clopyralid, dicamba, hexazinone, sulfometuron methyl, metsulfuron methyl, triclopyr, glyphosate, chlorsulfuron, imazapic, and imazapyr. (USFS 1995d; USFS 1996c,d; USFS 1997c; USFS 1998b,c; USFS 1999b-e; USFS 2000c; USFS 2001f; USFS 2002; USFS 2003b,d; USFS 2004a-f; USFS 2005a)

Three levels of analyses were used in the above risk assessment processes: 1) a review of toxicity test data (i.e., acute, chronic, and sub-chronic) for herbicides proposed for use on the Project to determine dosage that could pose a risk to human health; 2) an estimate of exposure levels to which workers (applicators) and general public may be exposed during treatment operations; and 3) comparison of dose levels to toxicological thresholds developed by EPA to determine potential health risks.

Toxicity test data on laboratory animals is available for herbicides proposed for use in this analysis. Most tests have been conducted under EPA pesticide registration/re-registration requirements for use in the United States. The EPA uses test data to determine conditions for use of herbicides in the United States.

Label restrictions on herbicides are developed to mitigate, reduce, or eliminate potential risks to humans and the environment. Label information and requirements include: PPE; User Safety; First Aid; Environmental Hazards; Directions for Use; Storage and Disposal; General Information; Mixing and Application Methods; Approved Uses; Weeds Controlled; and Application Rates.

Analysis of herbicide use in this EIS assumes compliance with the product label during handling and application. Additional environmental protection measures are typically developed by Forest resource specialists to further reduce potential risks to human health and the environment during application of herbicides. These measures are implemented during analysis and at time of application to ensure mitigation is greater than required by USEPA label requirements.

Factors Affecting Hazard of Herbicide

Method of Application

How herbicides are applied can have a direct impact on the potential for human health effects. According to risk assessments completed on herbicide usage on forest lands (USFS 1995d; USFS 1996c,d; USFS 1997c; USFS 1998b,c; USFS 1999b-e; USFS 2000c; USFS 2001f; USFS 2002; USFS 2003b,d; USFS 2004a-f; USFS 2005a) herbicide applicators are at a higher risk than the general public from herbicide use. The risk assessments compared risks to workers for all types of application, including aerial, backpack, ground-mechanical, and hand applications. Lower risks were estimated for aerial and ground mechanical application as compared to other methods, even though the total amount of herbicide applied in a given day was higher. Risks associated with backpack and hand application of herbicides were estimated to be the highest, due to workers being closer to the nozzle and to the containers from which the herbicides were sprayed. Backpack and hand application was also reported to increase the likelihood of a worker receiving repeated exposures that may remain on the worker's skin for an extended time period.

The USEPA, in its re-registration of picloram (USEPA 1995), also noted that the highest risk for herbicide applicators was for those using the backpack application method. The lowest risk was for aerial and ground-boom applicators.

Length of Exposure

The magnitude of a dose that is hazardous to health depends on whether a single dose is given all at once (acute exposure); multiple doses are given over longer periods (chronic exposure); or, regularly repeated doses or exposures over periods ranging from several days to months (sub-chronic). The USEPA develops Reference Doses (RfDs), which are an estimate of a daily dose over a 70-year life span that a human can receive without an appreciable risk of deleterious effects (USEPA 1989). RfDs include a "safety factor" where the No Observable Effect Level (NOEL) is divided by a factor, usually 100, to account for uncertainty and hypersensitive individuals. The 100 value is derived by including a safety margin of 10 for extrapolating study results from mammals to humans, and an additional safety factor of 10 for variation in population response to a particular compound.

The RfD is a conservative threshold of toxicity relative to this analysis because it assumes daily exposure over a 70-year life span. Actual worker exposures for herbicide treatments in this project would typically be between 20 and 80 days each year for substantially less than 70 years. The RfD is also calculated from the NOEL, assuming humans are 100 times more sensitive than animals to the chemical tested.

Potential doses to workers or the public from application of herbicides would be transitory. Lifetime RfDs are used here as a convenient and conservative comparison for determining significance of human doses. Lifetime RfD values are based on daily feeding studies, whereas workers and the general public would not be exposed daily over a lifetime. Maximum duration of exposure for workers on a yearly basis was estimated in the range of 10 to 40 days for commercial applicators (USEPA 1995). This may be on the lower end of the range as treatments of weeds in spring and fall have become more popular.

Route of Exposure

Substances tested for acute toxicity are usually administered by pumping a chemical down a tube into an animal's stomach. From this route of exposure, an oral LD_{50} (lethal dose that kills 50 percent of a test population, measured in one milligram of herbicide per kilogram of animal weight) can be estimated. Exposure during chronic testing usually involves placing the chemical in the animal's food, and then measuring the amount of food eaten during each 24-hour period (USEPA 1996a,b).

Test substances are also applied to the shaved skin of an animal to estimate a dermal LD_{50}. About 10 percent of the animal's body surface is exposed to a chemical covered by a patch for 24 hours. In acute exposure studies, whether by oral or dermal routes, animals are monitored for a range of adverse responses for 14 days following dosing (USEPA 1996c).

Skin acts as a protective barrier to limit and slow down movement of a chemical into the body. Studies of pesticides applied to the skin of humans indicate that for many only about 10 percent or less passes into the blood. In contrast, absorption of chemicals from the small intestine is quicker and more complete than from the skin (Ross *et al.* 2000). For this reason, dermal LD_{50}'s are usually much higher than oral LD_{50}'s.

Test organisms are also administered substances in air to estimate an inhalation LD_{50}. In this case, exposure units are expressed as milligrams of test substance per unit of volume (usually a liter of air, which is equivalent to 0.035 cubic feet). The onset of illness can occur more quickly by inhalation exposure than by oral or dermal contact due to rapid entry of the substance into the blood stream. However, studies with pesticide applicators (who receive higher exposures than the general public) indicate dermal exposures are greater than inhalation exposures (Ross *et al.* 2000).

Required personal protective equipment (PPE) used by workers during pesticide application (gloves, waterproof boots etc.) is designed to reduce exposure to sensitive areas on the body. Use of PPE as required by the Forest Service job hazard analysis would protect worker health.

Toxicity of Herbicides

A comparison of toxicity for typical herbicides is shown in **Table 4-18.** Toxicological studies using animals typically involve purposeful exposure to dosages required to cause an effect (i.e. tumors, changes in immunity, etc.), or to establish a Lowest Observed Effect Level, known as a (LOEL) or a No-Observed-Effect-Level (NOEL). This often requires administration of relatively high doses of a chemical in order to document an effect or lack thereof. The causal dose in many toxicological studies is significantly greater than what an applicator might be exposed to while applying herbicides or the public may be exposed to walking through a treated field or living adjacent to treated land. Therefore, concluding that an applicator may experience neurological effects because a study in rats showed such connection, may lead to an erroneous conclusion because the dose administered to the rat is in no way representative

TABLE 4-18
Comparison of Herbicide Toxicity

Herbicide	Carcinogenic[1]	Estimated Exposure to Public[2]	Estimated Exposure to Worker[2]	Chronic RfD (mg/kg/day)	Mutagenic and Reproductive[3]	Acute oral LD50 for rats (mg/kg/day)
Glyphosate	E	<RfD	<RfD	0.1	No	2,000 - 6,000
Picloram	E	<RfD	<RfD[6]	0.2	No	3,000 - 5,000
Hexazinone	D	<RfD	below to slightly above RfD[7]	0.03/0.05[4]	No	1,690
Clopyralid	E	<RfD	<RfD	0.15	No	2,675 - 5,000
2,4-D	D	<RfD	below to slightly above RfD[8]	0.01	No	375 - 666
Dicamba	D	<RfD	<RfD	0.045	No	750 – 3,000
Chlorsulfuron	E	<RfD	<RfD	0.02	No	>5,000
Metsulfuron methyl	E	<RfD	<RfD	0.25	No to slight	>5,000
Triclopyr	D	<RfD	<RfD	0.05	No to slight	630 – 2,055
Sulfometuron methyl	E	<RfD	<RfD	0.02[5]	No	>5,000
Imazapyr	E	<RfD	<RfD	2.5[5]	No	>5,000
Imazapic	E	<RfD	<RfD	0.5	No	5,000

RfD = Reference Dose; Units expressed as milligrams of herbicide per kilogram of body weight = mg/kg; LD_{50} = lethal dose in milligram of herbicide per kilogram of animal weight that kills 50 percent of a test population.

1 EPA carcinogenicity classification based on daily consumption for a 70-year life span. D = Not Classifiable as to Human Carcinogenicity; E = Evidence of Non-Carcinogenicity

2 Exposures under typical exposure scenarios. Accidental and extreme exposure scenarios may exceed the RfD.

3 Unlikely that compound is mutagenic or would pose a mutagenic risk to humans at expected exposure levels.

4 Two RfDs reported.

5 Provisional RfD, USEPA has not derived RfD for this compound.

6 USFS (1999b) reports that worker wearing contaminated glove may received an absorbed dose greater than the RfD.

7 USFS (1997c) reports that over a range of plausible application rates, workers may be exposed to hexazinone at levels that exceed the RfD.

8 USFS (1998b) reports that worker involved in ground or aerial application of 2,4-D may be exposed to levels above the RfD if effective methods to protect workers and minimize exposure are not employed.

Source: Infoventures 1995a-j; OSU 1996a-h; USEPA 1990; USEPA; 1990a; USFS 1995d; USFS 1996c; USFS 1996d; USFS 1997c; USFS 1998b,c; USFS 1999c,d; USFS 2000c; Tu et al. 2001; USFS 2001d,f; USFS 2003b-d; USFS 2004; USFS 2004 a-f ; USEPA 2005.

to what an applicator may be exposed to when applying a herbicide. In addition, the method of exposure to herbicides in animal studies is uniquely different than that of a worker or person of the general public, possibly leading to a causal effect. In animal studies, herbicides are commonly pumped into stomachs (gavage), put directly into food, or placed directly on shaved skin. Herbicide applicators and the general public are clothed and do not purposely ingest herbicides under the same conditions as animals studies of toxicological significance.

Estimates of exposure to workers and the general public of herbicides applied to forest lands have been reported under various conservative exposure scenarios (USFS 1995d; USFS 1996c,d; USFS 1997c; USFS 1998b,c; USFS 1999b-e; USFS 2000c; USFS 2001f; USFS 2002; USFS 2003b,d; USFS 2004a-f; USFS 2005a). The most reasonable interpretation of the risks associated with application of most herbicides on forest lands is that, except for accidental exposures or extremely atypical and perhaps implausible exposures scenarios (i.e. acute direct spray entirely covering a naked child), the use of herbicides on forest lands would not pose an identifiable risk to workers or the general public. Exposures under typical exposure scenarios (those following guidelines on the label) would be below the RfD, a dose level determined to be safe by USEPA over a lifetime of daily exposure.

There are exceptions worth noting that may help identify protective measures that could be instituted when applying herbicides. USFS (1997d) reports that over a range of plausible application rates, workers may be exposed to hexazinone at levels that exceed the RfD. Likewise, there is reasonable concern that workers applying triclopyr over a prolonged period of time in the course of a single season and/or several seasons may be at risk of impaired kidney function. (USFS 2003b) USFS (1998b) reports that if 2,4-D were applied directly to fruits and vegetables at anticipated application rates, the consumption of vegetables would be undesirable and could lead to health effects. They point out; however, that the likelihood of such an exposure seems remote when applying on forest lands. USFS (1998b) also reports that exposure levels for workers involved in ground or aerial application of 2,4-D may exceed the RfD slightly, based on central estimates of exposure, or substantially, based on upper limits of exposure. They go on to indicate that 2,4-D can be applied safely, (exposure doses below the RfD) if effective methods are used to protect workers and minimize exposure (personal protective equipment). USFS (1999b) also reported that there is no evidence that typical exposures to picloram would lead to a dose level that exceeds the RfD or level of concern with the exception of wearing contaminated gloves for one hour, which results in estimates of absorbed doses that exceed the RfD.

Acute Toxicity

Acute toxicity is measured by the LD_{50}, defined as the dosage of toxicant expressed in milligrams per kilogram of body weight, which is lethal to 50 percent of animals in a test population within 14 days of administration (USFS 1992). Since potential exposure levels to workers and the general public associated with use of herbicides on forest lands have been estimated to be at or below USEPA RfDs, dosages would not exceed acute toxicity dose levels when applying herbicides on forest lands.

Sub-Chronic and Chronic Toxicity

There is considerable information on sub-chronic and chronic effects due to exposure to herbicides in controlled animal studies. The information suggests that the herbicides proposed for use by the forest are classified in two different categories: 1) not carcinogenic, and 2) not classifiable as to human carcinogenicity, indicating there is no convincing evidence to suggest that the herbicides proposed for use by the forest would result in carcinogenic, mutagenic, teratogenic, neurological or reproductive effects based on anticipated exposure levels to workers and the public (Arbuckle 1999; Charles et *al.* 1996; Faustini 1996; Ibrahim, et.al 1991; Mattsson 1997; Mustonen et al. 1986; Infoventures 1995a-j; OSU 1996a-h; USEPA 1990; USEPA; 1990a; USFS 1995; USFS 1996a; USFS 1997a; USFS 1998; USFS 1998 b,c; USFS 1999b-e; USFS 2000c; USFS 2001f; USFS 2003b-d; USFS 2004;USFS 2004a-f; USFS 2005a).

Synergistic Interactions

Concerns are occasionally raised about potential synergistic interactions of herbicides with other herbicides in the environment or when they are mixed during application (tank mixing). Synergism is a special type of interaction in which the combined impact of two or more herbicides is greater than the impact predicted by adding their individual effects. The RAHUFS addresses the possibility of a variety of such interactions. These include the interaction of the active ingredients in an herbicide formulation with its inert ingredients, the interactions of these herbicides with other herbicides in the environment, and the cumulative impacts of spraying as proposed with other herbicide spraying to which the public might be exposed.

No one can guarantee the absence of a synergistic interaction between herbicides and/or other chemicals to which workers or the public might be exposed. For example, exposure to benzene, a known carcinogen that comprises 1 to 5 percent of automobile fuel and 2.5 percent of automobile exhaust, followed by exposure to any of these herbicides could result in unexpected biochemical interactions (USFS 1997c). Analysis of the infinite number of materials a person may ingest or be exposed to in combination with chemicals is outside the scope of this analysis. That being said, there is some indication that the co-exposure to 2,4-D and picloram may induce effects not associated with exposure to 2,4-D or picloram alone (USFS 1998b; Cox 1998; OSU 1996a).

Impurities, Adjuvant and Inert ingredients in Herbicide Formulations

During commercial synthesis of some pesticides, byproducts can be produced and carryover into the product eventually formulated for sale. Occasionally byproducts or impurities are considered toxicologically hazardous, and their concentrations must be limited so that potential exposures do not exceed levels of concern (Felsot 2001).

Technical grade picloram (prior to mixing with other inerts) and clopyralid contains hexachlorobenzene (HCB) as a byproduct of the synthesis of the active ingredients (USFS 1999c). HCB is also a byproduct of chlorinated solvents used extensively in industry and occasionally around the home. HCB was registered as a fungicide until banned by EPA over concerns that it may be carcinogenic. As a result, EPA has imposed a limit of 100 parts per million (ppm), HCB in Tordon®. The manufacturer of Tordon® has set its own manufacturing standard even lower and reportedly maintains HCB levels in formulated picloram at 50 ppm or less (i.e. 50 milligrams per liter of formulation). Average concentrations of HCB in picloram have been estimated at 8 ppm (USEPA, 1995). Therefore, HCB comprises only 0.000005 percent of the Tordon® formulation, which is then further diluted when the spray solution is prepared in accordance with the label.

Given the dilution of formulations by water in the final spray solution, estimates of HCB exposure from use of picloram or clopyralid-containing products have shown that resulting residues in the environment and bystander exposure levels do not exceed current background levels. Longer-term dose estimates for the general public exposed to HCB in clopyralid were below the general background exposure to HCB in the environment by factors of about 25,000 to several million (USFS 1999c). The central estimates of worker exposure to HCB under normal conditions were estimated to be lower than the background levels of exposure by factors of about 1,000. Likewise, the exposure assessments based on the use of picloram by the USFS have been estimated to result in long-term predictions for the general public that are below background doses of HCB due to environmental contamination by factors of about 1,400 to seven million (USFS 1999b). Thus, for commercially sold products which are more dilute than technical grade products, there appears to be no basis for asserting that the use of clopyralid or picloram in accordance with the label by the USFS would result in substantial increases in the general exposure of either workers or members of the general public to HCB.

Another concern is potential presence of dioxin in formulations containing chlorinated chemicals. Dioxins are a group of chemicals involving 76 different types of related molecules called congeners, each having from two to eight chlorine atoms. The toxicity of each of the types of dioxin molecules is different. The toxic potency is determined by spatial arrangement of the chlorine atoms in a molecule rather than mere presence of chlorine. Of all of the congeners, one—TCDD (2,3,7,8-tetrachloro-para-dibenzodioxin), is the most potent. All other congeners are considered 10 to 10,000 times less potent than TCDD. Congeners with the greatest number of chlorine atoms are the least potent (Van den Berg *et al.* 1998).

TCDD and a few other dioxin congeners are byproducts of the synthesis of trichlorophenol. Most of the other dioxin congeners contain more chlorine than TCDD but are byproducts of the combustion of biomass (e.g., wood) and municipal waste. Dioxin congeners have always been in the environment as a result of natural fires and volcanic eruptions, and burning coal, wood, and gasoline (Alcock *et al.* 1998). Thus, dioxin congeners are ubiquitous, but with the exception of TCDD, their potency is quite low and not of much toxicological concern (Safe 1990).

TCDD is a byproduct of the active ingredient in 2,4,5-T. This herbicide was used as a mixture with 2,4-D to defoliate vegetation during the Vietnam War. In the past, a few imported formulations of

2,4-D were shown to contain some highly chlorinated dioxin congeners, the same congeners found in the environment and believed to be primarily the result of combustion processes. Compared to TCDD, their biological activity of the other congeners is low, and absent direct ingestion of these compounds in the diet, they are unlikely to be absorbed through the skin. Current quality control procedures during manufacturing have essentially eliminated any dioxin congeners of concern from domestic 2,4-D formulations. Thus, use of 2,4-D products manufactured in the U.S., whether at home or in agriculture and forestry, do not contaminate the environment with the dioxin congener of greatest regulatory concern, TCDD.

The proprietary nature of herbicide formulations limits the understanding of the risks posed by inert ingredients and adjuvant in herbicide formulations. Unless the compound is classified as hazardous by the USEPA, the manufacturer is not required to disclose its identity. It could be suggested that the inert ingredients in these herbicides are not toxic, or their toxicity would be reported to the EPA. This would hold true if considerable toxicological testing of inert ingredients has been done. That, however, has not been the case. USEPA is increasing the testing requirements for inert ingredients, but in many cases, the inert ingredients currently in use have not been tested rigorously and their toxicity is not well characterized. That being said, studies on the toxicity of technical grade formulations, which often contain the inert ingredients, account for the toxicity of the inert ingredients, and as has been reported here, these studies show that the use of herbicides by the Forest would not expose workers or the public to levels of concern.

Literature does report considerable information on types of inert ingredients and adjuvants present in herbicides proposed for use by the forest. As noted in USFS (1997c), Velpar L®, the trade name for hexazinone, contains 40-45 percent ethanol, an eye irritant and a considerable toxin if ingested. It has been reported the most common impurities of technical grade 2,4-D include other phenoxyacetic acids, a variety of chlorinated phenols, and possibly low levels of nitrosamines in amine salts (Ibrahim *et al.* 1991). Transline, the commercial formulation of clopyralid contains clopyralid as the monoethanolamine salt and isopropyl alcohol, an approved food additive (USFS 1999c). Both Tordon 22 and 22K contain the potassium salt of picloram (24.4%), the remaining consisting of polyglycol 26-2, the DOW name for polyethylene glycol, a widely used family of surfactants, considered to have low toxicity and frequently used in the formulation of ointments and cosmetics (MCCHB 2001).

USFS (1996c) reports that Garlon® formulations of triclopyr contain ethanol and kerosene. Technical formulations of imazapyr contain isopropyl alcohol and isopropanolamine salts of imazapyr (USFS 1999e). Glyphosate has been reported to contain small amounts of nitrosamine, and N-nitroglyphosate (USFS 1996d). Roundup, a formulation of glyphosate, contains the surfactant polyoxyethyleneamine (POEA), and contains 1,4-dioxane, classified by the USEPA as a probable human carcinogen. However, carcinogenic studies of Roundup by the USEPA have shown the herbicide to be non-carcinogenic (USFS 1996d). USFS (2000c) reports the inert ingredients in Escort®, which contains metsulfuron methyl, are confidential. They do report; however, the inert ingredients in Escort® are not classified by USEPA as toxic.

Many herbicide formulations contain dyes. The use of dyes can be beneficial in that they can color vegetation, making it less likely for an individual to inadvertently or intentionally consume contaminated vegetation. The presence of a dye in herbicide formulations may also make it easier for workers to see when they have been contaminated and allow for prompt remedial action.

Significant technological advances have been made with respect to dyes available for pesticide applicators. Several water soluble dyes of low toxicity are available now, and their use can provide an added level of safety for the worker and the public. One such dye Hi-Light™ is currently used by the forest. This dye is non-toxic, dissolves quickly and thoroughly in water-based pesticides, and breaks down in sunlight or dissipates in rain, and therefore does not appreciably migrate from the point of use (Becker Underwood 2003).

Surfactants are also commonly used in herbicide formulations. Surfactants are added to herbicides to improve herbicide mixing and the absorption or permeation of the herbicide into the plant. Like dyes and other inert ingredients, there is often limited information on the types of surfactants used and the toxicity of surfactants, especially since the industry considers the surfactant to play a key role in the effectiveness of the herbicide formulations. Most knowledge of surfactants is kept as proprietary information, and not disclosed. This is not always the case. USFS (1997c), which attempted to assess the effects of surfactant formulations on the toxicity of glyphosate, reported that the toxicity of glyphosate alone was about the same as the toxicity of the glyphosate and surfactant mixed and greater than the toxicity of the surfactants alone. Whether this same pattern would hold true of other herbicides having the same or different surfactants is unknown. If so, the toxicological studies performed on herbicide formulations (which contain the inert ingredients and surfactants) may accurately portray the toxicity and risks posed to humans by the surfactant.

The Helena NF currently uses Phase-II™ as a surfactant for application of herbicides. Phase II™ is a high-quality methylated seed oil derived from oilseed rape (95% by weight), formulated as an emulsified concentrate. (Loveland 2003). It is an alternative to mineral oil, recommended for use with herbicides. According to the manufacturer, it has a minimal impact on the environment due to its excellent degradation characteristics, but should not be applied directly to water (Loveland 2003).

Endocrine Disruption

The endocrine system includes tissues and hormones that regulate metabolism, growth, and sexual development. The Food Quality Protection Act (FQPA) requires that EPA develop tests to screen for chemicals with the potential to mimic hormones. Chemicals that do mimic hormones and cause biochemical changes in tissues are called endocrine disrupters or hormonally active agents (HAAs).

The concern over HAAs is due to the fact that the endocrine system is intimately linked with the brain and the immune system. All three systems communicate with one another to affect body development and functioning. Adverse effects on this network have been blamed for a variety of maladies ranging from cancer to infertility to behavioral problems (Felsot 2001).

Chemicals, other than our own hormones, can interact with components of the endocrine system. Scientists have discovered that many kinds of chemicals, including natural food biochemicals as well as industrial chemicals and a few pesticides, can mimic the action of the hormones estrogen or testosterone. Concern has also been expressed about potential effects on the thyroid hormone during early development (Felsot 2001).

Two general types of tests are used to screen chemicals for endocrine disrupting abilities. The most widely used tests are in-vitro tests. These tests are conducted in a test tube or dish using cells and in some cases the actual protein receptors, enzymes, and genes involved in the biochemistry of the endocrine system. In-vitro tests can be used to quickly screen large numbers of chemicals for their ability to interact with different biochemical components of the endocrine system.

Positive in-vitro tests, however, do not necessarily indicate that a substance would actually disrupt hormone functioning in a whole organism. In-vitro screening tests are properly used to determine which chemicals should be subjected to a second type of test, the in-vivo or "live animal" test. In-vivo tests use whole animals that are fed various doses of chemical. In some cases, the chemical is injected beneath the skin or directly into the body cavity. Developmental and reproductive toxicity studies with live animals over several generations are especially useful for determining if a substance adversely affects the endocrine system.

With one exception, the drug DES (diethylstilbesterol), all chemicals that have been tested in-vitro are thousands to millions of times less potent than the natural estrogen hormone (estradiol) (Felsot 2001). Also, as exhibited by estradiol, all chemicals tested in-vitro, appear to show definitive threshold effects (i.e., NOELs) for estrogenic activity. No pesticides, food biochemicals, or other synthetic chemicals have definitively shown greater and/or different in-vitro effects at low doses as compared to higher doses. Although our natural hormones function at very miniscule levels in the body, endocrine disrupter tests have shown that interactions of hormone receptors with natural and synthetic chemicals are still related to dose during exposure. Even chemicals capable of interacting with the endocrine system at sufficiently high doses have not been found biologically active at low doses (USEPA 1997a).

In the in-vivo (live animal) studies to date, only a handful of chemicals, including natural food biochemicals, a few pesticides, and several industrial chemicals show endocrine disrupting effects (Felsot 2001). The in-vivo experiments usually involve feeding pregnant rats or mice one or more doses of a chemical. With one exception, the drug DES, any effects that have been observed were in tests with doses at least thousands of times greater than environmental or dietary concentrations.

In virtually all published cases where a series of doses are tested in-vivo, endocrine effects did not occur below some threshold dose (USEPA 1997a). The EPA (1997a) concluded with few exceptions (e.g. diethylstilbestrol) a causal relationship between exposure to a specific environmental agent and an adverse effect on human health operating via an endocrine disruption mechanism has not been established.

Chemically Sensitive Individuals

A small percentage of the population may have a hypersensitivity to a wide variety of pesticides, perfumes, household cleaners, construction products or industrial chemicals, including the herbicides proposed for use by the Forest. These people are generally aware of their sensitivities and would not be allowed to work on herbicide spray crews or in treated areas until either safe re-entry periods, or a period they feel is adequate based on their personal knowledge of their sensitivity, has passed. (Safe re-entry in areas where herbicides have been applied is when the herbicide has dried on the leaf surface). Hypersensitive individuals may also be subject to effects from gasoline engine exhaust, gasoline powered weed mowers, and automobiles used for invasive weed control and public use both in and outside the Project areas.

Uncertainty

With the exception of accidental exposures or exposures under very conservative and somewhat implausible exposure scenarios, workers and the general public should not be exposed to a herbicide at concentrations that result in an adverse health effects. This conclusion is predicated on forest service employees wearing appropriate personal protection, applying herbicides in accordance with the label, and implementing the job hazard analysis program to be used on this project. By doing so, possible exposure by contact or through drift would result in a potential dose below that determined to be safe by the EPA over a lifetime of daily exposure. It is also predicated on the findings, back by toxicological studies, that a person can be exposed to some amount of a contaminant and not have an adverse effect (i.e. the dose determines the effect.)

All of the herbicides proposed for use by the Forest must be registered for use by the USEPA and the Montana Department of Agriculture. Registration of these herbicides and Federal regulations adopted to protect workers and the general public has required more scientific information and justification for use of herbicides. Nevertheless, there are many reports in the scientific literature and sections of this report that document associations between herbicide exposure and alterations of the immune system, autoimmune disorders, and increases in the probability of carcinogenesis. MCCHB (2001), Citron (1995), USEPA (1995) Glover-Kerkvliet (1995) are just a few references that provide information on such effects. The body of literature on herbicide effects raises concerns about additive and synergistic effects of exposure to more than one herbicide, unstudied or unknown consequences of low-level chronic exposures, toxicity of inert ingredients, by-products or contaminants of herbicides, and uncertainties about the health effects of sensitive populations. There is also the realization that it is difficult, if not impossible, for government or any scientific agency to fully evaluate a chemical and all the potential combinations of them to ensure that there would not be an adverse effect.

It would be inappropriate to suggest that use of herbicides to control noxious weeds is without risk to workers and the general public. If herbicides are used, there is the possibility of worker and general public exposure, no matter how many mitigation measures are implemented. All chemical exposure results in some level of health risk, the risk primarily being a function of the dose, or amount a person or organism is exposed to over a period of time.

It is equally inappropriate to conclude that any exposure, regardless of dose, would result in an effect. It is easy to find a report showing a health effect caused by the exposure to a herbicide or any other chemical. The toxicological studies are purposely done using high doses to demonstrate an effect. It is the herbicides that show effects at low levels of exposure or those levels anticipated when in use that should raise concern. With respect to this project, the potential dose received by the worker or person of the public does not approach the exposure levels shown to cause acute or chronic toxicity in the literature. Acute effects occur at doses thousands to tens of thousands of times higher than those estimated for the worker or public for this project. Likewise, chronic effects reportedly occur at doses significantly higher than that expected for this project.

There are simply too many variables (receptor sensitivity, dose received, use of personal protection, etc.) for anyone to predict with 100 percent certainty the potential health risk of herbicide use and exposure. What is known is that through a process of continual review of toxicological data on herbicides, the EPA, using very conservative assumptions, has determined a dose they believe would not result in an adverse health effect for herbicides proposed for use on this project. We know that there are studies which show that exposure to the herbicides proposed for use at high doses can cause deleterious effects. We also know that risk assessments have been completed to determine the estimated dose a worker or person of the general public might be exposed to under varying exposure scenarios. Most important, we know through a comparison of EPA established safe doses and estimated exposures that the estimated dose that a worker or person of the general public may be exposed to through use of a herbicide on this project would be below that determined to be safe by the EPA for a lifetime of daily exposure. Therefore, no health effects and risks to workers and the general public are anticipated by the use of herbicides by the Forest.

Herbicide Drift

Dynamics

Spray drift is largely a function of droplet particle size, release height, and wind speed. Other factors that control drift to a lesser degree include the type of spray nozzle used, the angle of the spray nozzle, and the length of the boom. The largest particles, being the heaviest, would fall to the ground sooner than smaller sizes upon exiting the sprayer. Medium size particles can be carried beyond the sprayer swath (the fan shape spray under a nozzle), but all particles would deposit within a short distance of the release point. The physics of sprayers dictates that there would always be a small percentage of spray droplets small enough to be carried in wind currents to varying distances beyond the target area. Because the small droplets are a minor proportion of the total spray volume, their significance beyond the field boundary rapidly declines as they are diluted in increasing volumes of air (Felsot 2001).

Drift characteristics differ between pesticides. With herbicides proposed in this analysis, it is not critical to coat the entire leaf since some of the products can be absorbed by the plant roots and good efficacy can be achieved by larger droplets on leaves to the target plant. Therefore, herbicide drift can be intentionally reduced by generating larger droplets without reducing efficacy.

Spray nozzle diameter, pressure, amount of water in the tank mixture, and release height of the spray are important controllable determinants of drift potential by virtue of their effect on the spectrum of droplet sizes emitted from the nozzles (Felsot 2001). Meteorological conditions such as wind speed and direction, air mass stability, temperature and humidity and herbicide volatility also affect drift.

Commercial drift reduction agents are available that are designed to reduce drift beyond the capabilities of the determinants previously described. These products create larger and more cohesive droplets that are less apt to break into smaller particles as they fall through the air. They reduce the percentage of smaller, lighter particles that are the size most apt to drift off the treatment area.

Wind speed increases the concentration of drifting droplets leaving the treated area if the wind is adverse (blowing away from the release point in the treatment area). If the wind is favorable (blowing into the treatment area) drift can be reduced. Numerous studies have shown that over 90 percent of spray droplets land on the target area, and about 10 percent or less move off-target, and that the droplets that move off-target most typically deposit within 100 feet of the target area (Felsot 2001; Yates *et al.* 1978; Robinson and Fox 1978).

Herbicide Drift from Aerial Applications

Drift deposition on surfaces measured downwind from aerial spray sites is typically less than 1 percent, and often less than 0.1 percent, of on site deposition (Yates *et al.* 1978; Robinson and Fox 1978). Drift deposition from ground equipment can be one-tenth of that from aerial application at comparable distances from a spray site (Yates *et al.* 1978).

Less information is available on the concentrations of herbicides that remain airborne at greater distances from application sites. Robinson and Fox (1978) measured airborne concentrations of herbicides at various distances from aerial spray plots. Under conditions designed to reduce drift, these researchers did not detect airborne levels of herbicides beyond 100 feet downwind of 500-foot wide spray plots (detection limit of 0.1 microgram - there are about 28 million micrograms in an ounce).

These researchers also measured ambient air concentrations of 2, 4-D at seven stations in eastern Washington where several million acres of wheat are treated with herbicides annually. Ambient concentrations of non-volatile fractions of 2, 4-D typically averaged 0.1to 0.2milligrams/cubic meter during periods of heavy application. Picloram and clopyralid, the herbicide most like to be used by the Forest, are also non-volatile herbicides, and the long-range drift of these compounds may exhibit similar dynamics as the non-volatile fractions of 2, 4-D. Therefore, the ambient concentrations of picloram or clopyralid from the proposed projects may be similar to the concentrations measured by Robinson and Fox.

Numerous investigations of factors affecting drift from aerial applications are reported in scientific literature (DiTomaso 1999; Yates *et al.* 1978; Robinson and Fox 1978). Three of the most comprehensive studies are discussed below.

RAHUFS Drift Estimations

The 1992 Risk Assessment for Herbicide Use in Forest Service Regions 1,2,3,4 and 10 and on Bonneville Power Administration Sites, or RAHUFS, determined spray drift distances downwind of an application site for aerial, backpack, and ground mechanical application equipment. The detailed methodology used in this study is included in USFS (1992). The results of the RAHUFS spray drift analysis indicates "low" health risk to the public from ground and aerial applied herbicides (USFS 1992). "Low risk" was defined in the study as drift from the herbicides that presents a less than one in a million systemic, reproductive or cancer risk. Spray drift from hand application equipment was found to be negligible.

AGDRIFT / Felsot Drift Estimations

Felsot (2001) used the EPA/USDAFS AGDRIFT model to simulate herbicide sprays for several application scenarios, including a truck mounted spray boom set at two heights and a helicopter at two heights. These simulations included crosswinds blowing at ten and six mph. The model output was an estimated amount (percent of that applied) that deposited a defined distance from the edge of a spray swath. A spray deposition curve was developed to calculate a dose that a bystander could potentially receive if standing within the drift zone of an application. The whole body surface area was assumed exposed to a drifting spray (highly conservative), and the bystanders were assumed to be an adult weighing 70 kg and a child weighing 10 kg. Absorption of the depositing dose was assumed to be 10 percent. Calculations were made to determine the percentage of the depositing spray that a child could be exposed to on a daily basis over a 70-year life span and be within the EPA safety guidelines as defined by the RfD (i.e., the "safe dose"). The study estimated that for aerial application, the equivalent safe deposits corresponded to distances from the edge of the spray field of 0, 0, and about 60 feet respectively, for clopyralid, picloram, and 2,4-D. For a ground application, the child would receive a safe dose of 2,4-D at 27 feet from the sprayed field edge.

Mormon Ridge Field Drift Monitoring

In this study, herbicides were aerially applied with aircraft to the Mormon Ridge winter range in 1997 and 1999. Mormon Ridge presented a difficult treatment scenario in that it is extremely steep, has rolling topography, considerable microclimate variability and aerial application occurred upslope of Mormon Creek, a bull trout-spawning stream. Mormon Creek flows along the bottom of the roughly three miles by ½- to ¾-mile wide treatment area.

Picloram was aerial applied on Mormon Ridge in 1997. Buffer zones and water quality were monitored and continuous automated water samples collected. Analysis of the water samples (conducted by the Montana Department of Public Health and Human Services Chemistry Lab) indicated no herbicide entered the stream to a detection level of 0.1 parts per billion (USFS 1996b). The Maximum Contaminant Level (MCL) as set by the EPA for picloram in drinking water is 500 parts per billion (Dow AgroSciences 1999). No picloram was detected in Mormon Creek when tested at a level *5,000 times* lower than the EPA MCL. Drift cards were also placed along Mormon Creek to monitor drift. The cards indicated no detectable drift reached the creek.

The Mormon Ridge pilot project area was also aerial treated with picloram three growing seasons after the initial application to control invasive weeds that germinated from the soil seed bank after the herbicide decomposed. Drift cards used during this subsequent treatment did not detect picloram in the riparian aerial spray buffer.

Spray Drift Summary

Based on the above information, aerial herbicide applications would have a short-term, very localized impact as a result of drift. Most of the drift would settle to within 100-200 feet of the point of release in adverse conditions. Herbicide spray drift from aerial treatments under Alternative A would not significantly affect the health of the general public or adversely affect water quality, provided environmental protection measures are implemented to avoid drift toward persons and sensitive resources. Applications should be made when there is an organized wind less than 6 mph blowing *away* from sensitive areas. This practice combined with a buffer adjacent to sensitive areas and a drift reduction agent would likely result in no significant offsite drift. Significance in this context refers to concentrations above USEPA established "safe" levels.

ALTERNATIVE A

Potential for public exposure to herbicides under Alternative A is low since most project areas are remote and away from population centers and concentrated public recreation areas. Exposure to the public and sensitive areas is also limited for this alternative by implementation of several mitigation measures, including the use of buffer zones. Other mitigation measures include submitting press releases to local Newspapers indicating the potential windows of aerial treatment for specific areas. Signs would be placed at trailheads to notify the public of spraying two weeks before spraying and after the herbicide has been applied.

Aerial application would be prohibited when winds were blowing toward sensitive areas or private lands. Plastic spray cards would be placed within buffer zones to monitor herbicide drift along creeks and near sensitive resources. Even without the above mitigation measures, herbicide treatments (aerial and ground) under Alternative A would occur infrequently (every 2-3 years on an acre basis) and the public would not receive daily exposures above the USEPA RfDs, a dose level considered safe by the USEPA over a lifetime of daily exposure. Therefore, no adverse health effects are anticipated for the general public based on estimates of exposure, estimates of drift, and the mitigation measures that would be implemented under this alternative.

Under Alternative A, approximately 50 percent of the project areas would be treated by aircraft delivery systems. Potential human health risks to workers from aerial application of herbicides would be lower than other delivery systems because aircraft application requires less herbicide handling and fewer workers, reducing the potential for exposure, particularly to the skin during repeated handling. The duration of direct herbicide mixing would also be very short as compared to ground application, thereby reducing worker exposure time and the potential for an accident or spill to occur. Workers would not receive daily exposures above the USEPA RfDs, provided the herbicides are applied according the label, personal protective equipment is used, and the USFS job hazard analysis program is implemented. Therefore, health risks are not anticipated for workers applying herbicides.

Risks to human health from mechanical noxious weed control measures are minor and may include cuts, burns, repetitive motion injuries, back and knee strain, allergies, and skin irritation to individuals doing the work. The direct effects on human health would be greatest to allergy and contact dermatitis sufferers who are sensitive to invasive weeds or other wild land vegetation. Skin irritations may result from reaction to the sap of various invasive weeds on contact, such as spotted knapweed and leafy spurge, or to the physical parts of the plant itself, such stickers in thistles. Gloves, long sleeved shirts and boots would prevent injuries or irritations, and therefore, no human health effects are anticipated by mechanical removal of weeds.

Past experience on the Forest indicates biological and cultural management would not impose a risk to human health of workers wearing appropriate personal protection or the general public. There is a potential risk that is associated with the use of equipment; however, standard operating procedures will be followed to avoid these risks.

ALTERNATIVE B

Potential human health risks for the worker and the public from herbicides would be the greatest under Alternative B because more ground application would be done compared to Alternative A. The health risks not related to herbicide exposure would also be greatest under this alternative due to an increase in trips, slips, and falls associated with ground application in rough terrain. While risks to human health are greatest under this alternative, exposures to workers and the general public would be below a level considered to be safe by the EPA for all herbicides proposed for use by the Forest. Under this alternative, all project areas would be treated by backpack, OHV, and truck mounted herbicide delivery systems. Backpack applications have the greatest potential for worker exposure to herbicides. More handling and mixing of the herbicides, and more work in close proximity to the spray nozzle would result in greater exposure and significantly greater health risk to the worker. The duration of application and number of applications needed to treat the areas would also be the greatest under Alternative B, and would increase worker exposure. Backpack sprayers can treat about one to two acres per day on rugged, steep, and remote terrain. Therefore, treatment of large areas would likely require more applications over a period of 10 to 12 weeks in the spring and fall. Accidents and injuries to the applicator related to the use of horses, ATVs or trips, slips and falls are increased because of increased application time. The duration and number of applications needed would also increase the chance of the general public encountering a spray operation.

The more time spent applying herbicides increases the risk of a spill, accident, or mishap. Therefore, the risk of a herbicide spill or accident would be greatest under Alternative B. The general public may be secondarily exposed to a spill or release should it reach surface or ground water. The indirect effects of a spill in the form of public exposure and disruption would be commensurate with the proximity of the spill area to the public and public exposure pathways.

Indirect effects on human health would increase as invasive weeds spread and affect those persons sensitive to them, although to a lesser degree than Alternative C.

As in Alternative A, there would be no impacts associated with mechanical, biological, and cultural treatment of weeds for workers and the public.

ALTERNATIVE C

Alternative C is the No-Action Alternative and would maintain the current level of weed control. As with all of the alternatives, the potential risk of an injury to the applicator related to trips, slips, and falls and risk of infury associated with use of ATVs and horses exists. The implementation of standard operating procedures would reduce this risk significantly.

Under this alternative, weeds would continue to spread on the Forest and impact individuals affected by allergies, asthma, and minor skin irritations caused by certain noxious weed species. Approximately 10 to 15 percent of the United States population suffers from allergy symptoms from noxious weed species such as knapweed. Knapweed pollen is a common and powerful allergen that peaks in August and produces strong allergy symptoms. Knapweed pollen has been implicated in causing allergic rhinitis. Allergies to airborne seeds may also complicate or trigger asthma that may take up to two years to get completely under control (Nielsen 1999). Indirect effects on human health would increase as invasive weeds spread and affect those persons sensitive to them.

As in Alternatives A and B, there would be no impacts associated with mechanical, biological, and cultural treatment of weeds.

CUMULATIVE EFFECTS

Past, present and reasonably foreseeable activities that may have cumulative effects on human health include weed control efforts (aerial and ground application of herbicides) on private and public lands in central Montana.

Based on the results of risk assessments performed by the Forest Service, the ongoing and future activities are not expected to result in exposures to workers and the general public at doses that exceed the RfD. Therefore, under Alternatives A and B, no cumulative adverse health effects are anticipated for workers and the general public, provided herbicides are applied in accordance with the label as proposed. Alternative C proposes no additional herbicide use, so there are no anticipated cumulative human health effects associated with potential exposure to herbicides under this alternative. There are no anticipated cumulative health effects associated with biological, mechanical, or cultural treatment of weeds.

Inherent to having confidence in these conclusions is an understanding of what an RfD is (how safe it is) and how it is determined. The EPA develops RfDs for chemicals including the herbicides proposed for use by the Forest. The RfD is defined by the USEPA (1989) as an estimate of a daily dose over a 70-year life span that a human can receive without an appreciable risk of deleterious effects. A reference dose is determined by subjecting animals to exposures of a substance and determining the NOEL from the entire body of scientifically supportable animal studies performed for that substance. The NOEL represents the dose the USEPA believes would not result in an effect. RfDs are calculated by dividing the NOEL, a level or dose already thought to not cause and effect, by a "safety factor," usually 100, to account for extrapolation of animal data to humans and sensitive individuals. Therefore, the RfD for a chemical is a dose at least 100 times lower than that shown to have an effect in any animal study performed with the subject chemical. With respect to herbicide applications, it has been estimated in nearly all cases (see **Table 4-18**) that the dose a worker or a person of the general public would be exposed to would be below the RfD, except for somewhat implausible exposure scenarios (spray over entire naked body, wearing heavily contaminated gloves for an extended period).

CONSISTENCY WITH FOREST PLAN, LAWS, AND POLICIES

All alternatives are consistent with EPA, OSHA and FS regulations regarding pesticide use and worker safety.

CHAPTER 5
CONSULTATION, COORDINATION, AND PREPARATION

LIST OF PREPARERS

FOREST SERVICE PERSONNEL

NAME/DUTIES	EDUCATION/EXPERIENCE
Dave Carroll NEPA	B.S. Forest Management 23 years experience
Dwight Chambers	M.S. Resource Management, B.S. Forestry w?Range Option 38 years experience
Carl Davis Historical Resources	M.A. Anthropology, B.A. Anthropology 22 years experience
Sue Farley Soils	B.S. Soil Science 26 years experience
Jan Fauntleroy NEPA	B.S. Resource Management 27 years experience
Duane Harp Line Officer Review	M.S. Wildland Resource Management, B.S. Forest Management 37 years experience
Dennis Heffner NEPA	Masters Public Administration, B.S. Forestry 32 years experience
Diane Johnson Human Health	16 years experience
Gerald Meyer Economics, Wild and Scenic Rivers, Research Natural Areas	B.A. History 26 years experience
Dea Nelson Project Co-Team Leader, Contracting Officer's Representative	M.S. Botany, B.A. Biology 20 years experience
Lois Olsen Vegetation	B.S. Range Management 25 years experience
Dave Payne Recreation, Wilderness and Roadless	B.S. Resource Management – Recreation 27 years experience
Denise Pengeroth Wildlife	M.S. Wildlife Biology, B.A. English, B.S. Wildlife Biology 18 years experience
Bo Stuart Watershed	M.S. Microbiology, B.S. Microbiology 28 years experience
Liz VanGenderen NEPA/Writer-Editor	B.S. Natural Resource Management 17 years experience

Len Walch Aquatics	M.S. Fisheries Management, B.S. Fishery Science, B.S. Biology 26 years experience
Jay Winfield Range, Weeds, Human Health Project Co-Team Leader	B.S. Range/Wildlife Management 22 years experience

CONTRACTOR/CONSULTANTS

NAME/DUTIES	EDUCATION/EXPERIENCE
Chris Cerquone – Tetra Tech Human Health	B.S. Biology, M.S. Environmental Studies 15 years experience
Cameo Flood – Tetra Tech Wilderness, Roadless, Research Natural Areas, Wild and Scenic Rivers	B.S. Forest Resource Management 18 years experience
Joe Elliott – Joe Elliot Consulting Vegetation	Ph.D. Botany, B.S. Biology/Chemistry 30 years experience
Dan Hall – Western Cultural Historical Resources	M.A. Interdisciplinary Studies (History/Anthropology), B.A./Geology 22 years experience
Tim Holman – Tetra Tech Wildlife	B.S. Earth Science-Physical Geography 5 years experience
Karen Lyncoln – Tech Services Socio-Economic	B.A./Urban Affairs 32 years experience
Pat Mullen – Tetra Tech Project Manager	M.A. Zoology (Wildlife Biology), B.S. Biology 22 years experience
Joe Murphy – Tetra Tech Recreation	B.A. Liberal Arts/Geography 29 years experience
Doug Rogness – Tetra Tech Water	M.S. Hydrology, B.S. Geology 24 years experience
Sally Staley – Tetra Tech GIS Analysis and Maps	25 years experience
Walt Vering – Tetra Tech Aquatics	M.S. Natural Resources, B.A. Biology 15 years experience

FEIS MAILING LIST

Alliance for the Wild Rockies

Beaverhead-Deerlodge National Forest

Bill Hammer

Bob Bushnell

Boulder Community Library

Broadwater Community Library

Broadwater County Commissioners, Elaine Mann

Broadwater County Extension Service, Virginia Knerr

Broadwater County Weed District, Pam Converse

Capital Trail Vehicle Association, Action Committee

Custer National Forest, Kim Reid

Dan Edeas

David Mannix

Don Burnham

Doug Abelin

Ecology Center

Gallatin National Forest, Susan Lamont

Gary Sutton

Gordon Thompson

Helena Hunters & Anglers Assn., Stan Frasier

Honorable Conrad Burns

Honorable Dennis Rehberg

Honorable Brian Schweitzer

Honorable Max Baucus

Janet Spencer

Jefferson County Commissioners

Jefferson County Weed District, Sam Little

Jim Frisbee

Jim Rice

Jock Doggett

Joe Dooling

John Robinson

Kathy Lloyd & Drake Barton

Kelly Ingalls

Ken Krause

Last Chance Back Country Horsemen, Bob Braico

Lewis & Clark County Commissioners, Ed Tinsley

Lewis & Clark County County Library

Lewis & Clark County Weeds, Larry Hoffman

Lewis & Clark National Forest

Lincoln Community Library

Lisa Bay

Madison County Weed Board, Margie Edsall

Mark Lincoln

Meagher County Commissioners

Meagher County Weed Board, Otto W. Ohlson

Melissa Kwasny

Mitchell Hegman

Montana Department of Environmental Quality

Montana Department of Fish Wildlife & Parks, Jeff Hagener, Gayle Joslin, Tom Carlsen, Regions 2, 3 & 4

Native Ecosystems Council, Sara Jane Johnson

Office of Environmental Affairs

Paul M. Backlund

Phyl Miller

Powell County Commissioners

Powell County Weed Board, Jason Smith

Ray Smith

Roger Lloyd

Sandy Smith

State Clearinghouse, Manager, Intergovernmental Review

U.S. Department of Interior, Bureau of Reclamation, Great Plains Region

U.S. Department of Interior, U. S. Fish and Wildlife Service, Mark Wilson

U.S. Department of the Interior, Office of Environmental Affairs

U.S. Environmental Protection Agency, Office of Federal Actions, EIS Filing Section

U.S. Environmental Protection Agency, Region 8, MT Office

USDA Forest Service, Director, Environmental Coordination

USDA Forest Service, Northern Region

USDA National Agricultural Library

USDA Office of Civil Rights

Wild Divide Chapter, Montana Wilderness Association, David Rusoff

CHAPTER 6
REFERENCES

Alcock, R. E., M. S. McLachlan, A. E. Johnston, and K. C. Jones. 1998. Evidence for the presence of PCDD/Fs in the environment prior to 1900 and further studies on their temporal trends. Environ. Sci. Technol. 32(11):1580-1587.

Arbuckle, T.E. et al. 1999. Exposure to Phenoxy Herbicides and the Risk of Spontaneous Abortion. (Abstract). 10 (6).

Asher, J. 1998. The Spread of InvasiveWeeds in Western Wildlands: A State of Biological Emergency. The Governor's Idaho Weed Summit. Boise, ID, May 1998.

Bakke, D. 2003. Human and ecological risk assessment of Nonylphenol Polyethoxylate-based (NPE) Surfactants in Forest Service Herbicide Applications. USDA Forest Service, Pacific Southwest Region.

Banci, V. 1994. Wolverine. Pages 99-127 in L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.F. Lyon, and W.J. Zielinski, eds. American marten, fisher, lynx, and wolverine in the western United States. U.S. Forest Service Gen. Tech. Rep. Rm-254

Barton, D. and S. Crispin. 2001. Sensitive plants in weed management areas on the Helena National Forest. Unpublished Report. Montana Natural Heritage Program. Helena, MT.

________2002. Sensitive plant species in weed management areas on the Helena National Forest. Final Report, December 2002. Montana Natural Heritage Program. Helena, Montana.

Beck, K.G. 1999. Biennial thistles. In: Biology and management of noxious rangeland weeds. pgs. 154-161. Eds. R. Sheley and J. Petroff. Oregon State University Press, Corvallis, Oregon.

Becker Underwood. 2003. Hi-Light takes the guesswork out of spraying!. Available online at www.bucolor.com.

Beebee, T.J. and R.A. Griffiths. 2005. The amphibian decline crisis: a watershed for conservation biology? Article in press, Biological Conservation.

Blair, A. 1996. Risk factors: Pesticides. Pages 99-101 in A. Harris, B.K. Edwards, W.J. Blot, and L.A. Gloeckler Ries, eds. Cancer Rates and Risks (4th Edition). pgs. 99-101. U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health. NIH Publication No. 16-691.

Bowles, A. 1995. Responses of wildlife to noise. *In* Knight, R. L. and Gutzwiller *eds.*Wildlife and Recreationists. Island Press, Washington D. C. 372 pp.

Brady, N.C., and R.R. Weil. 1999. The Nature and Properties of Soils. 12th Edition. Pgs. 204-205, 410-411, 413-414, 674, 734. Prentice Hall. Upper Saddle River, NJ.

Brown, M., C. Duncan, L. Olsen, R. Beard, and T. Playford. 2002. Effect of herbicide treatments in Dalmatian toadflax establishment and spread in burned forested site. Preliminary Report. Weed Management Services, pgs.1-12. Helena National Forest, and Dow Agrosciences.

Brussard, et al. 1997. Biodiversity and ecosystem functioning in soil. Ambio. 26:563-570.

Bull, E. and J. Jackson. 1996. The Birds of North America. No. 148, Pileated Woodpecker.

Bull, E.L. and B.C. Wales. 2001. Effects of disturbance on amphibians of conservation concern in eastern Oregon and Washington. Northwest Science Vol. 75, Special Issue.

Buskirk, S.W. and L. F. Ruggiero. 1994. American Marten. Pp. 7-37 in L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. U.S. Dept. of Agriculture, Forest Service, Gen. Tech. Rep. RM-254.

Bussan, A. and W. Dyer. 1999. Herbicides and rangeland. In: Biology and management of noxious rangeland weeds. Eds. R. Sheley and J. Petroff. Oregon State University Press, Corvallis, Oregon.

Carey, C. and C. Bryant. 1995. Possible interrelations among environmental toxicants, amphibian development, and decline of amphibian populations. Environmental Health Perspectives. Volume 103, Supplement 4. May 1995.

Charles J.M. et al. 1996. Chronic dietary toxicity/oncogenicity studies on 2,4-Dichlorophenoxyacetic acid in rodents. Fundamental and Applied Toxicology 33: 166-172.

Citron, M. 1995. Perplexing peroxisome proliferators. Environmental Health Perspectives Volume 103, Number 3. March.

Clark, T.W. 1987. Martes Americana. Mammalian Species No. 289: 1-8.

Cooper, S., P. Hendricks, C. Currier, and W.M. Jones. 2004. Survey of amphibians, sensitive plants and community types of wetlands: focus on area of Snow-Talon Fire and vicinity, Helena National Forest. 17 pp.

Cox, C. 1998. Herbicide Factsheet. Picloram. Journal of Pesticide Reform Vol. 18 No. 1. pgs 13-20. Eugene, Oregon.

DeBano, Leonard F., Daniel G. Neary and Peter F. Fflolliott. 1998. Fire's effects on ecosystems. Pgs. 63-64, 96-99, 178-183. John Wiley & Sons, Inc. New York.

DiTomaso, J. 1999. Risk analysis of various weed control methods. Weed Science as repeated in TechLine. University of California. Davis.

DiTomaso, J.M., J.R. Miller, G.B. Kyser, A.W. Hazebrook, J. Trumbo, D. Valcore, and V.F. Carrithers. 2004. Aerial application of clopyralid demonstrates little drift potential and low toxicity to toads. California Agriculture 58 (3): 154-158.

Dow AgroSciences (DOW). 1999. Picloram and the Environment. Technical Profile. November.

________ 2001. Answers to questions about products containing picloram: picloram and animals/wildlife.

Duncan, C. 1997. Environmental benefits of weed management. pgs. 3-18. Weed Management Services.

Duncan, C.L. 2001. The Montana weed management plan. Weed summit steering committee and weed management task force in cooperation with federal and state agencies, county weed districts, and private land managers. 37 p. plus appendices.

Duncan, C., J.Story, and R. Sheley. 2001. Montana Knapweeds: Identification, Biology, and Mangement. Montana State University. Circular 311. 19 pp.

Ecobichon, D.J. 2001. Toxic effects of pesticides. Pages 763-810 in C.D. Klaassen, ed. Casarett and Doull's Toxicology: The basic science of poisons, Sixth ed. McGraw-Hill Medical Publishing Division, New York, NY.

FaunaWest Wildlife Consultants. 2004. Summary of northern goshawk surveys at five selected sites on the Helena National Forest. 9 pp.

Faustini, A., L. Settimi, R. Pacifici, V. Fano, P. Zuccaro, and F. Forastiere. 1996. Immunological changes among farmers exposed to phenoxy herbicides: preliminary observations. (Abstract) Occupational and Environmental Medicine. 53: 583-585.

Felsot, A. 2001. Assessing the safety of herbicides for vegetation management in the Missoula Valley region – A question and answer guide to human health issues. Food and Environmental Quality Laboratory. Washington State University. Richland.

Foresman, K. R. 2001. The Wild Mammals of Montana. American Society of Mammalogists. Special Publication No. 12. Pp. 39-41.

Forlani, G., M. Mantilli, M. Branzoni, E. Nielsen, and F. Favilli. 1995. Differential sensitivity of plant-associated bacteria to sulfonylurea and imidazolinone herbicides. Plant and Soil. 176:243-253.

Foresman, K. R. 2001. The Wild Mammals of Montana. American Society of Mammalogists. Special Publication No. 12.

Fryrear, D.W. 2000. Wind erosion. G195-G216. In Handbook of Soil Science. pgs. G-195 thru G-198. M.E. Sumner (Ed). CRC Press. Boca Raton, FL.

Fuhlendorf, S.D., D.M. Engle, D.C. Arnold and T.G. Bidwell. 2001. Influence of herbicide application on forb and arthropod communities of North American tallgrass prairies. Agriculture Ecosystems and Environment.

Garabrant, D.H. and M.A. Philbert. 2002. Review of 2,4-Dichlorophenoxyacetic acid (2,4-D) epidemiology and toxicology. Crit. Rev. Toxicol. 32:233-57.

Gilliom R.J., J.E. Barbash, C.J.Crawford, P.A.Hamilton, J.D.Martin, N. Nagagaki, L.H. Nowell, J.C.Scott, P.E. Stackelberg, G.P.Thelin, and D.M Wolock. 2005. The Quality of our Nation's Waters--Pesticides in the Nations's Streams and Ground Water, 1992-2001: U.S. Geological Survey Circular 1291, 172 pp.

Glover-Kerkvliet, J. 1995. Environmental assault on immunity. Environmental health perspectives. Vol. 103, No. 3, March 1995. Available online at http://ehpnet1.neihs.nih.gov/docs/1995/103-3/focus.html.

Goodwin, K.M and R.L. Sheley. 2001. What to do when fires fuel weeds. A step-by-step guide for managing invasive plants after a wildfire. Rangelands 23(6), pp. 15-21 December 2001.

Graham, R.T., R.T. Reynolds, M.H. Reiser, R.T. Bassett and D.A. Bayce. 1993. Sustaining forest habitat for the northern goshawk: a question of scale. In: Block, W.M., M.L. Morrison and M.H. Reiser, eds. 1993. The northern goshawk: ecology and management. pgs. 12-17. Cooper Ornithological Society. Studies in Avian Biology, No. 16.

Gratkowski, H. J. 1977. Seasonal effects of phenoxy herbicides on ponderosa pine and associated brush species. Forest Science 23(1): 2-12.

Hall, R. and P. Henry. 1992. Assessing effects of pesticides on amphibians and reptiles. Status and Need. Herpetological Journal Vol. 2. pgs. 65-71.

Hash, H.S. 1987. Wolverine. Pages 575-585 in M. Novak, J.A. Baker, ME. Obbard, eds. Wild furbearer management and conservation in North America. Toronto: Ontario Ministry of Natural Resources: 575-585.

Hayes, H.M., R.E. Tarone, K.P. Cantor, C.R. Jessen, D.M. McCurnin, and R.C. Richardson. 1991. Case-control study of canine malignang lymphoma: positive association with dog owner's use of 2,4-dichlorophenoxyacetic acid herbicides.(Abstract) J. Natl. Cancer Inst. 83:1226-1231.

Hayes, T.B., A. Collins, M. Lee, M. Mendoza, N. Noriega, A. A. Stuart, and A. Vonk. 2002. Hermaphroditic, demasculinized frogs after exposure to the herbicide atrazine at low ecologically relevant doses. Proc. Natl. Acad. Sci. 99:5476-5480.

Heinemeyer, K.S. and J.L. Jones. 1994. Fisher biology and management in the western United States: a literature review and adaptive management strategy. USFS, Forest Service, Northern Region, Missoula, MT. Pp. 14-19.

Hendricks, P. 1997. Status, distribution, and biology of sculpins (Cottidae) in Montana: a review. Montana Natural Heritage Program. (Abstract) Helena, MT. 29 pp.

Hillis, M., A. Jacobs, and V. Wright. 2002. USDA Forest Service Region 1. Black-backed woodpecker assessment, Review Draft. 19 pp.

Hutto, Richard L. 1995. Composition of bird communities following stand-replacement fires in northern Rocky Mountain (U.S.A.) conifer forests. Conservation Biology 9(5): 1041-1058

Horn H. and T. Baumgartl. 2000. Soil Physics. *In* Handbook of Soil Science. Ed. Sumner M.E. CRC Press. Boca Raton Fl. pp A-33.

Ibrahim, M.A., G.G. Bond, T.A. Birke, P. Cole, F.N. Dost, P.E. Enterline, M. Gough, R.S. Greenburg, W.E. Haplerin, E. McConnell, I.C. Munrun, J.A. Swendberg, S.H. Zahm and J.D. Graham. 1991. Weight of evidence on the Human Carcinogenicity of 2,4-D. Environmental Health Perspectives 96:213-222.

Information Ventures, Inc. 1995a. Glyphosate: Pesticide Fact Sheet. Prepared for the U.S. Forest Service by Information Ventures, Inc. http://infoventures.com/e-hlth/pestcide/glyphos.html

________1995b. Triclopyr: Pesticide Fact Sheet. Prepared for the U.S. Department of Agriculture Forest Service by Information Ventures, Inc. Accessed at http://infoventures.com/e-hlth/pestcide/triclopy.html.

________1995c. Chlorsulfuron pesticide fact sheet. Prepared for the USDA Forest Service. Available on line at http://infoventures.com/e-hlth/pesticide/chlorsul.html.

________1995d. Clopyralid methyl: Pesticide Fact Sheet. Prepared for the U.S. Department of Agriculture Forest Service by Information Ventures, Inc. Accessed at http://infoventures.com/e-hlth/pesticide/choyrali.html.

________1995e. Dicamba Pesticide Fact Sheet. Prepared for the USDA Forest Service. Information Ventures, Inc. Available on line at http://infoventures.com/e-hlth/pesticide/dicamba.html.

________1995f. Hexazinone: Pesticide fact sheet. Prepared for the U.S. Department of Agriculture Forest Service by Information Ventures, Inc. Accessed at http://infoventures.com/e-hlth/pestcide/hexazino.html.

________1995g. Imazapyr: Pesticide Fact Sheet. Prepared for the U.S. Department of Agriculture Forest Service by Information Ventures, Inc. Accessed at http://infoventures.com/e-hlth/pestcide/imazapyr.html

________1995h. Metsulfuron methyl Pesticide Fact Sheet. Prepared for the USDA Forest Service. Information Ventures, Inc. Available on line at http://infoventures.com/e-hlth/pesticide/metsulf.html.

________1995i. Picloram: Pesticide Fact Sheet. Prepared for the U.S. Forest Service by Information Ventures, Inc. http://infoventures.com/e-hlth/pestcide/picloram.html

________1995j. Sulfometuron methyl pesticide fact sheet. Prepared for the USDA Forest Service. Available on line at http://infoventures.com/e-hlth/pesticide/sulfomet.html.

________1995k. 2, 4-D: Pesticide Fact Sheet. Prepared for the U.S. Forest Service by Information Ventures, Inc. http://infoventures.com/e-hlth/pestcide/24d.html

Ka, J.O., P. Burauel, J.A. Bronson, W.E. Holben, and J.M. Tiedje. 1995. DNA probe analysis of microbial community selected in field by long-term 2,4-D application. Soil Science Society of America Journal. 59:1581-1587.

Kelsey, R. G. and R.D. Mihalovich. 1987. Nutrient Composition of Spotted Knapweed (Centaurea maculosa). Journal of Range Management 40(3), May 1987. pg. 277-281.

Kendall, R.J., T.A. Anderson, R.J. Baker, C.M. Bens, J.A. Carr, L.A. Chiodo, G.P. Cobb III, R.L. Dickerson, K.R. Dixon, L.T. Frame, M.J. Hooper, C.F. Martin, S.T. McMurry, R. Patino, E.E. Smith, and C.W. Theodorakis. 2001. In C.D. Klaassen, ed. Casarett and Doull's Toxicology: The basic science of poisons, Sixth ed. McGraw-Hill Medical Publishing Division, New York, NY. Pgs. 351-386, 673-709, 763-810.

Kotliar, N.B., S. Hejl, R.L. Hutto, V. Saab, C.P. Melcher, and M. E. McFadzen. 2002. Effects of fire and post-fire salvage logging on avian communities in conifer-dominated forests of the Western United States. Studies in Avian Biology (25): 49-64.

Lacey, J.R., C.B. Marlow, and J.R. Lane. 1989. Influence of spotted knapweed (Centaurea maculosa) on surface runoff and sediment yield. Weed Technology. 3:627-631.

Lacey, C.A., J.R. Lacey, P.K. Fay, J.M. Story, and D.L. Zamora. 1995. Controlling knapweed on Montana rangeland. Montana State University Extension Service. Circular 311.

Lajeunesse, S., P.K. Fay, D. Cooksey, J.R. Lacey, R.M. Nowierski, and D. Zamora. No Date. Dalmatian and Yellow Toadflax: Weeds of Pasture and Rangeland. Montana State University Extension Service.

Lauenroth, W.K., O.E. Sala, D. Coffin, and T.B. Kirchner. 1994. The importance of soil water in the recruitment of Bouteloua gracilis in the shortgrass steppe. Ecological Applications. 4:741-749.

Loveland. 2003. Phase-II. A new generation MSO adjuvant oil. Loveland Inducstries Ltd. Cambridge, UK. Available online at http://www.loveland.co.uk/.

Lym, R. G., K.K.Sedivek, D.R. Kirby. 1997. Leafy spurge control with angora goats and herbicide. Journal of Range Management 50:123-158. March, 1997.

Mackie, G. L. 1998. Applied aquatic ecosystem concepts. Available in manuscript form from Univ. Guelph Bookstore, ISBN 0- 901024-3-1. pgs. 248-297, p. 300-338.

Magoun, A.J. and J.P. Copeland. 1998. Characteristics of wolverine reproductive den sites. J. Wildl. Manage. 62:1313-1320.

Marler, M. 2000. A survey of exotic plants in federal wilderness areas. USDA Forest Service Proceedings RMRS-P-15-Vol-5. pgs 318-327.

Mattsson, J.L., J. M. Charles, B. L. Yano, H. C. Cunny, R. D. Wilson, and J. S. Bus. 1997. Single-dose and chronic dietary neurotoxicity screening studies on 2,4 dichlorophenoxyacetic acid in rates. (Abstract.) Fundamentals and Applied Toxicology 40:101-119.

Maxell, B. A., J. K. Werner, P. Hendricks, and D. Flath. 2003. Herpetology in Montana: A History, Status Summary, Checklists, Dichotomous Keys, Accounts for Native, Potentially Native, and Exotic Species, and Indexed Bibliography. Northwest Fauna Number 5, Society for Northwestern Vertebrate Biology. Pp. 44-47, 60-62.

Mayer, F.L. and M. Ellersieck, 1986. Manual of acute toxicology: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Dept. of the Interior, US Fish and Wildlife Resources Publication 160, 506pp. In: Fairchild, J.A., Sappington, L.C. and Ruessler, D.S., 1997. An Ecological Risk Assessment of the Potential for Herbicide Impacts on Primary Productivity of the Lower Missouri River. pgs. 1-10.

Mayes, M.A., D.L. Hopkins and D.C. Dill, 1987. Toxicity of picloram (4-amino-3,5,6-trichloropicolinic acid) to the lifestage of the rainbow trout. Bull. Environ. Contam. Toxicol. 38:653-660.

McCallum, D. A. 1994. Flammulated Owl (Otus flammeolus). In The Birds of North America, No. 93 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

McIver, James D. and Lynn Starr, technical editors. 2000. Environmental effects of postfire logging: literature review and annotated bibliography. General Technical Report PNW-GTR- 486. USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon. Page 16.

MCCHB. 2001. Missoula City-County Health Board. Report to Missoula City Council on the health Effects and Environmental fate of herbicides as they pertain to Weed Management. www.ci.missoula.mt.us/packets/council/2001-11-19/referrals/herbicide%20Report.htm.

MDNRC. 2003. Montana Department of Natural Resources and Conservation. Snowtel Station Information. http://www.dnrc.state.mt.us/wrd/home.htm.

MDEQ. 2004. 2004 Montana Integrated Water Quality Report. Montana Department of Water Quality. Helena, Montana. Available at: http://nris.state.mt.us/wis/environet/2004Home.html.

MDEQ. 2006. Circular DEQ-7, Montana Numeric Water Quality Standards. Helena, Montana. February 2006. Montana Department of Environmental Quality. Helena, Montana. Available at: http://www.deq.state.mt.us/wqinfo/Standards/CompiledDEQ-7.pdf

Metadata. 2004. Helena Weeds Metadata and GIS Data. August 11, 2004.

MFWP (MT Fish, Wildlife and Parks). 1999. Memorandum of understanding and conservation agreement for westslope cutthroat trout (*Oncorhynchus clarki lewisi*) in Montana.

Montana Bald Eagle Working Group. 1994. Montana Bald Eagle Management Plan. Bureau of Reclamation, Billings, MT. Pp. 4, 22-24.

MT Fish, Wildlife and Parks Department, Helena, MT.MNHP. 2001. Montana Natural Heritage Program. Montana plant field guide. Available on line at http://nhp.nris.state.mt.us/.

Montana Bull Trout Scientific Group, 1995. Bitterroot river drainage bull trout status report. Prepared for the Montana Bull Trout Restoration Team.

MT Department of Commerce. 2001. County profiles, MT Department of Commerce, Research and Analysis Bureau; Employment by Industry, last revised September 2001.

Mueggler, W. and W. Stewart. 1980. Grassland and shrubland habitat types of western Montana. USDA Forest Service. General Technical Report INT-66. Ogden, Utah.

Muledeernet 2003. Mule deer News and Information Network. State of Montana Mule Deer Status Report. http://www.muledeernet.org/statusmontana.htm.

Munn, M.A. and P.J. Gilliom., 2001. Pesticide toxicity index for freshwater aquatic organisms. US Geological Survey. Water Resources Investigation and Report 01-4077. National Water Quality Assessment Program.

Mustonen, R., j. Kangas, P. Vuojolahti and K Linnainmaa. 1986. Effects on phenoxyacetic acids on the induction of chromosome aberrations in vitro and in vivo. (Abstract). Mutagenesis 1:241-245.

National Research Council. 1994. Rangeland health, new methods to classify, inventory and monitor rangelands. National Academy Press, Washington D.C. Page 1.

National Weather Service. 2002. Climatography of the United States No. 81. Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days for Montana. pgs. 20-22.

Nesser, John. 2001. Personal e-mail communication, dated July 13, 2001 to Sue Farley, Helena National Forest Soil Scientist. On file: Helena National Forest Supervisor's Office, 2880 Skyway Drive, Helena MT.

Newmaster, S. and F. Bell. 2002. The effects of silvicultural disturbances on cryptogam diversity in the mixed boreal-mixedwood forest. Can. J. For. Res. 32: 38-51.

Newmaster, S., F. Bell, and D. Vitt. 1999. The effects of glyphosate and triclopyr on common bryophytes and lichens in northwestern Ontario. Can. J. For. Res.29: 1101-1111.

Nielson, P. 1999. A review of public health and ecological risks associated with the use of picloram and clopyralid herbicides for weed management on Mount Jumbo. Missoula City County Health Department. http://www.co.missoula.mt.us/measures/weeds_jumbo.htm

Nimmo, D.R. 1985. Pesticides. In Fundamentals of aquatic toxicology (Gary Rand and Sam Petrocelli ed.) Hemisphere Publishing Corp. Pages 335-373.

Norris, L.A. 1991. Chapter 7, Forest chemicals in: influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19. Edited by W. R. Mehann.

Norris, L.A., H.W. Lorz, and S.V. Gregory. 1983. William R. Meehan, Technical Editor. Influence of forest and rangeland management on anadromous fish habitat in western North America, (9) Forest Chemicals. USDA Forest Service General Technical Report PNW-149, Pacific Northwest Range Experiment Station, Forest Service, Portland Oregon. 95 pp.

NPS. 2001. National Park Service, National Rivers Inventory.

NRIS. 2002. Montana Natural Resource Information System Watershed. Information for Fourcodes 10030101, 10030102, 10030103, 10020006, 17010201, & 17010203, Montana. http://nris.state.mt.us/mapper/watershed.

Oakes D.J. and J.K. Pollak. 1999. Effects of a herbicide formulation, Tordon 75D, and its individual components on the oxidative functions of mitochondria. *Toxicology*. 136 pp 41-52.

Olson, B.E. 1999a. Impacts of noxious weeds on ecologic and economic systems. In Biology and management of noxious rangeland weeds. 4-18. Roger L. Sheley and Janet Petroff (eds.). Oregon State University Press. Corvallis, OR.

________1999b. Grazing and weeds. 85-96 IN Biology and Management of Noxious Weeds. R. L. Sheley and J. K. Petroff (Eds). Oregon State University Press. Corvallis, OR.

Olson, B.E., and R.G. Kelsey. 1997. Effect of Centuarea maculosa on sheep rumen microbial activity and mass in vitro. Journal of Chemical Ecology. 23:1131-1144.

Omang, R.J., 1992. Analysis of the magnitude and frequency of floods and the peak-flow gaging network in Montana. U.S. Geological Survey, Water-Resources Investigations Report 92-4048. Helena, Montana July 1992.

OSU. 1994. Oregon State University. OSU Extension Pesticide Properties Database. http://ace.orst.edu/info/npic/ppdmove.htm.

OSU. 1996a. Oregon State University. EXTOXNET Extension Toxicology Network, Pesticide Information Profiles. Triclopyr. http://extoxnet.orst.edu/pips/triclopy.htm

________1996b. Oregon State University. EXTOXNET Extension Toxicology Network, Pesticide Information Profiles. 2,4-D. http://extoxnet.orst.edu/pips/24-D.htm

________1996c. Oregon State University. EXTOXNET Extension Toxicology Network, Pesticide Information Profiles. Dicamba. http://extoxnet.orst.edu/pips/dicamba.htm

________1996d. Oregon State University. EXTOXNET Extension Toxicology Network, Pesticide Information Profiles. Picloram. http://extoxnet.orst.edu/pips/picloram.htm

________1996e. Oregon State University. EXTOXNET Extension Toxicology Network, Pesticide Information Profiles. Imazethapyr. http://extoxnet.orst.edu/pips/imazetha.htm

________1996f. Oregon State University. EXTOXNET Extension Toxicology Network, Pesticide Information Profiles. Glyphosate. http://extoxnet.orst.edu/pips/glyphosa.htm.

________1996g. (Extoxnet) Extension Toxicology Network, Pesticide Information Profiles. Hexazinone. Available online at http://extoxnet.orst.edu/pips/hexazin.htm

________1996h. (Extoxnet) Extension Toxicology Network, Pesticide Information Profiles. Sulfometuron-methyl. Available online at http://extoxnet.orst.edu/pips/sulfomet.htm

Parrett, C., D.R. Johnson, and J.A. Hull, 1989. Estimates of monthly streamflow characteristics at selected sites in the Upper Missouri River Basin, Montana, Base period water years 1937-86. U.S. Geological Survey, Water-Resources Investigations Report 89-4082. pgs. 4, 86, 87. Helena, Montana.

Pasitschniak-Arts, M. and S. Larivière. 1995. Gulo gulo. Mammalian Species No. 499.

Paulson, N. and J. T. Hatch. 2002. Burbot, Lota lota, member of the Cuskfish family. Fishes of Minnesota-Burbot. Accessed at http://www.gen.umn.edu/faculty_staff/hatch/fishes/burbot.html.

Pesticide Management Education Program (PMEP). 1983. Chemical facts sheet for dicamba (Banvel) Herbicide Profile. Pesticide Management Education Program, Cornell University. http://pmep.cce.cornell.edu/profiles/herb-growthreg/dalapon-ethephon/dicamba/herb-prof-dicamba.html.

Pfister, R.D., B.L. Kovalchik, S.F. Arno, and R.C. Presby. 1977. Forest habitat types of Montana. USDA Forest Service Intermountain Forest and Range Experiment Station General Technical Report INT-GTR-34. USDA Forest Service. Ogden, UT

Pierce, Jennifer L., Grant A. Meyer and A.J. Timothy Jull. 2004. Fire-induced erosion and millennial-scale climate change in northern ponderosa pine forests. Nature, Vol. 432. Pages 87-90.

Pierce, Kenneth L., Don G. Despain, Cathy Whitlock, Kenneth P. Cannon, Grant Meyer and Lisa Morgan. Quaternary geology and ecology of the greater Yellowstone area: in Easterbrook, D.J. ed., Quaternary Geology of the United States, INQUA 2003 Field Guide Volume, 32 pages.

Pimental, David, L. Lach, R. Zuniga, and D. Morrison. 2000. Environmental and Economic Costs od Nonindigenous Species of the Untied States. Bioscience. Vol. 50 No. 1. Pp. 53-65.

Randall, J. 2000. Improving management of nonnative invasive plants in wilderness and other natural areas. USDA Forest Service Proceedings, RMRS-P-15-VOL-5. pgs. 64-73.

Reichel, J.D. 1996. Preliminary amphibian and reptile survey of the Helena National Forest: 1995. Montana Natural Heritage Program, Helena MT. Pp. 9-10, 23-26.

Reichel, J. M., and D. Flath. 1995. Identification of Montana's amphibians and reptiles. Montana Outdoors Magazine 26 (3):15-34. . May/June. 20 pg.24

Relyea, R.A. 2005. The impact of insecticides and herbicides on the biodiversity and productivity of aquatic communities. Ecological Applications 15(2): 618-627.

Rice, P. 2003 Surfactant/Bull Trout Notes.

Rice, P.M. 2003. INVADERS Database System (http://invader.dbs.umt.edu). Division of Biological Sciences, University of Montana, Missoula, MT 59812-4824.

Rice, P.M. and J. Toney. 1996. Plant population responses to broadcast herbicide applications for spotted knapweed control. Down to Earth. vol. 51(2):14-19.

________1998. Exotic weed control treatments for conservation of fescue grasslands in Montana. Biological Conservation 85: 83-95.

Rice P.M., D.J. Bedunah, and C.E. Carlson. 1992. Plant community diversity after herbicide control of spotted knapweed. Res. Pap. INT-460 Ogden, UT: US Department of Agriculture, Forest Service, Intermountain Research Station. 6 p.

Rice, P.M., J. Toney, D. Bedunah, and C. Carlson. 1997a. Plant community diversity and growth from responses to herbicide applications for control of Centaurea maculosa. Jour. of Applied Ecology 34:1397-1412.

Robinson , E. and L. A. Fox. 1978. 2,4-D. herbicides in central Washington, APCA J., 28, 1015. in Grover. F. 1991. Environmental Chemistry of Herbicides. Nature, transport, and fate of airborne residues.pgs. 89-117.

Rogers, J.M. and R.J. Kavlock. 2001. Developmental toxicology. Pages 351-386 in C.D. Klaassen, ed. Casarett and Doull's Toxicology: The basic science of poisons, Sixth ed. McGraw-Hill Medical Publishing Division, New York, NY.

Rook, E. J. S. 1999. Lota lota, burbot. Flora, fauna, earth, and sky; the natural history of the Northwoods. Accessed at http://www.rook.org/earl/bwca/nature/fish/lota.html.

Ross, J. H., M. H. Dong., and R. I. Krieger. 2000. Conservatism in pesticide exposure assessment. Regulatory Toxicology and Pharmacology (Abstract) 31:53-58.

Ruediger, W., J. Claar, S. Gniadek, B. Holt, L. Lewis, S. Mighton, R. Naney, G. Patton, T. Rinaldi, J. Trick, A. Vandehey, F. Wahl, N. Warren, R. Wenger, and A. Williamson. 2000. Canada lynx conservation assessment and strategy. USFS Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Missoula, MT.

Rychert, R.C. and J. Skujins. 1974. Nitrogen fixation by blue-green algae-lichen crusts in the Great Basin Desert. Soil Sci. Soc. Amer. J. 338: 768-771.

Safe, S. 1990. Polychlorinated biphenyls (PCBs), dibenzo-p-dioxins (PCDDs), dibenzofurans (PCDFs), and related compounds: environmental and mechanistic considerations which support the development of toxic equivalency factors (TEFs). Critical Reviews in Toxicology 21(1):51-88.

Sanchez-Martin M.J., M.S. Rodriguez-Cruz, and M. Sanchez-Camazano. 2003. Study of the description of linuron from soils to water enhanced by the addition of an anionic surfactant to soil-water system. *Water Research*. 37 pp 3110-3117.

Schiffer, M.B. 1987. Formation Processes of the Archaeological Record. University of New Mexico Press, Albuquerque, NM. pgs. 121, 126.

Sedivek, K.K., and T. Hanosn, C. Heiser. 1995. Controlling leafy spurge using goats and sheep. North Dakota State University Extension Service.

Sheley, R., S. Kedzie-Webb and B. Maxwell. 1999. Pages 57-68. Integrated Weed Management on Rangeland. In: Biology and Management of Noxious Rangeland Weeds, Roger L. Sheley and Janet Petroff (eds.). Oregon State University Press. Corvallis.

Shepard, B.S., B.E. May, and W. Urie. 2003. Status of westslope cutthroat trout (Oncorhynchus clarki lewisi) in the United States: 2002. Status Report, Montana Department of Fish Wildlife and Parks, Helena, Montana.

Siegel, D. I. 2000. Pesticides in Groundwater: Vulnerability, Transport and Fate. Workshop Manual for the Montana Department of Agriculture, November 1-4, 2000. Presented by Environmental Education Enterprises, Inc., Ostrander, Ohio. pgs. 10, 11, 96-99, 122, 123

Solomon, Rhey M. 2005. Cumulative impact analysis and documentation, supplemental handouts. Proceedings from Cumulative Effects Workshop, June 6-7, 2005, Missoula, MT. Appendix pages E-1 to E-6.

Strickland, M. and C. Douglas. 1987. Marten. In Wild Furbearer Management and Conservation in North America. Novak, M., J. Baker, M. Obbard and B. Malloch, eds.

Thomas, M.J. and J.A. Thomas. 2001. Toxic responses of the reproductive system. Pages 673-709 in C.D. Klaassen, ed. Casarett and Doull's Toxicology: The basic science of poisons, Sixth ed. McGraw-Hill Medical Publishing Division, New York, NY.

Tisdall, J.M., and J.M. Oades. 1982. Organic matter and water-stable aggregates in soils. Journal of Soil Science. 33:141-163.

Tomkins, D. J. and W.F. Grant. 1977. Effects of herbicides on species diversity of two plant communities. Ecology 58: 398-406.

Torri, D., and L. Borselli. 2000. Water erosion. In Handbook of Soil Science. M.E. Sumner (Ed). CRC Press. Boca Raton, FL. pgs. G-171, G-185, G-186.

Tu, M., C. Hurd, and J. Randall. 2001. Weed Control Methods Handbook: Tools and techniques for use in Natural Areas. The Nature Conservancy. Available at http://tncweeds.ucdavis.edu/handbook.html.Chapters 7A, 7B, 7E, 7F, 7G, 7H, 7I, 7K.

Tyser, R. 1992. Vegetation associated with two alien plant species in fescue grassland in Glacier National Park, Montana. Great Basin Naturalist 52(2):198-193.

Tyser, R. and C. Key. 1988. Spotted knapweed in natural area fescue grasslands: An ecological assessment. Northwest Science 62:151-160.

USBLM. 1991. Vegetation Treatment on BLM Lands in thirteen western states (FEIS), executive summary. US Department of the Interior, Bureau of Land Management.

________2001. Off-highway vehicle environmental impact statement and proposed plan amendment for Montana, North Dakota and portions of South Dakota, executive summary. US Department of the Interior, Bureau of Land Management, Montana State Office and USDA Forest Service, Northern Region. Available online at http://www.mt.blm.gov/ea/ohv/AppendixD.pdf.

US Census Bureau. 2002. State and County Quick Facts2000 Census, last revised September 2002.

USDA 2002. ECS – Biology – Fish and Wildlife Habitat Management Leaflet Number 11 – American Elk (Order: Cervus elaphus). USDA Natural Resource Conservation Service, Wildlife Habitat Management Institute, Ecological Sciences Technical Note.

USEPA. 1989. US Environmental Protection Agency. Integrated Risk Information System. 2,4-Dichlorophenozyacetic acid (2,4-D) (CASRN 94-75-7). http://www.epa.gov/iris/subst/0150.htm.

________1990. US Environmental Protection Agency. Integrated Risk Information System, Hexazinone available online at http://www.epa.gov/IRIS/subst/0246.htm.

________1990a. US Environmental Protection Agency. Integrated Risk Information System, chlorsulfuron available online at http://www.epa.gov/IRIS/subst/0027.htm.

________1995. US Environmental Protection Agency. Reregistration Eligibility Decision (RED) Picloram. August 1995. Chapters I, II, III, IV, and part of V.

________1996a. US Environmental Protection Agency. Health Effects Test Guidelines OPPTS 870.1100: Acute Oral Toxicity. EPA 712-C-96-190, Washington, DC

________1996b. US Environmental Protection Agency. Health Effects Test Guidelines OPPTS 870.4100: Chronic Toxicity. EPA 712-C-96-192; Washington, D.C.

________1996c. US Environmental Protection Agency. Health Effects Test Guidelines OPPTS 870.1200: Acute Dermal Toxicity. EPA 712-C-96-210; Washington, D.C.

________1997a. US Environmental Protection Agency. Carcinogenicity Peer Review (4th) of 2,4-Dichlorophenoxyacetic acid (2,4-D). Washington DC.

________1998. US Environmental Protection Agency. EPA R.E.D. FACTS. TRICLOPYR. EPA-738-F-98-007. 7 pp.

________2003. Inert Ingredients in Pesticide Products as found on Internet at: http://www.epa.gov/opprd001/inerts/

________2005. 2,4-D RED Facts. June 30, 2005, EPA-738-F-05-002. http://www.epa.gov/REDs/factsheets/24d_fs.htm

USFS. 1986. Forest plan. USDA Forest Service, Helena National Forest. April, 1986

________1988. Soil Survey of Helena National Forest Area, Montana. Forest Service and Natural Resources Conservation Service

________1992. Risk assessment for herbicide use in Forest Service Regions 1, 2, 3, 4, and 10 on Bonneville Power Administration sites. USDA Forest Service, Contract # 53-3187-9-30.

________1995a. Inland native fish strategy DN and FONSI. USDA Forest Service. Region 1.

________1995b. Blackfoot Landscape Analysis. Forest Service, Helena National Forest. August.

________1995c. Inland native fish strategy implementation plan. USDA Forest Service. Region 1. October 1995.

________1995d. Vanquish Risk Assessment Final Draft. Syracuse Environmental Research Associates, Inc. under contract with USDA Forest Service. Fayetteville, New York, and Syracuse Research Corporation, Syracuse, New York.

________1996a. Divide Landscape Analysis, Existing Condition Report, Recreation. USDA Forest Service, Helena National Forest. January.

________1996b. Mormon Ridge Big Game Winter Range Restoration, Final Environmental Impact Statement. USDA Forest Service, Lolo National Forest, Missoula, MT.

________1996c. Vanquish (dicamba) risk assessment final report. Syracuse Environmental Research Associates, inc. (SERA) Syracuse, NY under contract to USDA Forest Service.

________1996d. Selected commercial formulations of glyphosate - Accord, Rodeo, Roundup and Roundup Pro risk assessment final report. Syracuse Environmental Research Associates, inc. (SERA) Syracuse, NY under contract to USDA Forest Service.

________1997a. South Elkhorn Range and Vegetation Environmental Assessment. USDA Forest Service, Helena National Forest.

________1997b. Establishment record for the Cabin Gulch Research Natural Area within Helena National Forest, Lewis and Clark County Montana. USDA Forest Service

________1997c. USDA Forest Service. Selected commercial formulations of hexazinone – human health and ecological risk assessment final report. Syracuse Environmental Research Associates, inc. (SERA) Syracuse, NY.

________1997d. USDA Forest Service. Use and assessment of marker dyes used with herbicides. Syracuse Environmental Research Associates, inc. (SERA) Syracuse, NY.

________1997e. Environmental assessment herbicide weed control. USDA Forest Service, Kootenai National Forest. Libby, Montana.

________1998a. Nevada/Dalton Project; Including Timber Harvest, Prescribed Fire, Fish and Wildlife Habitat Improvement, Road Construction, Road Obliteration, and Travel Management. USDA Forest Service, Helena National Forest, Lewis and Clark County, Montana. 1998.

________1998b. 2,4-Dichlorophenoxyacetic acid Formulations- Human Health and Ecological Risk Assessment Final Report. Syracuse Environmental Research Associates, Inc. under contract to USDA Forest Service. Fayetteville, New York September 1998. pgs. 3-43, Ch. 4-5.

________1998c. Sulfometuron methyl (Oust) final draft. Syracuse Environmental Research Associates, inc. (SERA) Syracuse, NY under contract to USDA Forest Service. Fayetteville, New York September 1998.

________1999a. North Belts Travel Plan/Magpie-Confederate Vegetation Restoration Project, Draft Environmental Impact Statement. USDA Forest Service, Helena National Forest, Helena, Montana. 1999.

________1999b. Picloram (Tordon K and Tordon 22K) - Final Report. Syracuse Environmental Research Associates, Inc. under contract to USDA Forest Service. Fayetteville, New York. Ch. 4, 5

________1999c. Clopyralid (Transline) Final Report. Syracuse Environmental Research Associates, Inc. under contract to USDA Forest Service. Fayetteville, New York. April 1999. Ch. 4, 5"

________1999d. Dicamba Herbicide Information Profile. USDA Forest Service. Pacific Northwest Region.Ch. 4, 5

________1999e. Imazapyr (Arsenal, Chopper, and Stalker Formulations), Final Report. Syracuse Environmental Research Associates, Inc. Fayetteville, New York.

________1999f. Forest Service manual, FSM 2500 – watershed and air management, R-1 supplement no. 2500-99-1. Effective November 12, 1999.

________2000. Watershed Baselines for the Helena Forest 6th code hydrologic units of the of the Little Blackfoot portion of the Upper Clark Fork Bull trout Section 7 Watershed. Helena National Forest. Helena Montana.

________2000a. Cave Gulch Fire Burned Area Emergency Rehabilitation (BAER) Plan, July-August, 2000, Helena, MT. Prepared by Burned Area Rehabilitation Team. Helena National Forest. August 2000.

________2000b. Watershed Baselines for the Helena Forest 6th code hydrologic units of the Blackfoot River Bull Trout Section 7 Watershed. Helena National Forest. Helena Montana.

________2000c. Metsulfuron methyl (Escort) Final Report. Syracuse Environmental Research Associates, Inc. Fayetteville, New York. Ch. 4, 5; App. 2-5, 6, 7, 3-1, 2, 3, 4, 5, 7, 8, 9.

________2001a. Lolo National Forest Big Game Winter Range and Burned Area Weed Management FEIS App. P, C. USDA Forest Service, Lolo National Forest.

________2001b. Draft Helena National Forest Roads Analysis – Informing Decisions about Managing the Transportation System. Helena National Forest Forest-wide Analysis of Maintenance Levels 3, 4, and 5 Roads and Roads of Other Jurisdictions. Helena National Forest. July.

________2001c. Beaverhead-Deerlodge National Forest Noxious Weed Control Draft EIS. pgs. 3-17 thru 3-21, 4-11 thru 4-20 August.

________2001d. USDA Forest Service. Final Environmental Impact Statement and Record of Decision. Maudlow-Toston Post Fire Salvage Sale, Helena National Forest. May 2001.

________2001e. Biological assessment for herbicide treatment of noxious weeds on the Nez Perce National Forest for 2001.

________2001f. Imazapic [Plateau and Plateau DG] – Human Health and Ecological Risk Assessment Final Report. Syracuse Environmental Research Associates, Inc. Fayetteville, New York, and Syracuse Research Corporation, Syracuse, New York. USDA Forest Service. January 2001.

________2001g. Annual heritage resource compliance report, 2001 field season. USDA Forest Service, Northern Region, Helena National Forest.

________2002a. USDA Forest Service. Final Environmental Impact Statement and Record of Decision. Beaverhead-Deerlodge Noxious Weed Control Program.

________2002b. Miscellaneous Water Resources Data from Agency Database. Bo Stuart, Hydrologist, Helena National Forest, Helena, MT.

________2002c. [Draft] Update of goshawk nest monitoring report, Helena National Forest, Helena, Montana. October 2002

________2002d. Aerial herbicide application for noxious weed control in the Northern Region: observations, recommendations, and considerations. Any Kulla, Weed Program Leader, Lolo National Forest. January 2003.

________2002e. Helena National Forest Annual Monitoring Report, Fiscal Year 2001.

________2003. Update of Goshawk Nest Monitoring Report, Helena National Forest, Helena, Montana. October 2003.

________2003b. Triclopyr – Revised Human Health and Ecological Risk Assessments. Syracuse Environmental Research Associates, inc. (SERA) Syracuse, NY under contract to USDA Forest Service.

________2003c. Glyphosate - Human Health and Ecological Risk Assessments. Syracuse Environmental Research Associates, inc. (SERA) Syracuse, NY under contract to USDA Forest Service.

________2003d. Picloram - Revised Human Health and Ecological Risk Assessments – Final Report. Syracuse Environmental Research Associates, inc. (SERA) Fayetteville, NY under contract to USDA Forest Service.

________n.d. Cultural resource atlas. Maps on file, Helena National Forest Supervisor's Office, Helena, MT. USDA Forest Service.

_______ 2004. Chlorsulfuron – Human Health and Ecological Risk Assessment – Final Report. Syracuse Environmental Research Associates, Inc. (SERA). Fayetteville, New York, under contract to USDA Forest Service.

_______2004a. Clopyralid - Human Health and Ecological Risk Assessment – Final Report. Syracuse Environmental Research Associates, Inc. (SERA). Fayetteville, New York, under contract to USDA Forest Service.

_______2004b. Dicamba - Human Health and Ecological Risk Assessment – Final Report. Syracuse Environmental Research Associates, Inc. (SERA). Fayetteville, New York, under contract to USDA Forest Service.

_______2004c. Imazapic - Human Health and Ecological Risk Assessment – Final Report. Syracuse Environmental Research Associates, Inc. (SERA). Fayetteville, New York, under contract to USDA Forest Service.

_______2004d. Imazapyr - Human Health and Ecological Risk Assessment – Final Report. Syracuse Environmental Research Associates, Inc. (SERA). Fayetteville, New York, under contract to USDA Forest Service.

_______2004e. Metsulfuron methyl - Human Health and Ecological Risk Assessment – Peer Review Draft. Syracuse Environmental Research Associates, Inc. (SERA). Fayetteville, New York, under contract to USDA Forest Service.

_______2004f. Sulfometuron methyl - Human Health and Ecological Risk Assessment – Final Report. Syracuse Environmental Research Associates, Inc. (SERA). Fayetteville, New York, under contract to USDA Forest Service.

_______2005. Final Environmental Impact Statement: Snow Talon Fire Salvage. March 2005. Helena National Forest. Helena, Montana.

_______ 2005a. Hexazinone - Human Health and Ecological Risk Assessment – Final Report. Syracuse Environmental Research Associates, Inc. (SERA). Fayetteville, New York, under contract to USDA Forest Service.

_______2005b. Gallatin National Forest EIS and ROD.

USFWS. 1984. American peregrine falcon Recovery Plan (Rocky Mountain/Southwest Population). Prepared in cooperation with the American Peregrine Falcon Recovery Team. USFWS, Denver, CO. 105 pp.

_______ 1987. Northern Rocky Mountain Wolf Recovery Plan. U.S. Fish and Wildlife Service, Denver, Colorado. 119 pp

_______1993. Grizzly bear recovery plan. U.S. Fish and Wildlife Service. Missoula, MT. 181 pp

_______2002. Threatened, endangered, and candidate species for the Helena National Forest (3/20/03). Species list provided for consultation purposes to the Helena National Forest in reference to proposed weed treatment project EIS.

_______ 2003a. Rocky Mountain Wolf Recovery 2002 Annual Report. U.S. Fish and Wildlife Service, the Nez Perce Tribe, the National Park Service, and USDA Wildlife Services. 2003. T. Meier, ed. USFWS, Ecological Services, 100 N. Park, Suite 320, Helena, MT. 64 pp.

________ 2003b. Endangered and Threatened Wildlife and Plants; Removing the Western Distinct Population Segment of Gray Wolf from the List of Endangered and Threatened Wildlife. Federal Register Vol. 68, No. 62, Proposed Rule.

USFS, USFWS, Montana Department Fish, Wildlife, and Parks, and Confederated Tribes of the Salish Kootenai. 2002. Grizzly bear distribution outside Recovery Zones: Map development process. Forest Service Northern Region, Missoula, Montana. 2pp. (unpublished).

Van den Berg et al. 1998. Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife, Environ. Health Perspectives 106:775-792.

Van Eimeren, P., 1996. Westslope CUTTHROAT TROUT Oncorhynchus clarki lewsi In: Conservation assessment for inland cutthroat trout. distribution, status and habitat management implications. US Department of Agriculture, Forest Service, Intermountain Region, Ogden, Utah. D.A. Duff, tech. Ed. pp. 1-10.

Vering W. 2004 Final Specialist Report- Aquatic Resources Noxious Weed Treatment Project Helena national Forest. Prepared under contract for the Helena Forest by maxim Technologies Inc. Boise Idaho. 34 pp plus appendices.

Vincent, F.G., R.E. Tarone, I.R. Hirsch, J.M. Abdalla, D.P. Lombardi, L.K. Long, B.L. Burroughs, D.B. Barr, and J.S. Kesner. Undated. Biomarker correlations of urinary 2,4-D levels in foresters: Genomic instability and endocrine disruption. Environmental Health Perspectives. 109:495-500.

Virginia Cooperative Extension, 1996. Pesticides and aquatic animals: a guide to reducing impacts on aquatic systems. Publication Number 420-013.

Walch L. 2003a. Project file concerns on use of surfactants, fisheries effects analysis, and proposed mitigation for the Draft EIS.

Walch L. 2003b. E-mail correspondence to Kate Walker regarding adjuvants/surfactants.

Walch, L. 2006. Fisheries Biological Assessment and Evaluation, Helena National Forest Weed Treatment Project. Helena National Forest. Helena, Montana.

Walch, L., and B. Stuart. 2002. Personal communication with Helena National Forest Resource Specialists (Oct-Nov.).

Wardle, D. A., G. W. Yeates, K. I. Bonner, K. S. Nicholson, and R. N. Watson. 2001. Impacts of ground vegetation management strategies in a kiwifruit orchard on the composition and functioning of the soil biota. (Abstract) Soil biology and biochemistry 33: 893-905.

Wardle, D.A., and D. Parkinson. 1991. Relative importance of the effect of 2,4-D, glyphosate, and environmental variables on the soil microbial biomass. Plant and Soil. 134:209-219.

Werner, J.K., B.A. Maxell, P. Hendricks, and D.L. Flath. 2004. Amphibians and reptiles of Montana. Mountain Press Publishing Company, Missoula, MT. Pp. 68-70, 72-74, 96-98.

Whisenant, S.G. 1990. Changing fire frequencies on Idaho's Snake River Plains: ecological and management implications. In E.D. McArthur, E.V. Romney, S.D. Smith, and P.T. Tueller, eds. Proceedings-Sympisoium on Cheatgrass Invasion, Shrub Die—off, and Other Aspects of Shrub Biology and Management. Las Vegas, Nevada. 1989. USDA Forest Service Intermountain Research Station Gen. Technical Report, INT-276. 4-10.

Willard, E.E., D.J. Bedunah, C.L. Marcum. 1988. Impacts and Potential Impacts of Spotted knapweed (*Centaurea maculosa*) on Forest and Rangelands in Western Montana. Final Report. Montana Forest and Conservation Experimental Station, University of Montana, Missoula, MT. pgs. 1-104.

Wilson, L. and H. McCaffrey. 1999. Biological control of noxious rangeland weeds. *In* Biology and management of noxious rangeland weeds. Sheley and Petroff (eds.). Oregon State University Press. Corvallis.

Winfield, J. 2003. Cave Gulch fire/weeds monitoring project. Unpublished Report. Helena National Forest. Helena, Montana.

Woodward, D.F. 1976. Toxicity of the herbicides dinoseb and picloram to cutthroat (Salmo clarki) and lake trout (Salvelinus namaycush). J. Fish. Res. Board Can. 33: 1671-1676.

Yates, W.E., N.B. Akesson, and D.E. Bayer. 1978. Drift of glyphosate sprays applied with aerial and ground equipment. Weed Science 26(6):597-604.

INDEX

CHAPTER 7
RESPONSE TO COMMENTS

The Notice of Availability for the Draft Environmental Impact Statement was published in the Federal Register on October 17, 2003, initiating the 45-day public comment period. The comment period closed on December 1, 2003. The EIS was sent to those that commented during scoping and county, state and federal agencies. Public meetings to solicit comments on the DEIS were held in Helena, Townsend, and Lincoln, Montana during the first week of November, 2003.

The DEIS was reviewed by agency staff, other state and federal agencies, and the public. In addition to the agency comments, nine letters were received during the comment period. No written comments were submitted at the public meetings. All letters are included in this chapter, along with Forest Service responses to substantive comments.

Comments in the letters are identified with brackets and a number, which correspond with a response to the right of the letter. Responses that refer to a page number refer to the FEIS.

LETTER **PAGE**

ThreeFat@aol.com
10/21/2003 07:52 PM

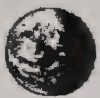
To: comments-northern-helena@fs.fed.us
cc:
Subject: noxious weed treatment project

Having read through the Draft Environmental Impact Statement for the Noxious Weed Treatme
I urge you to pursue **Alternative A.** we cannot afford, in any sense of the word, to allow noxiou
any permanent foothold on our public lands. We must be aggressive and immediate in our acti
can consider less radical approaches only after we have made this kind of effort.

Thanks for listening.

Mitchell Hegman
Box 5671
Helena, MT

LETTER 1 - MITCHELL HEGMAN



"Janet Spencer"
<janet@triviaqueen.com>
11/04/2003 03:56 PM

To: <comments-northern-helena@fs.fed.us>
cc:
Subject: weeds

-1 Concerning aerial spraying for knapweed, it would be my suggestion that you ONLY spray in areas where you are certain that water which falls as rain will not run downhill. Any place where water is going to run downhill, don't spray because the spray will end up in the streams, rivers, and lakes where it will kill the aquatic insects and aquatic weeds, affecting fish populations and water quality. Since I don't know of any places on this planet where rainwater will NOT run downhill, I think you should scrap the idea of spraying for weeds under any circumstance and stick to earth-friendly control methods instead. You can buy ■ hell of a lot of knapweed-controlling beetles for the same money you're proposing to spend on hiring airplanes. It's a lot slower of a method but it sure is better for the earth.

I keep fish in aquariums as a hobby. Once, after reaching in to adjust something underwater in my guppy tank, I forgot that I had recently put scented hand lotion on my hands. Every fish in that tank died as a result of that brief exposure to ■ pollutant, and that's when I realized how fragile and tender fish are. I never used pesticides or herbicides again after that day.

In as much as the Forest Service is supposed to be acting as stewards of public property, I must ask you: Please don't pour herbicides into our water!!

Janet Spencer, Trivia Queen of the Universe
Royal Ruler of Useless Information
Master of Arcane Knowledge and Extraneous Lore
Keeper of Forgotten Facts and Startling Statistics
Freelance Hysterics - Creative Profanities - Quantum Perplexities

212 7th Av. Apt. #1
Helena, MT 59601
1-866-TriviaQ / (406) 443-0469

Janet@TriviaQueen.com
WWW.TriviaQueen.com

LETTER 2 - JANET SPENCER

Comment	Response
2-1	These issues are addressed in the DEIS and the FEIS in Chapter 4, the Water Resources section and the Fisheries and Aquatic Resources section. In addition, the stream buffers that will be established to protect water quality with Alternative A are outlined in Chapter 2, Table 2-4.

MEAGHER COUNTY WEED DISTRICT **Nov. 5, 2003**
P. O. Box 309
White Sulphur Springs, Montana 59645

Forest Service – Helena National Forest
2880 Skyway Drive
Helena, MT 59601

RE: comments on Draft Environmental Impact Statement on Noxious Weed Control Project.

First, I would like to compliment you on a very thorough Environmental Impact Statement on your proposed Weed Control Project.

I do have several major concerns though, which I feel need addressed.

3-1 { 1. Unfortunately, Meagher County Weed District was left off the DEIS mailing list. I can only hope that this was inadvertent. In fact, Meagher County is sadly for the biggest part left off the DEIS list with only one individual represented in Meagher County. Please add the Meagher County Weed district to the list for any future correspondence.

3-2 { 2. In addition to being left off the list to receive the DEIS and related correspondence, Meagher County Weed District was not contacted in any way regarding the problem or assistance with the Noxious Weed Treatment Plan. As the DEIS addresses, the noxious weeds are a serious problem along the Broadwater, Meagher County Line and are along the Forest Service Roads leading into and in Meagher County. Roads of particular concern include Confederate Gulch and Deep Creek. These roads are major transportation routes and as such are responsible for carrying a significant amount of Noxious Weeds into the County. Meagher County spends a disproportional amount of their control dollars on the counties portions of these roads due to inadequate control on the USFS and in Broadwater County.

3-3 { 3. Also, of major concern is that the USFS seems to want to stand alone with a serious problem that includes Federal, County, State and Private Land. An example in a recent conversation with Diane Johnston regarding the acres of spotted knapweed in Deep Creek, I suggested the acreage obviously only reflects the USFS portion of the problem and does not address the 'whole picture'. She

LETTER 3 - OTTO W. OHLSON, MEAGHER COUNTY WEED DISTRICT

Comment	Response
3-1	Meagher County Weed District has been added to the list in Chapter 6.
3-2	These roads were included as treatment areas in Alternative A, B and C. Please see Figures 2-1, 2-5 and 2-9.
3-3	This EIS evaluates the potential impacts of a noxious weed treatment project and alternatives on the Helena National Forest. Please see Chapter 1 of the FEIS, the section on Project Area. However, as discussed in Chapter 1 of the FEIS, the Forest Plan does emphasize that noxious weed control be approached in an integrated weed control program and this project is just one component of that program. For more information on Ongoing Weed Treatment, Prevention and Education please see Chapter 2 of the FEIS. Helena National Forest officials met with Meagher County officials in January 2004 and again with Broadwater and Meagher County officials in March 2006 to discuss the Forest's weed program and explore opportunities to improve coordination between the two programs. Work to develop participating agreements between the Forest and the counties within the Forest is ongoing.

admitted that this was in fact true and that that was their only area of concern, that they did not want to seem like 'big brother' and attempt to get control of noxious weeds in areas such as mining claims, DOT road right of ways, private land, etc. that, this is in fact not their problem. This is a sad approach, as if anyone is going to win in the battle against noxious weeds, a coordinated effort needs to take place.

4. It is only through a coordinated effort, again, that the weeds will be effectively controlled. I would suggest a significant modification to the Noxious Weed Treatment Project to include a coordinated effort between Federal, State, County and private individuals. I know that as a Federal agency, you would find this difficult (I retired from a Federal Agency after working there 31 years so I know), however, it is the only way that will work and have any form of effective weed control.

I would like to use Deep Creek, or Confederate Gulch, again, as an example. After visiting with Diane Johnson, I found out that control efforts in 2003 were limited to a small percentage of the USFS and a bit of highway right of way, adjacent to the USFS in exchange for the MDT helping with traffic control. These acreages were minute in comparison with the size of infestation. To emphasize the problem, if there were 2000 acres of spotted knapweed in Deep Creek (a good estimate of the entire problem) and the DOT has sprayed 20 acres and the USFS sprayed 150 acres, and as a good estimate, the patch grew 10% which is not unreasonable, what good was done??? It means that spotted knapweed in Deep Creek only grew by 30 acres in 2003. To further compound this problem is the amount of viable weed seed that entered Meagher County and the significant costs associated with the control due to the lack of adequate control in Broadwater County and the Helena National Forest.

Control costs also, are reduced significantly in larger control projects.

The Meagher County Weed District would more than welcome a coordinated effort to control a serious weed problem. Dalmation Toadflax has been found in Meagher County as only individual plants along the road system. As such, we are able, annually to totally eradicate the problem. As one drives up Confederate and Whites Gulch, it is becoming rapidly obvious that this may soon no longer be the case. This is also the case with spotted Knapweed. While Meagher County is not weed free as far as spotted knapweed, a concerted effort is keeping the problem in check, although at great expense due to the lack of an adequate program with the USFS and Broadwater County. We would welcome a coordinated effort and am extending the offer to help in any way possible.

Sincerely,

Otto W. Ohlson, Noxious Weed Supervisor, Meagher County

LETTER 4 - ROBERT F. STEWART, U.S. DEPARTMENT OF INTERIOR

United States Department of the Interior

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

TAKE PRIDE IN AMERICA

November 21, 2003

ER 03/862

Thomas J. Clifford
Forest Supervisor
Helena National Forest
2880 Skyline Drive
Helena, MT 59601

Dear Mr Clifford:

The Department of the Interior has reviewed the Draft Environmental Impact Statement for the Helena National Forest Noxious Weed Treatment Project, and has no comments.

Sincerely,

Robert F. Stewart
Robert F. Stewart
Regional Environmental Officer

United States Department of the Interior
BUREAU OF RECLAMATION
Great Plains Region
Montana Area Office
P.O. Box 30137
Billings, Montana 59107-0137

IN REPLY REFER TO:
MT-210
ENV-6.00

NOV 26 2003

RECEIVED
DEC 1 2003
Townsend Ranger District

Thomas J. Clifford, Forest Supervisor
Helena National Forest
2880 Skyway Drive
Helena, MT 59601

Subject: Draft Environmental Impact Statement of the Helena National Forest Weed Treatment Project

Dear Mr. Clifford:

The Montana Area Office (MTAO) of the Bureau of Reclamation has reviewed the Draft Environmental Impact Statement of the Helena National Forest Weed Treatment Project. We concur with the preferred alternative and commend the Forest Service on a well conceived plan. In particular, the Environmental Protection Measures described to protect water quality of tributaries and receiving waters are fully supported.

5-1 We have two minor requests associated with air operations. Please notify Reclamation and the Lewis and Clark County Sheriff's Department the day before any aerial treatments are planned in the southern third of Township 11 North, Range 1 West. We also request that aerial applicators avoid flying within ½ mile of Canyon Ferry Dam. This will help avoid false security alerts.

If you have any questions, please contact Tom Sawatzke at 406-247-7314.

Sincerely,

Susan J. Kelly
Area Manager

LETTER 5 - SUSAN J. KELLY, BUREAU OF RECLAMATION

Comment	Response
5-1	An environmental protection measure (EPM 15 and 16) has been included in Table 2-4 requiring notification of the Bureau of Reclamation and the Lewis and Clark County Sheriff's Department and another has been added to avoid flying within ½ mile of Canyon Ferry Dam.

LETTER 6 - JOHN F. WARDELL, U.S. ENVIRONMENTAL PROTECTION AGENCY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8, MONTANA OFFICE
FEDERAL BUILDING, 10 West 15th St, Suite 3200
HELENA, MONTANA 59626

Ref: 8MO

November 26, 2003

Mr. Thomas J. Clifford, Forest Supervisor
Helena National Forest
2880 Skyway Drive
Helena, MT 59601

Re: CEQ # 030464, Helena National Forest Noxious Weed Treatment Project Draft Environmental Impact Statement

Dear Mr. Clifford:

The Environmental Protection Agency (EPA) Region VIII Montana Office has reviewec the Draft Environmental Impact Statement (DEIS) for the Helena National Forest Noxious Wee Treatment Project. The EPA reviews EISs in accordance with its responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. Section 309 of the Clean Air Act directs EPA to review and comment in writing on the environmental impacts of any major Federal agency action.

The EPA commends efforts to address noxious weed infestations in Helena National Forest before weed problems become an epidemic. We support the purpose and need of the Helena National Forest Noxious Weed Treatment Project to control invasion of new noxious weeds; treat rangeland weeds to provide cover and forage for wildlife; and treat weeds in burne areas and in remote areas using integrated pest management strategies. Impacts to native plant communities are much reduced when control actions are taken at an early stage of invasion.

The EPA does not object to aerial application of herbicides for the management and control of weeds as proposed in Alternative A. We believe the presentation of information in DEIS Table 2-11 shows that Alternative A will more effectively control the spread of invasive weeds than Alternatives B and C. Aerial application facilitates effective weed management ove large areas, and with proper application of herbicides and incorporation of adequate environmental protection measures should also provide necessary protection for water quality, fisheries, wildlife, desired plant communities, and public health. It is important to ensure, however, that adequate environmental protection measures are incorporated into aerial herbicide 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). Table 2.4 showing proposed environmental protection measures includes a good compilation of environmental protection measures to reduce environmental impacts associated with herbicide use. Our enclosed comments include suggestions for additional measures that would further mitigate potential environmental effects of proposed weed treatments.

We believe aquatic monitoring is an important element of an effective weed control program utilizing herbicides, and is a necessary and crucial element in identifying and understanding consequences weed treatments, and should be an integral part of any management decision. Monitoring is needed to validate that herbicide application protocols and environmental protection measures are effective in preventing herbicide transport to surface and ground waters, protecting public health, and avoiding impacts to wildlife and non-target plant communities.

6-1 Monitoring appears to be proposed in 9 of 105 project area watersheds (6[th] HUC) in the four landscape areas that would be treated. However, few details of the monitoring program are provided in the DEIS. It would be helpful if more detail was providing regarding proposed monitoring in the 9 representative watersheds (e.g., why the representative watersheds were selected for monitoring; sampling locations relative to area of herbicide treatment; parameters to be monitored; methodologies to be used; frequency, pattern and number of samples to be collected; etc.,).

6-2 We generally recommend that sensitive streams adjacent to or nearby aerial herbicide treatment areas be monitored to validate that herbicide transport to aquatic areas does not occur, particularly monitoring for picloram and clopyralid, since these herbicides are highly soluble and mobile, and relatively persistent and toxic (i.e., select a stream with a high potential for herbicide drift for monitoring or high nearby treatment acreage, and if no herbicide is identified in this stream, you can better validate and extrapolate that mitigation measures were effective in preventing herbicide drift to other aquatic areas with lower intensity of treatments). Such monitoring will determine if mitigation measures were effective in avoiding herbicide drift to streams, and may increase public confidence that chemical contamination of surface waters did not occur during weed treatments.

6-3 We also note that many of the watersheds with the highest acreages of weed treatments are not among the 9 representative watersheds proposed for monitoring. In general, we believe watersheds with the highest acreages of weed treatment would be the best candidates for aquatic monitoring. For example, the 6 watersheds, Lower Trout Creek, Cave Gulch, Oregon Gulch, Upper Little Blackfoot, Moose Creek, and Poorman Creek watersheds have 6,454 aerial treatment acres, whereas the 9 watershed proposed for monitoring only include 1,753 aerial treatment acres.

6-4 It is also noted that modeling shows potential for picloram standard exceedances in Cave Gulch, Oregon Gulch, and Grizzly-Orofino Gulch which are not proposed for monitoring. While the model results are conservative, we believe it would be prudent to consider some level of monitoring in these drainages to validate that herbicide standard exceedances does not occur. It may also be prudent to carry out some herbicide monitoring above the water supply intakes in the Ten Mile Creek and McClellan Creek municipal watersheds for the City's of Helena and East Helena to verify that herbicide contamination of public water supplies does not occur during treatment of weeds.

Comment	Response
6-1	More details regarding monitoring have been added to the FEIS. Please see page 2-21 of the FEIS.
6-2	All aerial spraying will be monitored at the time of spraying. Please see Table 2-4.
6-3	The 9 watersheds were chosen to be representative of the various geo-climatic conditions throughout the Helena National Forest and recently burned areas. However, the FS agrees that it is also important to monitor water quality in municipal watersheds and heavily-treated drainages. The suggested streams have all been added to list of watersheds to be monitored with the exception of Oregon Gulch, which is dry. See page 2-21 of the FEIS.
6-4	The potential for herbicide standard exceedances would be mitigated through a reduction in treatment.

Our more detailed comments, questions, and concerns regarding the analysis, documentation, and/or potential environmental impacts of the Helena National Forest Noxious Weed Treatment Project DEIS are enclosed for your review and consideration as you complete the Final Environmental Impact Statement (FEIS). Based on the procedures EPA uses to evaluate the adequacy of the information and the potential environmental impacts of the proposed action and alternatives in an EIS, the Helena Noxious Weed Treatment Project DEIS has been rated as Category EC-2 (Environmental Concerns - Insufficient Information). A copy of EPA's rating criteria is attached.

EPA supports the need for an integrated weed management program to control invasion of noxious weeds, and does not object to the preferred alternative. We note the need to include adequate environmental protection measures to reduce potential for herbicide transport to surface and ground waters, and to protect public health, and are providing suggestions for additional measures to further mitigate potential environmental effects of proposed weed treatments. We also recommend that additional information be provided regarding monitoring for herbicides in selected watersheds to validate effectiveness of environmental protection measures.

The EPA appreciates the opportunity to review and comment on the DEIS. If we may provide further explanation of our concerns please contact Mr. Steve Potts of my staff in Helena at (406) 457-5022 or in Missoula at 406-329-3313.

Sincerely,

John F. Wardell
Director
Montana Office

Enclosure

cc: Larry Svoboda/Julia Johnson, EPA, 8EPR-N, Denver
Jim Olivarez, Forest Service Region 1, FRM, Missoula
Donna Rise, Montana Dept. of Agriculture, Helena
Carole Mackin, MDEQ, Helena

U.S. Environmental Protection Agency Rating System for Draft Environmental Impact Statements
Definitions and Follow-Up Action*

Environmental Impact of the Action

LO - - Lack of Objections: The Environmental Protection Agency (EPA) review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunitie for application of mitigation measures that could be accomplished with no more than minor changes to the proposa

EC - - Environmental Concerns: 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 that can reduce these impacts.

EO - - Environmental Objections: The EPA review has identified significant environmental impacts that should l avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU - - Environmentally Unsatisfactory: The EPA review has identified adverse environmental impacts that are o sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1 - - Adequate: EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2 - - Insufficient Information: The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses or discussion should be included in the final EIS.

Category 3 - - Inadequate: EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the National Environmental Policy Act and or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revise draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment. February, 1987.

EPA Comments on Helena National Forest Noxious Weed Treatment Project Draft Environmental Impact Statement

BRIEF PROJECT OVERVIEW:

The Helena National Forest has prepared this DEIS to evaluate a proposal to implement noxious weed treatments and prevention measures on approximately 23,000 acres of Helena National Forest land over the next 12 years. The purpose and need is to implement the Forest Plan to manage infestation of weeds through integrated weed management. Specific needs are to control invasion of new noxious weeds (e.g., orange hawkweed, common tansy, perennial pepperweed, and tamarisk); treat rangeland weeds to provide cover and forage for wildlife; and to treat weeds in burned areas and in remote areas. The predominant weeds in the area are spotted knapweed, dalmatian toadflax, Canada thistle, leafy spurge, and sulfur cinquefoil.

Alternative A, the proposed action, would use an Integrated Weed Management approach involving ground and aerially applied herbicide, biological controls, grazing, and mechanical treatment on approximately 22,668 acres. Chemical treatments would include both ground and aerial application of herbicides (using helicopters, trucks, ATV's, horse, and backpack sprayers). Herbicides proposed for use include picloram (Tordon), 2,4,-D (various trade names), clopyralid (Transline), dicamba (Vanquish or Banvel), glyphosate, imazapyr, hexazinone, chlorosulfuron, imazapic (Plateau), metsulfuron methyl (Escort), sulfurometuron methyl, and triclopyr. The surfactant adjuvant would be used in certain instances (e.g., toadflax) to increase efficacy. High intensity short duration grazing with sheep or goats would occur on approximately 1,356 acres (leafy spurge, dalmatian toadflax, spotted knapweed). Mechanical treatments such as hand pulling, mowing, or cultivation would occur on sensitive areas or areas of small or new infestations. Alternative A is the preferred alternative.

Alternative B would incorporate all components of the proposed action except aerial application of herbicides to address concerns over the ability to control drift of herbicides into riparian areas, streams and private land with aerial application. Areas proposed for aerial application would instead be treated by ground application where possible. Areas with steep slopes or that are too remote or difficult to access would not be treated. Approximately 18,913 acres would be treated.

Alternative C is the no action alternative in which current weed management activities would continue, although some environmental protection measures would apply. The Helena N.F. has an ongoing weed treatment, prevention, and education program that has focused on reducing weed populations in major travel corridors. These existing weed treatments would treat approximately 15,871 acres.

COMMENTS:

1. The EPA commends efforts to address noxious weed infestations in the Helena National Forest before weed problems become an epidemic. We support efforts to control noxious weeds in the Helena National Forest while continuing to emphasize integrated pest

management strategies that prevent the establishment and spread of noxious weeds. Impacts to native plant communities are much reduced when control actions are taken at an early stage of invasion. We support the project purpose and need to control invasion of new noxious weeds; treat rangeland weeds to provide cover and forage for wildlife; and to treat weeds in burned areas and in remote areas.

The EPA does not object to aerial application of herbicides for the management and control of weeds as proposed in Alternative A. Aerial application facilitates effective weed management over large areas. The presentation of information in Table 2-11 (page 2-23) shows that Alternative A will more effectively control the spread of invasive weeds, than Alternatives B and C, and with proper application of herbicides and incorporation of adequate environmental protection measures will provide protection for water quality, fisheries, wildlife, desired plant communities, and public health.

We do consider it important, however, to ensure that adequate environmental protection 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). Table 2.4, with a few suggested additions as discussed in our comment #4 below, includes a good compilation of environmental protection measures to reduce environmental impacts associated with herbicide use.

2. Thank you for including the discussion of ongoing weed treatment, prevention and education programs (beginning on page 2-8). This is useful information that improves understanding of the no action alternative and provides good perspective for evaluating the action alternatives. We are pleased that weeds along travel routes and elsewhere have been reduced as a result of ongoing weed treatment, prevention and education efforts. We support prioritizing perimeter weed infestations such as around trailheads and roadsides ahead of treating interior weed infestations.

3. Thank you also for providing the tables showing weed treatment by landscape area for each alternative, and the maps showing each landscape area and proposed weed treatment areas for Alternatives B and C. However, the DEIS indicates that Figures 2-1 through 2-4 show weed treatment areas for each landscape area for Alternative A, the preferred alternative, but we did not have these Figures in our copy of the DEIS. We have Figures 2-5 through 2-12 which are weed treatment maps for Alternatives B and C, but not the maps for Alternative A (i.e., Figures 2-1 through 2-4 are missing). We are particularly interested in these maps, since they are stated to show the ground and aerial weed treatment areas in relation to waterbodies for the preferred alternative.

4. Table 2-4, Environmental Protection Measures (pages 2-12 to 2-14), Table 2-5, Picloram Treatment Area Thresholds in Sensitive Watersheds (page 2-15), and Table 2-6 Herbicide Application Rates and Timing (page 2-16), and several Appendices (e.g., Appendix A-Treatment Acres by Watershed; Appendix C-Spill Plan Procedures; Appendix D-

2

RAVE/Site Evaluation Form; and Appendix F- Procedures for Mixing, Loading and Disposal of Pesticides) are all very helpful in disclosing proposed measures to mitigate environmental impacts of the weed treatments. We particularly support environmental protection measures such as the proposed 300 foot buffer around aquatic areas (which could be reduced to100 feet based upon monitoring results); and measures to reduce herbicide drift such as using GPS, use of drift reduction agents, spray detection cards, close monitoring of wind direction and speed and weather conditions, flagging and marking areas on the ground; and conducting aquifer vulnerability evaluations, and the other aquatic protection measures.

We have some recommendations for additional measures to consider for environmental protection as follows:

6-5 -Require operators to calibrate spray equipment at regular intervals to ensure proper rates of application;

6-6 -Use more selective herbicides (clopyralid) in conifer associated communities to minimize impacts on non-target plants;

6-7 -Use only treatment methods that target individual noxious weed plants in riparian and wetland areas. Depending on the targeted weed species, manual control (hand pulling) may be one of the best options for weed control within riparian/wetland areas or close to water. The herbicide application technique of hand or manual wipe-on is not mentioned as an option to control weeds up to the existing water level adjacent to streams or sensitive aquatic sites. We note that Table 2-4 indicates that picloram would not be used within 50 feet of streams or subirrigated land regardless of application method, and that RAVE site characteristics may indicate more restrictive distances than 50 feet. Picloram is toxic, mobile and persistent, and we would be concerned about use of picloram use near streams or areas of high groundwater. For your information, Dow AgroSciences, the manufacturer of Tordon 22K, has recently developed supplemental labeling for Tordon 22K for areas west of the Mississippi River. They have directions for wick or carpet roller applications. Tordon 22K herbicide can be applied using wick or carpet roller equipment where drift presents a hazard to susceptible crops, surface waters, and other sensitive areas. One part Tordon 22K is mixed with 2 parts water to prepare a 33% solution. The wick method of application is more labor intensive but very effective at targeting particular noxious weeds adjacent to surface waters, wetlands, or protected plants.

-We are pleased that the environmental protection measures indicate picloram applications may be postponed for at least 10 to 12 months. We support measures to reduce potential for persistant herbicides such as picloram to accumulate in soil. We did not see mention of the frequency of aerial/boom applications for other persistent herbicides. Potential for herbicides to accumulate in harmful amounts would be reduced

3

Comments	Response
6-5	This measure was included in the DEIS and is included in the FEIS. Please see Table 2-4 (EPM's 24, 25).
6-6	Measures to protect native plant communities have been included in the DEIS and the FEIS (EPM's 1, 17, 22, 46). Please see Table 2-4. The Forest Service expects minor conifer mortality in some locations where weed species are not effectively treated by Clopyralid. Effects have been analyzed (see pages 4-66).
6-7	Please see Table 2-4 (EPM's 1, 10, 12, 17, 18, 19, 39, 40, 41, 42). Measures to protect riparian areas and wetlands have been included in the DEIS and the FEIS. Aerial spraying of any herbicide is not allowed within 100 feet of streams or wetlands. The Forest Service recognizes wipe and hand application of herbicides as an effective treatment where selectivity is critical. Use of these tools will be determined on a site-by-site basis.

6-8 if most sites are treated only once per year (twice being the limit). A second treatment application if needed should only occur after 30 days (or according to label directions).

6-9 -If there is any risk to aerial application support staff on the ground (e.g., human flaggers) it may be appropriate to specify that support staff assisting aerial herbicide applications wear appropriate personal protective equipment

6-10 -We also suggest that Forest wildlife and fisheries biologists and botanists review and coordinate spray projects with the District/Forest Weed Coordinator, and that surveys for rare plants be conducted by qualified surveyors prior to application of herbicides. It is important that rare plant species viability and population be protected where such plants are found in areas with weed infestations.

Table 2.4 with the few suggested additions discussed above would provide a very good compilation of mitigation measures to reduce environmental impacts associated with herbicide use.

5. EPA is pleased to see cooperative weed monitoring efforts with Rocky Mountain Research labs, Montana State University, University of Montana and other state and federal agencies. Weed monitoring is a key aspect of integrated pest management and should continue throughout the entire duration of the noxious weed treatment project.

The EPA supports the proposed adaptive management approach and decision tree in the DEIS (pages 2-19 to 2-21) to monitor results of treatment activities to document and assure effective weed treatment with minimal impacts on non-target species and no other

6-11 adverse environmental or public health effects. All treatment methods used should be tracked to provide a comparison of the effectiveness of control measures. We encourage monitoring and tracking weed infestations and control actions in a Forest-level weed database.

6. 6-12 Table 2-6, Herbicide Application Rates and Timing, (page 2-16) shows that picloram (Tordon 22 K) may be applied at rates of 1 quart/acre in the fall to control leafy spurge. Picloram is a mobile, toxic, and persistent herbicide. Would applications of less than 1 quart/acre of picloram effectively control leafy spurge?

7. It is shown that spotted knapweed is the most prevalent noxious weed species in the project area, infesting 10,445 acres (page 3-27). We note that spotted knapweed is non-rhizomatous and should be relatively easy to control with lower rates of the most selective low toxicity herbicides.

8. 6-13 We recommend that sites for application of existing and newly approved biological control agents (page 2-6) be protected from other management actions that could negatively influence the biocontrol agent. These sites can also function as collection

4

Comments **Response**

6-8 All herbicides would be applied as directed by label instructions and required by law. Please see pages 2-6/7, and 2-16 to 2-18 of the FEIS for discussion of herbicide application and timing of treatments.

6-9 Personal protective equipment will be required. Please see the Human Health and Safety section in Chapter 2 of the FEIS.

6-10 These issues have been addressed in the DEIS and the FEIS. Please see Table 2-4 (EPM's 22, 29, 39-46) and the Adaptive Management Strategy section in Chapter 2 of the FEIS.

6-11 The Forest Service has a weed database which is used to track information from weed inventories, along with treatment methods, acres, timing, etc.

6-12 Application rates that are displayed in Table 2-6 are those rates that have been shown to be safe and effective. Monitoring on the Helena District indicated that using a pint per acre or less was less than 50% effective (project file).

6-13 The treatment plan has been developed in a manner to maximize effectiveness and the treatments are designed to work together.

points for redistribution of established biocontrols to other sites.

9. Thank you also for providing a summary of water quality and soil quality monitoring of herbicide usage and adaptive management strategy (e.g., monitoring to focus on 9 representative watersheds; may include groundwater monitoring in selected wells in close proximity to application sites; measurement of herbicide movement in the watershed by infiltration and runoff; monitoring of plant community; soil erosion and sedimentation rates; soil microbiologic assays; and herbicide concentrations in soils; page 2-19).

We believe aquatic monitoring is an important element of an effective weed management program utilizing herbicides, and is a necessary and crucial element in identifying and understanding consequences weed treatments, and should be an integral part of any management decision. Monitoring is needed to validate that herbicide application protocols and environmental protection measures are effective in preventing herbicide transport to surface and ground waters, and avoiding impacts to wildlife and non-target plant communities.

6-14 In regard to aquatic monitoring, we generally recommend that sensitive streams adjacent to or nearby aerial herbicide treatment areas be monitored to validate that herbicide transport to aquatic areas does not occur, particularly monitoring for picloram and clopyralid, since these herbicides are highly soluble and mobile, and relatively persistent and toxic (i.e., select a stream with a high potential for herbicide drift for monitoring or high nearby treatment acreage, and if no herbicide is identified in this stream, you can better validate and extrapolate that mitigation measures were effective in preventing herbicide drift to other aquatic areas with lower intensity of treatments). Such monitoring will determine if mitigation measures were effective in avoiding herbicide drift to streams, and may increase public confidence that chemical contamination of surface waters did not occur.

The 9 representative watersheds proposed for monitoring appear to be Avalanche, Magpie, Whites Gulch, McClellan, Ophir, Spotted Dog, Telegraph, Copper and Nevada Creeks (page 3-6). We would be very interested in having maps for the preferred alternative showing the proposed weed treatment areas in relation to these representative waterbodies (i.e., the DEIS is missing Figures 2-1 through 2-4 as noted in comment #3 above).

6-15 It would also be helpful if more detail was providing regarding proposed monitoring in these nine representative watersheds (e.g., why the representative watersheds were selected for monitoring, sampling locations relative to area of herbicide treatment, parameters to be monitored, methodologies to be used, frequency, pattern and number of samples to be collected, etc.,). We note that the DEIS indicates that there are 105 watersheds (6th HUC) in the four landscape areas that would be treated (page 3-5), so monitoring of only 9 of these 105 watersheds is a minimal commitment to aquatic

Comments	Response
6-14	Please see response to comment 6-1.
6-15	Please see response to comment 6-3.

monitoring.

6-16 Table A-1, Treatment Acres by Watershed, shows that there are several watersheds with significantly higher weed treatment acreage than the 9 representative watersheds. In general, we believe watersheds with the highest acreage of weed treatment would be the best candidates for aquatic monitoring. For example, the 6 watersheds, Lower Trout Creek, Cave Gulch, Oregon Gulch, Upper Little Blackfoot, Moose Creek, and Poorman Creek watersheds have 6,454 aerial treatment acres. Table A-1 indicates that there are 1,753 aerial treatment acres in the 9 representative watersheds. We suggest that watersheds with the highest amounts of weed treatment acreage be added to the list of watersheds to be monitored, or to perhaps replace watersheds with lower treatment acres (e.g., Telegraph Creek, which is one of the reference watersheds, has no aerial treatment acres, although it does have sensitive fisheries)?

6-17 It is also noted that modeling shows the potential for picloram standard exceedances in Cave Gulch, Oregon Gulch, and Grizzly-Orofino Gulch (page 4-9). While the model results are conservative, we recommend consideration of monitoring in these drainages to validate that herbicide standard exceedances do not occur.

6-18 We also note that Ten Mile Creek provides some of the water supply for the City of Helena, and thus, would also be a good candidate for monitoring to verify that herbicide contamination to the public water supply does not occur. The McClellan Creek water supply for the City of East Helena is already on the list of representative watersheds for monitoring. While it is stated that water supply diversion locations are located well downstream of the herbicide application areas, we believe it would be prudent to carry out some herbicide monitoring above the water supply intakes in both of these municipal watersheds to verify that herbicide contamination of public water supplies does not occur during treatment of weeds.

We also note that bioassay techniques using aquatic species sensitive to the herbicides to be used are available for detecting aquatic impacts from herbicide applications (e.g., stoneflies, cutthroat trout). EPA has prepared a toxicity testing manual entitled, "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms", EPA/600/4-90/027, September 1991. Toxicity testing procedures are described in this manual, including procedures using rainbow and brook trout. If you have questions regarding toxicity testing procedures we encourage you to contact Mr. Glenn Rodriguez at our EPA Denver Office at (303) 312-6832.

6-19 The aquatic monitoring program should be more completely described in the FEIS, perhaps in an Appendix, to assure that project effects on water quality (i.e., chemical and biological impacts) and public health will be detected, and to allow the adequacy of the monitoring program to be evaluated.

6

Comments	Response
6-16	Please see response to comment 6-3.
6-17	Please see response to comment 6-4.
6-18	Please see response to comment 6-4.
6-19	Please see response to comment 6-11.

6-20 10. We also ask if it would be more helpful to assess forest soil fertility rather than soil microbial activity. Weed infestations are often able to out compete native vegetation in soils where overgrazing, fire, or other disturbance has depleted soil fertility levels. It may be more useful to analyze for soil fertility parameters (pH, Ca, Mg, K, P, organic matter, % N). If soil fertility is low, it may be helpful to apply slow release fertilizers to initiate competitive growth of native vegetation.

6-21 11. Efforts to reseed disturbed areas with native vegetation are not well described. We suggest revegetation (reseeding with native grass mix) of sites within the control area where the vegetation density is low enough to allow reinfestation or introduction of other noxious weeds, or erosion. The goal of the seeding program should be to establish the sustainability of the area. Where no native, rapid cover seed source exists, we recommend using a grass mixture that does not include aggressive grasses such as smooth brome, thereby allowing native species to eventually prevail. Mr. Phil Johnson, Botanist, Montana Dept. of Transportation, in Helena at 406-444-7657, may be able to provide guidance on revegetation with native grasses.

12. The DEIS states that no aquatic life standards have been established for the herbicides proposed for use on the Forest (page 3-4). We want to note that while the Water Quality Standards do not identify numerical criteria for aquatic life protection for the herbicides proposed for use, it should be recognized that the research and data requirements necessary to establish numerical aquatic life water quality criteria are very rigorous, and there are many chemicals in use which are toxic, but for which numerical aquatic life **6-22** criteria have not been established. The Montana Water Quality Standards include a general narrative standard requiring surface waters to *be free from substances that create concentrations which are toxic or harmful to aquatic life.* We recommend that information be disclosed in the FEIS, along with information showing aquatic toxicity of the proposed herbicides for the fish species present in the areas to be treated.

The National Pesticide Telecommunication Network (NPTN) website at http://nptn.orst.edu/tech.htm which operates under a cooperative agreement with EPA and Oregon State University and has a wealth of information on toxicity, mobility, environmental fate on pesticides that may be helpful (phone number 800-858-7378).

6-23 13. Table 4-3 *General Characteristics of Herbicides to be Used* (page 4-5) provides valuable information for determining potential for environmental contamination. Since different chemical forms (salt vs. acid) of herbicides exhibit varying chemical properties, the properties of each form to be used should be listed in Table 4-3. For example, the solubility of the *acid* form of picloram (430 mg/L) is listed, yet it appears the *salt* form of picloram will be utilized which exhibits a much greater solubility of 200,000 mg/L. Similarly, the salt form of clopyralid has a solubility of 300,000 mg/L, which is considerably greater than the acid form solubility of 1,000 mg/L. The solubility for dicamba should read 500,000 mg/L instead of 4,500 mg/L.

7

Comments	Response
6-20	Fertilizer would only be used in conjunction with native seeding, and then, only if necessary. Many areas of the Helena National Forest have naturally low soil fertility.
6-21	Please see Table 2-4 (EPM 35). The description has been clarified for the FEIS.
6-22	This information has been included in the FEIS. Please see page 3-4 of the FEIS.
6-23	The salt form of all herbicides would be used and is what is currently used. Table 4-3 has been updated to include the information for this form.

14. Thank you for explaining how the 1/20th of the lowest 96 hour LC_{50} was chosen (page 4-41), and for including Table 4-6 identifying comparative aquatic toxicities of herbicides. The 1/20th of the lowest 96 hour LC_{50} for cutthroat trout has been selected for delivery modeling by the Helena N.F.. Are cutthroat trout among the most sensitive aquatic receptor species in the areas to be treated (e.g., are cutthroat trout among the most sensitive fish species of the Helena Forest fish distribution shown in Table 3-7, page 3-22)? The Blackfoot landscape area contains bull trout. Does use of cutthroat trout for modeling effectively model impacts to the threatened bull trout?

6-24

For your information, we are including some information from the National Pesticide Telecommunication Network (NPTN) website, http://nptn.orst.edu/tech.htm below:

Picloram: Picloram has a very high pesticide movement rating; a soil half-life of 90 days; water solubility of 200,000 mg/l and a sorption coefficient of 16 soil Koc. Picloram is slightly to moderately toxic to fish and aquatic invertebrates. The reported 96-hour LC50 values for picloram are 19.3 mg/L in rainbow trout, 14.5 mg/L in bluegill sunfish, and 55 mg/L in fathead minnow. The 48-hour LC50 in Daphnia is 50 mg/L, indicating moderate toxicity. Most salts are of similar or lesser toxicity, but the isooctyl ester may be highly toxic. The reported 96-hour LC50 for the isooctyl ester in rainbow trout is 4 mg/L, and in channel catfish is 1.4 mg/L. Other LC50 values in aquatic invertebrates ranged from 10 to 68 mg/L. Picloram is not expected to accumulate appreciably in aquatic organisms; the measured bioconcentration factor in bluegill sunfish was less than 0.54.

"Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates: Summaries of Toxicity Tests Conducted at Columbia National Fisheries Research Laboratory, 1965-78. U.S. Dept. of the Interior, Fish and Wildlife Service, Resource Publication 137, Washington, D.C., 1980, lists the picloram 96-h LC50 for cutthroat trout as follows:
1) Picloram technical grade material, 90 - 100%; Stage or wt.(g) 0.4; Temp. (C) 12; 96-hr LC50, 95%CI: 4.8 mg/l, 3.8-6.2 mg/l;
2) Picloram - potassium salt, 24.9%; Stage or wt.(g) 0.9; Temp.(C) 10; 96-h LC50, 95% CI: 1.5 mg/l, 0.8-3.0 mg/l;

2,4-D: 2,4-D has a moderate pesticide movement rating; a soil half-life of 10 days; water solubility of 890 mg/l and a sorption coefficient of 20 soil Koc. 2,4-D is slightly to highly toxic to fish depending upon the formulation used. The LC50 ranges between 1.0 to 100 mg/l depending upon the formulation used. The LC50 value for the compound is 18 mg/L in the fathead minnow, 7.5 to 17 mg/L in the bluegill sunfish, and 2 to 14 mg/L in the rainbow trout. No studies were available on the toxicity of the compound to freshwater or marine invertebrates.

"Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates: Summaries of Toxicity Tests Conducted at Columbia National Fisheries Research Laboratory, 1965-

8

Comments **Response**

6-24 As discussed on pages 4-49/50 and 4-55, the modeling method used will protect federally listed aquatic species from unnecessary risk. Additional discussion is documented in the Biological Assessment and Specialist Report (see Project File).

Information from this site was used in the EIS, for example, the EXTOXNET citations. The information provided in this letter relates to chemical formulations that are not proposed for use by the Helena National Forest.

78. U.S. Dept. of the Interior, Fish and Wildlife Service, Resource Publication 137, Washington, D.C., 1980, lists the 2,4-D 96-h LC50 for cutthroat trout as follows:
1) 2,4-Dichlorophenoxyacetic acid, granular 100%; Stage or wt.(g) 0.3; Temp. (C) 10; 96-h LC50, 95% CI: 64 mg/l, 57-72 mg/l;
2) Butyl ester of 2,4-D liquid, 98.4%;Stage or wt.(g) 0.8; Temp. (C) 10; 96-h LC50, 95% CI: 0.9mg/l, 0.7-1.0 mg/l;
3) Propylene glycol butyl ether ester of 2,4-D, liquid 100%; Stage or wt.(g) 1.0; Temp.(C) 10; 96-h LC50, 95% CI: 1.0 mg/l, 0.9-1.2 mg/l;

Clopyralid: Clopyralid has a very high pesticide movement rating; a soil half-life of 40 days; water solubility of 300,000 mg/l and a sorption coefficient of 6 soil Koc. Reported 96-hour LC50 Rainbow trout 103.5 mg/l/Conditions of bioassay not specified/ LC50 Bluegill sunfish 125.4 mg/l/96 hr /Conditions of bioassay not specified.

Dicamba: Dicamba has a very high pesticide movement rating; a soil half-life of 14 days; water solubility of 400,000 mg/l and a sorption coefficient of 2 soil Koc. Dicamba is of low toxicity to fish. The LC50 (96-hour) for technical dicamba is 135 mg/L in rainbow trout and bluegill sunfish, greater than 100 mg/L in grass shrimp, and greater than 180 mg/L in fiddler crab and sheepshead minnow. The LC50 (48-hour) for dicamba is 35 mg/L in rainbow trout, 40 mg/L in bluegill, 465 mg/L in carp, and 110 mg/L in Daphnia magna, a small freshwater crustacean.

Metsulfuron-methyl: Metsulfuron-methyl has a high pesticide movement rating; a soil half-life of 30 days; water solubility of 9500 mg/l and a sorption coefficient of 35 soil Koc. The chemical has very low toxicity to aquatic organisms. 96-hour LC50 values are greater than 150 mg/l in rainbow trout and bluegill. Forty-eight hour toxicity tests with the freshwater invertebrate Daphnia magna resulted in a LC50 of greater than 150 mg/l (40). A 21-day life-cycle test with Daphnia magna also exhibited very low toxicity. The NOEL for survival and reproduction was >150 mg/l.

15. EPA generally is concerned when toxic and mobile herbicides such as picloram and clopyralid are used, since these herbicides have a high potential to be transported to surface and ground waters, have a high potential for leachability, do not readily adsorb to soils, do not photo degrade, and do not volatilize. Clopyralid is closely related structurally to picloram (3, 6, Dichloropicolinic acid). The Montana Dept. Agriculture (MDA) has found picloram and clopyralid in ground water in the Fairfield Bench area northwest of Great Falls where there are sandy clay soils. Clopyralid levels in ground water have been in the part per billion levels, below those considered a risk for human health.

Clopyralid and picloram can easily leach to ground water. Clopyralid has a water solubility of approximately 300,000 ppm, a relatively low adsorption coefficient, and a moderate half life (approximately 40 days). Picloram can persist and be transported in

9

water systems for long periods (e.g. picloram solubility in water of 430 mg/l). Picloram is also relatively toxic to aquatic life having a 96 hour LC50 of 3.5 mg/l in cutthroat trout. Tordon (picloram) application by a County Weed District in Wyoming (in accordance with herbicide label restrictions) resulted in transport of picloram through ground water a distance of several miles. Subsequent pumping of downstream ground water for household use resulted in the death of garden and household plants, evidencing the continuing presence of picloram in ground water.

We are most concerned about leaching to ground water in areas with highly permeable, sandy gravelly soil with high or perched ground water tables. The DEIS states that approximately 1,300 acres or 6 % of the proposed weed treatment areas have soil types that have shallow groundwater conditions (page 4-15). The Montana Department of

6-25 Agriculture recommends that pesticide/herbicide applicators establish soil depth criteria with sufficient depth to ground water to mitigate the potential for the movement of leachable herbicides such as picloram or clopyralid to ground water (Donna Rise, MDA, phone 444-5400). Six feet of soil may be adequate if the soils are less permeable (e.g., clay) and may provide adequate time for picloram and clopyralid to degrade. Six feet of soil, however, will <u>not</u> be adequate if the soils are sandy, gravelly or have cobbly, stony, or other permeable structural characteristics.

6-26 We suggest that the Forest Service contact the Ground Water Information Center at the Montana Bureau of Mines & Geology in Butte, MT at 496-4153 to see if there is well log information for the treated areas to identify ground water levels.

16. Thank you for including Table 4-4 (page 4-10) showing sensitive waters in the project area including thirty five impaired water bodies on Montana's Clean Water Act Section

6-27 303(d) list. We suggest contacting the Montana DEQ to identify and validate waterbodies in the area that are listed by the State impaired or threatened (i.e., contact Bob Barry or Robert Ray of MDEQ at 406-444-5342 or 406-444-5319, respectively). Information on Montana's 303(d) listed waters can be found on-line at http://www.deq.state.mt.us/ppa/mdm/303_d/303d_information.asp . Stream segments designated as "water quality impaired" and/or "threatened" listed on the States 303(d) list need development of a Total Maximum Daily Load (TMDL). The TMDL process:

Identifies the maximum load of a pollutant (e.g., sediment, nutrient, metal) a waterbody is able to assimilate and fully support its designated uses; allocates portions of the maximum load to all sources; identifies the necessary controls that may be implemented voluntarily or through regulatory means; and describes monitoring plan and associated corrective feedback loop to insure that uses are fully supported;

Or can also be viewed as, *the total amount of pollutant that a water body may receive from all sources without exceeding WQS*; or *a reduction in pollutant loading that results in meeting WQS.*

10

Comments	Response
6-25	See Appendix D, which accounts for depth to ground water, soil texture, herbicide properties and other important factors.
6-26	The Groundwater Information Center was searched and a wide range of depth-to-groundwater measurements were found, depending on location and lithology. For example, wells completed in bedrock in the mountains (typical of proposed herbicide treatment areas) have greater depth to groundwater (i.e. greater than 100 feet). Conversely, wells completed in alluvium in valley bottoms typically have shallow depth to groundwater (i.e. less than 20 feet).
6-27	The information presented in Table 4-4 regarding impaired water bodies has been checked with the Montana DEQ and the information in the table has been updated to reflect the current information.

Montana's approach is to include TMDLs as one component of comprehensive Water Quality Restoration Plans (WQRPs). TMDLs/WQRPs contain seven principal components:

1. Watershed characterization (hydrology, climate, vegetation, land use, ownership, etc.)
2. Description of impairments and applicable water quality standards.
3. Pollutant source assessment and estimate of existing pollutant loads.
4. Water quality goals, restoration targets (including TMDLs) and load allocations.
5. Restoration strategy
6. Monitoring Strategy
7. Public involvement (30 day public comment period, informational meetings, etc.)

The load allocations and targets established by TMDLs/WQRPs inform land managers how much sediment, nutrient or other pollutant discharge may be too much (i.e., prevent support of beneficial uses). We note that sometimes significant sources of pollutant loading occur in unlisted tributaries, and TMDLs must account for all sources of pollution, hence the need to identify and address sources throughout the watershed, including unlisted waters. A WQRP provides a means to track the health of a stream over time. If a WQRP has not restored beneficial uses within five years, the Montana DEQ conducts an assessment to determine if:

* the implementation of new and improved best management practices is necessary;
* water quality is improving but more time is needed to comply with WQS; or
* revisions to the plan will be necessary to meet WQS.

Pending completion of a TMDL in Montana, new and expanded nonpoint source activities may commence and continue, provided those activities are conducted in accordance with "reasonable soil, land and water conservation practices" (MCA 75-5-703). The Administrative Rules of Montana (17.30.602) define these as "methods, measures, or practices that protect present and reasonably anticipated beneficial uses." The EPA believes land management activities carried out in the watershed of 303(d) listed streams should not further degrade impaired streams, and should be consistent with TMDLs and associated WQRPs.

The Montana Dept. of Environmental Quality (MDEQ) is under a Court Ordered schedule to prepare TMDLs. This schedule includes the following for the TMDL planning areas in the Helena N.F. area:

Blackfoot Headwaters TMDL Planning Area due 2003
Middle Blackfoot TMDL Planning Area due 2004
Lake Helena TMDL Planning Area due 2004
Nevada Creek TMDL Planning Area due 2005
Upper Boulder TMDL Planning Area due 2006

11

Little Blackfoot TMDL Planning Area due 2007
Lower Boulder TMDL Planning Area due 2007
Holter TMDL Planning Area due 2007
Canyon Ferry TMDL Planning Area due 2007
Bitterroot TMDL Planning Area due 2005
Rock Creek TMDL Planning Area due 2005

Each TMDL planing area may include several impaired watersheds that have specific TMDL preparation needs.

EPA agrees with the statement in the DEIS (page 4-9) that proper application of herbicides with adequate environmental protection measures should not cause adverse effects to surface water quality, including water bodies on the 303(d) list. We also agree that establishment of TMDLs for the 303(d) listed waterbodies is not a prerequisite for weed treatment to take place. It may be prudent, however, to contact the Planning, Prevention, and Assistance Division of the MDEQ (i.e., Carole Mackin, Federal Consistency Coordinator at 444-7425 in Helena, MT) to ensure that MDEQ agrees that proposed weed treatments are consistent with TMDLs and Water Quality Restoration Plans. **6-28**

17. We are pleased that the DEIS states that based on available studies and environmental protection measures it is extremely unlikely that the lowest known acute toxicity levels for any aquatic species would ever be reached in streams. Although it also says while risks to aquatic species from <u>chronic exposure</u> are also unlikely, they are somewhat less certain. We agree with the proposed environmental protection measure to adjust treatment schedules for the drainages where modeling predicted potential for exceedances of picloram safety factors (reduce application, use alternative herbicide, etc., page 4-45).

18. The Bitterroot National Forest included an Aquatic Resources Implementation Monitoring Form for Aerial Treatment of Noxious Weeds with Herbicides in Appendix A of their EIS (see copy enclosed). Such an implementation monitoring form may be useful to help direct attention on the need to take actions to avoid drift and transport of herbicides to surface waters. The use of spray detection cards in buffers near sensitive resources to determine buffer zone width adequacy, and to adjust buffer zones based on detection card and/or water sampling results is an important component of a safe and effective aerial spraying program. **6-29**

19. Thank you for disclosing information on herbicide effects and toxicity to wildlife (pages 4-18 to 4-41), particularly for providing Table 4-5 *Effects of Each of the 12 Herbicides and Phase Surfactant*. This table contains a lot important information and will be useful throughout the duration of the treatment project. This table may provide a convenient means for disclosing herbicide toxicity to fish (i.e., adding another column identifying herbicide toxicity to fish).

12

Comments	Response
6-28	The Forest Service will continue to coordinate with the Montana DEQ. Streams in the project area are not listed due to herbicides.
6-29	Spray cards will be used and buffer widths adjusted depending on results. Please see response to comment 6-1. Also see Table 2-4.

6-30 20. For improved public understanding and disclosure we recommend that the herbicide specimen labels, information on susceptibility of weeds to different herbicides, material safety data sheets (MSDS sheets) be included in FEIS Appendices.

6-31 21. The Table of Contents listing of page numbers for Tables has many errors that should be corrected.

6-32 22. Table 3-6 (page 3-14) should also identify the bald eagle and Canada lynx as threatened species.

6-33 23. Appendix B should list *Lynx canadensis* rather than *Lynx lynx*.

Comments	Response
6-30	Tables 2-6 and 2-7 present information on herbicides and targeted weed species and application rates and timing. The Vegetation section in Chapter 4 discusses herbicide impacts on vegetation groups and individual species. Table 4-7 lists susceptibility of some non-target plant species to selected herbicides. A set of Material Safety Data Sheets (MSDS) is in the project file and is available upon request. Instructions on how to access label information and MSDS's is included in the FEIS. The referenced locations provide current information related to herbicides and brand named products. The websites referenced in the FEIS are: For labels, www.epa.gov/pesticides/pestlabels/; for MSDS, http://msds.ehs.cornell.edu/msdssrch.asp.
6-31	These errors have been corrected in the FEIS.
6-32	Information on the status of lynx and bald eagle is provided in the text. The table has been clarified by not listing the status of any species
6-33	This error has been corrected.

From Bitterroot N.F. Noxious Weed Treatment Project EIS

Aquatic Resources Implementation Monitoring Form for
Aerial Treatment of Noxious Weeds with Herbicides

Project Name______________________ Date_____/_____/_____

Herbicide Applied______________ Drainage ______________________

Monitoring Crew ______________________________________

Start Time ________ End Time________

Range of wind speeds and direction:

Time	Wind speed	Direction

(Attach map noting treatment area, buffers, drift card and water sample location)

SAMPLING DESIGN	Yes	No.	
Are there aquatic "sensitive areas" in the project area?			
If so, were they flagged for avoidance?			
Buffer used ___ ft (see mitigation measures for minimum buffer widths)			
Were drift cards set along the perimeter of the treatment area?			
Were drift cards set inside the buffer?			Spacing _____
Were drift cards set inside the treatment area?			
Water samples taken before and following aerial application?[1]			GPS Location N W
RESULTS			
Did drift cards set along the perimeter of the treatment area detect any herbicide?			Amount______
Did drift cards set inside the buffer detect any herbicide?			Amount______
Did drift cards set inside the treatment area detect any herbicide?			Amount______
How far was spraying equipment from surface water, wetlands or other aquatic sensitive areas?			

[1] Water samples would be collected before spraying and immediately after spraying. Laboratory analysis, by an independent lab, would test these water samples for herbicides whenever there is reason to suspect that herbicide may have entered the stream during the spraying operation (such as herbicides detected on drift cards, or if a spill occurred). Water samples would also be collected after the first substantial rain to detect herbicides that could possibly enter surface water through leaching or runoff. These water samples will be collected from the closest fish-bearing streams immediately downstream of the treatment area. This form does not track the post-rain samples.

Droplet deposition will be monitored using white plastic (Kromekote) spray cards positioned along the perimeter of the treatment area and inside the buffer around the sensitive areas (streams, wetlands). The herbicide will be lightly dyed with food coloring to produce a distinctive droplet stain when drops of herbicide contact the cards. The number of droplets on each card will be counted in the field immediately after spraying. Reexamination of the cards will occur in the office and the samples will be converted to a estimate of the application rate.

The first three aerial herbicide applications of each field season will be monitored. If all buffers and monitoring is implemented, and no drift into buffers is observed, monitoring will be reduced to monitoring drift at one of every three sites.

Broadwater County Weed District
515 Broadway
Townsend, MT 59644
Fax (406) 266-3674
(406) 266-9243

RECEIVED
DEC 2 2003
Townsend Ranger District

December 1, 2003

TO: Dea Nelson
Townsend Ranger District

FR: Pam Converse, Broadwater Co. Weed Coordinator

RE: Proposed Forest Service EIS

The weed board of Broadwater County would like to applaud the efforts of the Forest Service employees who have put together the proposed Environmental Impact Statement. Not only will this proposal help to step up weed management for the next twelve years, but it will also act as a guide for other employees to follow when coping with the problems of noxious weeds. After further review, the weed board fully supports the proposed Alternative A plan.

There are just a few items in the proposed plan that the board would like to comment on:

7-1 On page 3-29 a clarification should be made as to what plants are classified as "noxious farm weeds".

7- Management of nuisance weeds including cheatgrass, kochis, and fireweed should be addressed, as they are becoming a large problem in the state, especially after the events of a fire.

7-3 On table 2-6, some of the rates need to be checked and changed. For example, the label's recommended rate for whitetop treatment is 1–2 oz/ac not 0.3-0.5oz/ac.

The Broadwater County Weed District looks forward to the plan's implementation and to continue working with the Forest Service on these important issues. If there is anything the weed board can do to help, please contact the weed office at (406) 266-9243.

LETTER 7 - BROADWATER COUNTY WEED DISTRICT

Comment	Response
7-1	"Noxious farm weeds" is the terminology used in the Forest Service Manual. It is interpreted to mean "noxious weeds, which are designated by county, state and federal agencies. For further discussion, please see Chapter 1 of the EIS.
7-2	Cheatgrass has been addressed in the DEIS. Please see pages 1-2 and 1-4. The Adaptive Management Strategy discussed on pages 2-21 to 2-22 emphasizes the importance of quickly and effectively treating new weed infestations.
7-3	Please see note at the bottom of Table 2-6.

November 28, 2003

RECEIVED
DEC 2 2003
Townsend Ranger District

Dea Nelson
Townsend Ranger District
415 South Front
Townsend, MT 59644

Dear Ms. Nelson,
We are writing to comment on the Draft Environmental Impact Statement (DEIS) Helena National Forest Weed Treatment Project. We are very glad that the Helena National Forest (HNF) is reevaluating its position on weed management and is in the process of drafting a new plan. We are very concerned about noxious weeds and other exotic plants on the Helena National Forest and hope that our comments will be of benefit as the new plan is developed. In general, we support Alternative A with a stringent application of all Environmental Protection Measures (EPM), but have many questions about how realistic it is, effectiveness, commitment, funding and monitoring.

8-1 First of all, as we pointed out in our letter of January 12, 2002, common tansy (*Tanacetum vulgare*) needs to be added to the list of noxious weed species of concern. Common tansy has been listed in Montana as a noxious weed and is present, especially along road and stream corridors, in the Helena National Forest. Some sections of the DEIS fail to acknowledge that common tansy occurs on the HNF, and in fact, say it does not occur (S-1, 1-2, 1-9, 2-7), although other sections mention it as a weed on the HNF (2-16, 3-27, 4-55, 4-57). Common tansy DOES occur on the Helena National Forest, and needs to be treated.

8-2 What are the ultimate goals and objectives of the project? The only place a clear objective is mentioned is on page 2-9 that says a "…goal of reducing weed populations by 70 percent Forest-wide between 2000 and 2010". This is a lofty goal, given that this weed plan probably won't even take effect until 2005 at the earliest. Goals and objectives should be clearly defined and treatment options and results measured against the stated goals and objectives.

8-3 What does the word "control" mean in the context of the DEIS? Does it mean containing existing populations, reducing populations or eradicating noxious weeds from the HNF?

8-4 Are the 198 miles of roads known to be infested with noxious weeds included in the 22,668 acres of noxious weeds acknowledged by the HNF, or are they additional acres that need to be treated?

The statement on page S-1 that the rate of spread of weeds may increase due to large wildfires is not substantiated. This would only be true if noxious weeds were present in sufficient quantities pre-fire to expand more rapidly than other species, or if ground-disturbing activities like ORV riding were allowed in burned areas that favored the establishment and spread of noxious weeds.

LETTER 8 - KATHY LLOYD AND DRAKE BARTON

Comment	Response
8-1	Statements about common tansy have been corrected.
8-2	The goals and objectives for the project are included in the Purpose and Need section. Please see page 1-7 to 1-9. The 70 percent goal has been revised to a longer time (2015), and it is hoped that the goal would be achieved.
8-3	In the context of this EIS, the word control means to reduce the expansion and distribution of weed populations. Please see the Purpose and Need section in Chapter 1.
8-4	Roads are included in the 22,668 acres of noxious weed infestation.

8-5 Several citations in the text were not found in the References in Chapter 6. They include: Goodwin and Sheley 2001.

8-6 Pages S-1 and S-2 indicate that only 6,800 acres of the total 22,668 infested acres are NOT presently treated on the HNF. That means that approximately 15,868 acres ARE currently being treated (Alternative C, Table 2-3). Please substantiate this statistic and define "treated". If this many acres have been treated, the level of control has been dismal.

8-7 The statement is made that weed populations in accessible areas have decreased. Can this be substantiated? Our experience is that there are many noxious weed populations along road corridors in accessible locations. What monitoring has taken place to support this conclusion? As is discussed below, we are concerned that weed treatments that have been on going for a number of years on 15,868 acres have not resulted in noticeable reductions in weed populations. How will the treatments proposed in Alternatives A and B differ from this if they only get back to an area for follow-up in four years and then plan on only low-level maintenance after that?

8-8 We still feel that a program to involve lease/permit holders in weed control on lands they lease is a good idea and should be pursued. The reasons given not to move forward with such a program (S-5) seem very weak and ways could be found to deal with these objections. Leaseholders contribute to weed infestations on public land and should have some responsibility to mitigate those weed-related problems. If they are not required to control weeds on the land they lease, then allotment rates should be raised to cover the cost of the Forest Service doing the required work. Currently, local people are spraying and pulling weeds on Forest Service property because the lessees and the Forest Service have not done the required weed control and weeds have proliferated. Allotment Management Plans should take a strong position on weeds, control and prevention.

8-9 Page S-5 says 80 acres will be treated in Wilderness areas, but page S-7 lists 68 acres of Wilderness treatments.

8-10 The Table on S-6 says 11,086 acres will be treated with aerial applications, but page 4-46 says 11,074 acres will be treated with aerial spraying.

8-11 On page S-6, the Table "Addressing Concerns, Effects of weed treatment on natives grasses, forbs, shrubs, and trees" indicates that all three alternatives will have a 1-3 year reduction in growth for individual plants from herbicide applications. We believe this is misleading, as there will be more damage to non-targeted vegetation under Alternative A than under Alternatives B or C. The acres that are scheduled for aerial applications under Alternative A will have proportionately more damage to non-target species than the ground based acres in Alternative A, B, and C. This is not depicted in the Table. Additionally, we think a maximum of three years reduction in growth for native species is highly optimistic. This point is discussed in more detail later.

We are unsure how "Weed treatment effectiveness" (S-7) was rated "High" on all the acres treated in each of the three alternatives. The effectiveness of weed treatment is dependent on a number of factors and must include monitoring and adaptive management

Comment	Response
8-5	The spelling for this citation has been corrected in the References section in Chapter 6. Other cited references have been added to Chapter 6.
8-6	Please review the description of Alternative C in Chapter 2. Alternative C addresses what area the Forest Service currently has authority to treat.
8-7	Please see page 2-11, which discusses the current monitoring program. Also, review Chapter 2 which discusses the alternatives and adaptive management approach. The reduction in weed populations in accessible areas is based on a comparison of maps of previously infested roadsides, visual monitoring and photo monitoring, and a reduction in herbicide use dating back to the early 1990's.
8-8	Because of responsibility and liability issues, the Forest Service prefers to do the treatments or to contract with an experienced and licensed applicator. Congress sets the grazing rates. Allotment management plans currently address weeds through grazing management. Please see Appendix E.
8-9	The summary has been corrected.
8-10	The correction has been made in the FEIS.
8-11	The information presented on page S-8 is intended to be a summary. For more detailed information, please see Chapter 4 of the EIS.

8-12 strategies to refine treatment protocols. It will also require years of concentrated treatment efforts. No timeframe is indicated for "effectiveness" to be reached and no standards are given against which "effectiveness" is evaluated.

8-13 It is not clear to us why, on S-7, "Effects on apparent naturalness and natural integrity" and "Weed treatment effectiveness" list different percentages for Alternatives B and C. Theoretically, the acres treated are the same so why do they cite reduced weeds on 60% and 43%; and 84% and 70%, respectively? The figures seem to contradict each other in terms of the effectiveness of treatment.

8-14 Reduction in canopy cover is listed as a cause of increased susceptibility to weed invasion (1-2), and page 3-25 states that weeds do not invade forest communities that have more than 10% canopy, except where it has been thinned or removed by logging, road construction, etc., yet no consideration is given to reducing activities that remove canopy cover or cause ground disturbance. Since prevention is the first line of defense, it seems reasonable to consider measures that reduce activities that are known to contribute to weed invasion and spread. The Forest Plan directs the HNF to "confine present infestations and prevent establishing new areas of noxious weeds". The Forest Service Manual lists prevention of new invaders as the first priority when resources are limited. If we can't limit new infestations and spread, we are always behind the curve and are throwing the public's money at a problem that has already gotten ahead of us. We realize this will be considered "outside the scope" of this analysis, but effective weed control involves an entire mind-set and an approach that is willing to take a firm stand and is serious about adopting prevention measures. In this vein, we consider most of the suggestions listed on 2-4 and considered "outside the scope of the decision" to be reasonable if you are serious about preventing and reducing weed infestations.

8-15 "Features Common to all Alternatives" on pages 2-10 and 2-11 make a point of saying that the portion of the Administrative Travel Policy that allows administrative off-road travel for weed control will be allowed, yet the DEIS makes no statement about the HNF's intention to strictly enforce current travel plans that prohibit off-road travel by the public. Vehicles and off-road travel are clearly one of the most efficient vectors for weed spread (DEIS 3-33) and the HNF should rigorously enforce all travel regulations and publicize such enforcement efforts as part of a serious weed control plan.

8-16 Since common tansy is not listed as part of the field inventories for noxious weeds (1-2), even though it was brought to the attention of the forest several years ago, we question how accurate and thorough the weed surveys were and wonder how many acres were actually physically surveyed. How often is a weed inventory done? Page 2-19 says every acre of the Helena NF has not been inventoried for noxious weeds.

8-17 We are also very concerned about cheatgrass (*Bromus tectorum*), which is mentioned on pages 1-2, 1-3 and 1-4. Are acres of cheatgrass included in the acres of weeds known to infest the HNF? Cheatgrass is a serious problem and we would like to see treatment expanded to include this species. *Berteroa incana* is now listed as a noxious weed in Jefferson County. We know of infestations of this plant on HNF lands in the Divide landscape that need to be added to the treatment list. "To implement the Forest Plan and

Cont. on next page

Comment	Response
8-12	Timeframes for effective treatment are discussed in Chapter 2. Some areas would be treated repeatedly on a 2 or 3-year rotation to ensure effective control. Monitoring is used to determine effectiveness.
8-13	The naturalness & natural integrity are referring to Wilderness and Inventoried Roadless Areas, while weed treatment effectiveness percentages refer to the infested acres across the Forest. The percentages differ by alternative due to the limitations assigned to each alternative. The Forest manages 22,668 acres of weeds. However, alternatives present different approaches. The percentage of infested acres effectively treated varies by alternative due to equipment authorized, accessibility, and safety factors.
8-14	Please see the Purpose and Need section of the EIS. This project is a weed treatment project. It is considered to be one part of the Helena National Forest's weed management program. The potential to spread weeds is assessed when analyzing individual projects. Prevention measures are developed following guidance in FSM 2080-R1 2000-2001-1 (Appendix E).
8-15	Please see the description of ongoing Prevention and Education program in Chapter 2. Enforcement of the existing travel plan is outside the scope of the EIS.
8-16	Inventories are conducted on different portions of the Forest every year. We are aware of common tansy and where we have it. It is in the weeds database but is not reflected as a primary species because of its low occurrence and it is often inter-mixed with other weeds. Also see Table 3-9 & footnote.

8-17 meet more recent direction, the Helena NF must develop a weed treatment program that incorporates federal, state, and county direction and regulations" (1-5). Powell County lists *Carum carvi* (caraway) as noxious, and Lewis and Clark County lists perennial pepperweed (*Lepidium latifolium*), but we don't know if these species are found on the HNF. Certainly, we should all be aware of them as potential invaders.

8-18 Several plant scientific names are not included in Appendix B. They include hoary cress, absinth wormwood, field bindweed, purple loosestrife, common tansy, perennial pepperweed, orange hawkweed, tall buttercup, tamarix, sweet-scented bedstraw, and all the sensitive plants in Tables 3-10 and 3-11.

8-19 There is a discrepancy between the Table on page 2-5 and the Table on 1-9. Treatment acres listed for the Blackfoot area are 5,261 and 5,328 respectively. This means total acres to be treated is either 22, 668 or 22,587. Which is correct?

8-20 We have several comments about the description of Alternative A that begins on page 2-4. It seems extremely optimistic to believe only one to 10 percent of the initial treatment area will need follow-up treatment and that in 3 to 4 years a second treatment will attack new plants that have germinated. This assertion seems to be based on nothing. Every year new plants are likely to germinated from seeds in the soil, and depending on species biology, some will seed, putting more seeds into the seed bank. Knapweed seeds have been shown to remain viable in the soil for from 10-15 years and must be prevented from seeding every year for at least that long to deplete the seed bank. This fact is cited as a reason for not using mechanical control (2-9), yet it is not acknowledged that chemical treatment will need to be applied for that many years as well. Even if there is a residual chemical component left in the soil, as with picloram, the initial treatment will not reach every plant, every plant that is sprayed will not be prevented from seeding, and many areas will be sprayed with chemicals that have no soil residual. We are concerned that "spot treatments" may not be realistic and that a commitment to the real time needed to make significant headway in noxious weed control may be lacking. We are also

8-21 concerned that grazing sheep and goats may not have the desired effect. Native vegetation will surely be damaged and the "intensively herded" statement is not clarified. In some cases, grazing with domestic livestock entails hauling water, which means more motorized vehicles in areas where they may not be desired and which will cause more ground disturbance. It also means portable fencing that must be moved to new areas, entailing more driving around. The Soil Resources section on page 4-5 does not address

8-22 the possibility of additional soil compaction and disruption from the motorized vehicles that may be associated with livestock grazing. Livestock must be removed from public land before viable seeds are present on the target species, and they should be weed seed free before they are moved onto public land.

8-23 In general we approve of the Environmental Protection Measures (EPM) that are displayed in Table 2-4. Our main concern is the level of commitment necessary to actually apply all the listed measures. We would like to see a clearly defined line of authority, responsibility and enforcement for each of the EPM's. Under "Herbicide Use" we wonder who will evaluate treatment sites for sensitive plant habitat, who will evaluate

Comment	Response
8-17	Cheat grass is not listed by the state of Montana as a noxious weed and is not included in the inventory. However, the Forest Service is concerned about the spread of cheat grass and all other potential invaders, and has included treatment in Alternatives A and B, as well as the Adaptive Management Strategy.
8-18	The scientific names have been added to Appendix B and Table 3-10 and 3-11.
8-19	The corrections have been made.
8-20	The 10 percent estimate is based on past monitoring (see page 2-7).
8-21	Grazing will be part of IPM; grazing may be used with other tools as part of IPM approach to increase effectiveness of the weed treatment program. Utilization by grazing animals for weed treatment will not exceed 20 to 40 percent by weight on native species, depending upon the condition of the range (e.g. in dry years, when range conditions are less favorable, stricter utilization standards would be applied. Animals used for grazing for weed treatments would be specially conditioned to graze on target weed species.
8-22	Only minor soil disturbances are expected to occur as a result of increased motorized vehicle activity associated with utilization of grazing animals for weed treatment. Please see page 4-6 of the FEIS.
8-23	The Forest/Districts are responsible for following the Environmental Protection Measures and will be held accountable.

possible grazing areas for sensitive plant habitat, and who will function as the Forest
8-24 botanist since the HNF has no botanist? In the same section it says, "Motor vehicles would not be used in Wilderness Areas." That statement should be expanded to read, "...would not be used in Wilderness Areas or RNAs."
8-25 In the "Cultural Treatments" section we wonder who will monitor and evaluate sites to determine if seeding with native seed mixes is required, and how often such monitoring will occur.

8-26 Table 2-6 has some errors and omissions that should be corrected. Yellow starthistle is an annual, spotted knapweed is usually considered a biennial or short-lived perennial and diffuse knapweed can be an annual, biennial or a short-lived perennial. Sulfur cinquefoil is a perennial; musk thistle is a biennial; and houndstongue is biennial and is not rhizominous.

8-27 The Monitoring section should be expanded to include a timetable listing when monitoring will be done and who is responsible for each item. Also included in monitoring should be the effectiveness of chemical applications and an evaluation of how the program needs to change to be effective.

8-28 In the wildlife section beginning on page 3-10, we saw no mention of summer range and how many acres of summer range are infested with weeds. The ability of summer range to support native forage is an important factor in big game health and survival.
8-29 Table 3-6 (page 3-14) fails to list Bald Eagle and Canada lynx as threatened species.

8-30 Page 3-27 says, "Management prescriptions for invasive plants following wildfires are needed to reduce or prevent their establishment and spread on burned sites." We agree and wonder if these management prescriptions have been prepared? In our letter of January 12, 2002 we included information on weed risk assessments following wildfire and would like to see a similar protocol developed. We think weed risk assessment should be an integral part of post-fire evaluations and provisions should be made for the adoption of such an approach. We fear that blanket aerial or ground spraying post-fire will have detrimental effects to native vegetation that is fire dependent.
8-31 Indiscriminate spraying could kill fire-dependent, early-successional plants before they have a chance to flower and produce seed, thus changing the successional pathway of native plant development forever. The final weed plan should include provisions for conducting weed risk assessments after disturbance.

8-32 Page 3-28 says that 25 species of sensitive vascular plants are known or have the potential to occur in the HNF, but 26 species are listed in Table 3-10. The text says that 10 sensitive plant species have been documented, but Table 3-11 lists only 9 species (Austin's knotweed is missing).

8-33 On page 3-28 Hall's rush is listed as a grassland species. This may more accurately be described as a wet meadow or marshy species.
8-34 Ute's ladies' tresses occurs in Jefferson County and could possibly have suitable habitat within the Helena National Forest. We are curious to know how it was determined that no suitable habitat exists on the HNF.

Comment	Response
8-24	No off-road vehicle travel is allowed in RNAs. Weeds may be treated by vehicle from forest roads and trails.
8-25	Forest Service personnel would be responsible for monitoring.
8-26	The corrections have been made to Table 2-6.
8-27	Please see response to comments 6-1 and 6-11. Also see response to comments 2-10 and 2-19 for monitoring approach and objectives. The district ranger is responsible for monitoring activities.
8-28	Information on summer range weed infestations has been included in the FEIS (see page 3-13).
8-29	Please see response to comment 6-32.
8-30	Post-fire management prescriptions are developed after a fire occurs and are administered as Burned Area Emergency Rehabilitation (BAER) projects. BAER prescriptions do address vegetation recovery and weed risk assessments.
8-31	Information from a weed risk assessment has been included in the Purpose and Need and Alternatives A and B. Diagram 2-1 addresses assessing new infestations.
8-32	The corrections have been made.
8-33	The Montana Natural Heritage Program's "Plant Field Guide" indicates that habitat for Hall's rush is moist to dry meadows and slopes. This includes grasslands.
8-34	The Montana Natural Heritage Program's "Plant Field Guide" indicates Ute ladies' tresses habitat is "meandering wetlands and swales in broad, open valleys, at margins with calcareous carbonate accumulation". The HNF is not consistent with where this species has been found in Montana.

In addition to the management goals and standards for the Scapegoat Wilderness and Gates of the Mountains Wilderness that are listed on page 3-29, the following is also part of the Forest Plan (III/56, III/66): "Consider the special protection needs of endangered pant and animal species and their habitats."

8-35 The Recreation analysis on page 3-34 fails to distinguish between miles of motorized trails and miles of non-motorized trails in the Blackfoot and Continental Divide areas. These two uses have a vastly different impact on weed spread and establishment. The statement for the Continental Divide area that says "there are no designated motorized trails in the area for use during summer and fall…" is not correct. The Lava Mountain Trail is a motorized trail that is open during the summer, and the North and South Forks of Quartz Creek are designated as dual use year round.

8-36 The Research Natural Areas analysis on pages 3-36 and 3-37 includes no statement about the condition of Granite Butte, a candidate RNA. The text states that Canada thistle is found in the Cabin Gulch RNA, but is not in the database. This raises questions about the database and how frequently it is updated. Plant lists from Cabin Gulch RNA list cheatgrass (*Bromus tectorum*), yellow sweetclover (*Melilotus officinale*) and yellow **8-37** salsify (*Tragopogon dubius*) as present within the RNA. Since the Forest Service Manual 4063 directs that, if possible, exotic plants be removed from RNAs, we would like to see these species targeted for weed control within the RNA, especially if weed control efforts are happening there anyway.

8-38 Table 3-16 (page 3-39) does not include population figures for Lewis and Clark County and the average annual number of employees by industry is found in Table 3-17 and Table 3-18 (not Table 3-16).

8-39 Soil Resources Direct and Indirect Effects talks about weeds being eradicated and native plants established, but does not give any information on how this will occur. The Cumulative Effects discussion in the Water Resources section (page 4-17) mentions a short-term (less than one year) increase in sedimentation until native vegetation is reestablished. Throughout the DEIS an assumption seems to be made that native plants will automatically return once weeds are treated. This seems to us to be an overly optimistic and unsupported assumption. Conditions vary with habitat type and with the weed species and numbers that are present on the site. When weeds are treated, it seems likely that more weeds will return, until the weed seed bank is depleted. If native seeds are still present and viable in the soil after that and after all the chemical treatments, they may have a chance to develop. Or if they are present in near enough proximity to the site, they will eventually more in if more weeds don't become established first. The Vegetation section, pages 4-59 and 4-60, is the only place in the DEIS where realistic assumptions about the ability of native plants to recolonize a weedy area are made.

8-40 The analysis of Irreversible and Irretrievable Commitment of Resources, in the sections where it is addressed, is only true if the weed treatment efforts outlined in Alternative A are effective. Any loss of commitment, funding, resources or an increase in weed acres

Comment	Response
8-35	This information has been corrected.
8-36	A discussion of the condition of Granite Butte has been included in the FEIS. Canada thistle is not represented in the database as a primary species; it is often mixed with other weeds. Its exclusion in reports is a function of how the database is queried.
8-37	The presence of Cheatgrass in an RNA would be treated under the Adaptive Management Strategy. Please see Chapter 2 of the FEIS. Since yellow sweetclover and yellow salsify are not noxious weeds, their eradication is outside the scope of this EIS.
8-38	These corrections have been made.
8-39	The term "eradicated" should not have been used here. It has been changed to "treated." The discussions in the FEIS regarding recovery have been updated to more clearly reflect that we can expect a variety of response rates. Generally, more herbicide resistant species, such as grasses and sedges respond within one year following application due to reduced competition from weeds. Regardless, the Forest did not intend to imply the assumption that native plants will automatically return to the site once weeds are treated. The Forest strongly agrees that conditions vary with habitat type, weed species, herbicide and rate applied, and season of application. Individual site recovery rates are dependent on a wide variety of environmental and managerial variables.
8-40	The analysis of the alternatives does assume that the alternatives will be implemented as described.

beyond the scope of this analysis, will result in incomplete or ineffective treatment and the loss of natural habitat on the HNF.

8-41 The statement on page 4-27 "…there would be no long-term loss of species diversity of native vegetation due to the proposed treatments, and species composition under most treatments is expected to resemble native plant assemblages within one to three years…" is overly optimistic and not grounded in reality. The reference given for the source of this information is a paper by Peter Rice that deals with spotted knapweed. Conditions and the location referenced in this paper cannot be applied unilaterally across the HNF for all weed species in all locations. Brown et al. 2002 found that native forb species diversity and density were reduced by Dalmatian toadflax treatments (page 4-51). In drier forest communities, herbicides would shift dominance to grasses and sedges, at the expense of native forbs (page 4-51), and may affect non-vascular plant species diversity (page 4-51). Bryophyte communities, as well as fern and fern-allies, did not recover species diversity and abundance for at least five years (page 4-52).

In the Wildlife section on page 4-38 in the discussion under Alternative B, it says that 6,600 acres that are proposed for aerial treatment under Alternative A will not be treated. We are unsure how this figure was computed. On the following page the same number (6,600) is used to describe the numbers of acres that won't be treated in Alternative C. 8-42 That makes sense: 22,668 – 15,871 = 6797. The discussion for Alternative B should include the number of acres that are proposed for aerial spraying in Alternative A that won't be treated with ground applications in Alternative B.

8-43 The discussion on Runoff on page 4-45 is misleading. Norris et al. (1991) are cited several times "…leaching of chemicals…is least likely to occur in undisturbed forest environments" and "Risks tend to be lower on well-vegetated forests and rangeland …", but well-vegetated forest environments are not where the weeds are and are not where spraying will take place. 8-44 There is a discussion about soil hydrologic function and infiltration rates following fire, but no mention of soil compaction and infiltration rates due to logging, roads, grazing and other activities on forest lands.

8-45 Does the Felsot 2001 study that is cited on page 4-47 apply to light plane or helicopter spraying?

If the application rate for picloram (0.5 pint per acre) studied by Winfield (2003) for Dalmatian toadflax control is really effective and can be applied in the fall, we support that treatment, as it will have far fewer negative effects on desirable native vegetation. We also support chemical application in the late summer or fall when most native plants are dormant. However, such applications must be made before the target weed species have viable seeds, otherwise more seeds will have been added to the seed bank and more years of treatment will be needed. This is true for all targeted noxious weeds on the HNF.

Comment	Response
8-41	We agree that information presented in research papers cannot be applied unilaterally across the Helena National Forest for all weed species in all locations. We have updated the discussions regarding recovery rates in the FEIS (please also see response to comment 8-39). Plant communities studied by Rice et al (1992) are very similar to plant communities on the HNF. The studies by Rice and others monitored species diversity change over a three year period following herbicide treatment. The study conducted by Brown et al (2002) presents data for one year and did not address recovery of community diversity after three years. As stated on page 4-52 of the DEIS (page 4-65 of the FEIS), proposed application rates of picloram and imazapic for treatment of Dalmatian toadflax would likely reduce biomass and species diversity of non-target forbs and shrubs. The duration of the reduction is unknown. The discussion on Bryophytes has been revised in the FEIS.
8-42	The correction has been made in the FEIS.
8-43	The two sentences in the Runoff section on page 4-45 of the DEIS that refer to statements by Norris et al. 1991 have been deleted in the FEIS.
8-44	Soil compaction and infiltration rate impacts due to logging, roads, grazing, mining, and other activities on National Forest land is recognized in the FEIS. See Chapter 4, particularly the Soil Resources section and the Fisheries and Aquatic Resource section.
8-45	The study applies to helicopter.

We support the suggestion on page 4-54 that areas treated with herbicides be monitored for effects on weeds and non-target species so application rates can be adjusted as needed.

The positive benefit of reduction in pine and Douglas-fir seedlings discussed on page 4-55 is only true in grassland or other areas where fire suppression has been the norm. It may not be beneficial on burned or logged areas where tree regeneration is desired and weed treatment is necessary. As suggested, picloram should not be applied within the root zone of trees, as the chemical has the ability to move through soils.

8-46 Spot spraying with 2,4-D amine is recommended for use in riparian and other wet areas.

8-47 All known sensitive species locations should be protected from herbicide application. Any chemical use near those locations should be selectively applied by hand by educated, informed, and licensed applicators.

We have a strong concern about the level of commitment and education required for chemical applicators on the HNF. See below for more discussion of this point. Page 4-56 recommends educating applicators to identify and avoid sensitive plants and to have a qualified botanist present when sensitive plant locations are treated. We agree. Many sensitive plants look similar to target weed species and can be easily misidentified.

8-48 All herbicide applications must be made by licensed governmental applicators, commercial applicators, or their operators. To what extent will commercial applicators be used? How will the HNF insure proper operator training by the commercial operators?

We are in favor of biological controls that have been demonstrated to be host-specific. We are not in favor of any biological control that has the possibility of spreading to native plant species. Leafy spurge and musk thistle insects seem risky. Those that are host-specific should be used to the greatest extent possible, especially in those areas with difficult access.

8-49 Grazing with domestic livestock may shift a plant community toward weeds and native forbs and shrubs will be consumed. We think any program of livestock grazing needs to be strictly controlled and monitored with before and after data, so results can be clearly seen and adjustments made to the program. Without this level of monitoring there is no way to evaluate the benefits or consequences of the grazing program.

We are puzzled and distressed by the statement on page 4-66 that the "propose *sic* for these future decisions is to have a variety of motorized and administrative use, permitted use, and to access to *sic* private lands within the forest boundary". The purpose of upcoming travel planning on the forest is to provide for non-motorized recreation, as well as motorized, and to protect wildlife habitat, sensitive species, water quality and a host of other resources under agency jurisdiction. We are also very disturbed by the statement that "…increased use of IRAs by motorized vehicles, grazing, road construction (though

Comment	Response
8-46	This is one of the herbicides that will be considered for riparian areas.
8-47	Please see the Environmental Protection Measures section (EPM 22) in Chapter 2 of the EIS.
8-48	Commercial applicators will be used often. Contracts include requirements for experience and license, and contract administrators will ensure compliance with the contract requirements.
8-49	Grazing will be monitored at representative sites, and for species and/or projects of special concern (e.g. prescribed burns). Treatment effectiveness is evaluated on all treatment areas.

limited, logging and other ground disturbing activities would undoubtedly spread weeds further into wilderness areas and IRAs". This is an instance where true commitment to weed control can take precedence over other forest uses. Inventoried Roadless Areas SHOULD NOT experience any motorized vehicle or road construction uses. It is disturbing to realize that such degradation is considered a "done deal" and that no efforts to halt the decline and disturbance of some of the only refuges for native plant and animal life away from motor vehicles and roads are even considered. **8-50**

The continuity and commitment to weed control funding, and to the weed control program in general, is of particular concern to us. The Helena National Forest Plan (1986) states, "Funding for weed control on disturbed sites will be provided by the resource which causes the disturbance." Linking weed control to a project or activity is not sufficient to control existing weed populations or to prevent the establishment of new populations. Weed control funding should be constant and should be one of the top priorities within the Forest Service. Protection of the public resources under Agency control need not be tied to timber harvests or other activities. The weed problem is so large and weeds are already so well established that it is impractical to tie treatment to existing resources. This does not mean that projects should not include a strong weed control component. They should. It means that aggressive weed control will take place regardless of project implementation measures or duration. Since some noxious weed seeds remain viable for 10 to 15 years or longer, a long-term commitment is necessary to insure that weeds don't establish due to Agency actions, or subsequent inaction. And that doesn't even begin to address the spread of weeds by vectors the Agency has difficulty controlling, such as grazing animals and motorized vehicles. The Record of Decision for the Helena National Forest Noxious Weed Control Program, October 1987, states, "Implementation of this program is dependent on the level of funding and availability of labor to treat noxious weed infestations." Again, we want to stress the importance of moving weed control up the ladder of priorities so that funding and adequate personnel are available on a predictable and sustainable level, unconnected to other Agency activities. Whatever needs to happen on the federal level to insure consistent, high-level funding should be pursued with the utmost seriousness. The extensiveness of the proposed herbicide applications will be expensive and will have to last for many years. How is the proposal to be funded? How assured is the funding? What is the timeline for the funding? The cited figure for Alternative A is up to $1,106,994 for initial treatment. Apparently this figure does not include follow-up treatments after the initial treatments have been made. Follow-up treatment will be required on almost all acres originally treated and will have to continue until weeds are eradicated and are replaced by healthy native plant communities. This, of course, will require yearly monitoring. At the cited figure of $300,000 per year for weed control, initial treatment won't be completed for 3 or 4 years. In four years, without follow-up treatment having occurred on the first treatment acres, it is doubtful if any reduction in noxious weeds will be measurable on the first treatment acres. We fail to see how this approach will result in a reduction of weed populations by 70% by 2010. **8-51**

Another point we would like to discuss is the strategy for weed control that has been in place since Forest Plan adoption in 1986. The Forest Plan mentions "…confine present

Comment **Response**

8-50 Inventoried Roadless Area use and development is directed by the Helena Forest Plan and National policy and is outside the scope of this EIS. Only the treatment of noxious weeds in the Helena National Forest is under consideration.

8-51 Funding is described in the Socioeconomics and Environmental Justice section in Chapter 4 of the EIS. As with all federal government projects, funding is never assured. Funding is annual and varies from year to year. If funding drops, priorities will have to be shifted. Under an IPM approach concerted efforts using higher cost tools may be shifted to high priority areas and lower priority areas may be shifted to long term control via biocontrol.

infestations and prevent establishing new areas of noxious weeds." The 1987 noxious Weed Control Program final EIS refers back to Forest Plan standards (II/22), but also establishes a number of preventative measures that were to have been in effect since that time. These preventative measures include promptly treating all new infestations; prioritizing treatment areas; establishing treatment boundaries annually and concentrating efforts on containing infestations. Unfortunately, the FEIS tied treatment to insecure funding levels by stating, "Weeds inside these boundaries will be controlled as funding is available." The Divide Landscape Analysis, 1996, and presumably other landscape analyses, refers to an "aggressive confine/contain/reduce strategy", although this strategy is not specifically defined. The *Montana Weed Management Plan* (January 2001) specifically encourages the adoption of the weed prevention strategies outlined in appendix E of that document. It also says, "Current budget for noxious weed management [on USDA Forest Service land in Montana] is $931,000 and it is estimated that $5,000,000 is necessary to adequately contain and suppress current levels of infestations, conduct public education and awareness campaigns, and eradicate new invaders." We are sure that these figures have risen substantially since then. It is clear to us that the strategy employed in the past has not been effective, the Forest has not met its weed control goals and that weed infestations continue to accelerate at an alarming rate.
It is time to rethink the weed control strategy and to set clear, definable and measurable
8-52 standards and goals. Confine/contain/reduce seems to be a workable approach, with the
eventual goal of eradicating noxious weeds on the HNF. The problem is that it needs a
8-53 clear definition and application on the ground. How will areas be surveyed and mapped?
What standards and guidelines will be used to prioritize treatment areas? How will
8-54 treatment area boundaries be set? How will the treatment method(s) be chosen? How
will newly discovered individuals or populations be added into the system, prioritized
and treated? How will adequate training be conducted for Agency employees and
8-55 contractors? How will the effectiveness of treatment and the performance of employees
and contractors be measured and by whom?

8-56

During the summer of 2001, we conducted rare plant surveys in the Big Belt Mountains
8-57 in areas where potential rare plant habitat intersected mapped weed populations. We observed two different contracted weed crews at work and saw the results of weed spraying in many areas in the Big Belts. We concluded that the confine/contain/reduce strategy was not being applied effectively. We observed many instances where large populations were sporadically and ineffectively treated from the inside, while small populations and individuals on the outside perimeter were untreated. It was our impression that an influx of last minute money was being spent, even though the approach was not clearly thought out, and we fear the results will be marginal, at best. We also observed many instances where native plants were selectively sprayed, while weeds were not. We saw an inappropriate use of money, time and chemicals. Rocks and litter on the ground were selectively sprayed. We found large infestations of hound's-tongue, (*Cynoglossum officinale*), a biennial plant, that had already gone to seed because of the lateness of the season. Plants that had already seeded were sprayed, while the first year rosettes, that will produce seed next year, were left untreated. This indicates either a lack of education or a lack of concern and conscientiousness about the job. In cases like this, it is our opinion that more harm than good has probably been done. Native plants

Comment	Response
8-52	The Forest Service updates its weed inventory annually, using a global positioning system and geographic information system. New species may be added to the Montana state, county, and North American weed lists. New invaders, as identified by local and State agencies, would be given high priority for eradication, if feasible. Treatment will be based on risk assessments.
8-53	Please see response to comment 8-2.
8-54	Treatment area boundaries will be determined by location and extent of weed infestation.
8-55	Use of a weed risk assessment to assist in the prioritization of treatments has been included in the FEIS on page 2-4.
8-56	Please see the Adaptive Management Strategy section in the EIS. Also please see the response to comment 8-52.
8-57	Contractors have guidelines in their contracts related to performance that are enforced through contract administrators. Employee performance is judged by their supervisors. In recognition of problems with past performance of contractors, performance evaluations are currently being used in the selection of contractors.

will be killed by chemical application, while weeds will still be there from plants left untreated and from the seed source at the site. And now they will have even less competition. This points, again, to the importance of a long-term approach that treats the same area year after year and to a strong education program. **8-58** We think it might be more effective to pick fewer areas to treat, such as drainages or roadsides, and do a very good job in those areas, than it would be to haphazardly treat lots of areas in a sporadic and ineffective way. Treating new populations aggressively, and working from the outside perimeter toward the center of established populations makes sense.

Prevention must be a strong component of any weed plan, as pointed out in *The Montana Weed Management Plan*. One of the key elements of that prevention plan is the following component: "Keep all site disturbing vehicles on roads and trails designated or established for motor vehicles by the responsible land management agency". The 1987 **8-59** noxious Weed Control Program final EIS lists motor vehicles as prime vectors for weed spread and establishment. It is essential that strong, effective travel planning be implemented throughout the Forest as soon as possible. Enforcement of travel planning violations needs to be consistently and strongly applied. In conjunction with this need, we urge the Helena National Forest to seek to establish licensing of ORVs and snowmobiles consistent with that required on full-sized vehicles. Agency law enforcement officers can't effectively enforce travel regulations and the public cannot assist with law enforcement when license numbers are not visible. This should be a top priority for the Forest Service.

8-60 Education of all employees and contractors must be an integral part of any weed control strategy. Education should include weed and native plant identification, as well as information about proper methods and timing for weed control to be used on a particular site and particular species. The focus should be on making all efforts as effective as possible while doing minimal damage to natives. **8-61** We would like to see increased use of handwork, in addition to chemical application. In some instances, working within a defined boundary, the manual removal of seed heads and proper bagging and disposal of those seeds, would greatly enhance the effectiveness of treatment.

In general we remain skeptical of the aerial application of herbicides, but will support its use as defined in Alternative A if it will truly allow weed treatment and control in areas that otherwise would not be treated. However, any native populations and individuals that help slow the spread of noxious weeds would be indiscriminately killed by aerial applications of herbicides. Aerial application WILL (not "may") cause damage to unintended species (S-4). The only thing that would survive would be noxious weeds, due to their accumulated seed source in the soil, and some grass species. We are pessimistic about the continued level of commitment, funding and personnel that would have to be in place to treat these large areas year after year after year, and the same level of commitment that would have to be given to the revegetation effort that would have to follow. We have concerns about the health issues, for wildlife, water, soils and humans, associated with these large-scale and less closely controlled applications of chemicals. We approve of the EPMs that are designed to mitigate the dangers associated with aerial applications, but are less comfortable with the realization that only if these measures are

Comment	Response
8-58	The treatment alternatives considered would not be implemented in a haphazard manner and are expected to be effective. Please see the Adaptive Management Strategy section in Chapter 2 for more information on how new populations will be treated.
8-59	The Statewide OHV decision essentially limits motorized vehicle use to existing routes. Further Forest level travel planning has been completed for the Elkhorn Mountains, the Clancy-Unionville area, and the Dry Range and North end of the Big Belt Mountains. Travel Planning for the remainder of the Forest is scheduled for completion by 2009. Establishing licensing requirements for OHV's and snowmobiles is beyond the scope of this EIS.
8-60	The FS agrees. Please see response to comment 8-57. Licensing for both government and commercial applicators includes weed identification; education credits are required by state law for applicators to maintain their licenses. The HNF requires each ranger district to conduct herbicide applicator education and training at the beginning of each spray season. Identification of weed species and native plants, including sensitive species, is included in this training.
8-61	Manual treatments would be applied where it is most effective to do so.

stringently and consistently enforced will the benefits and safety features be in place. As we have stated before, a high level of commitment, education and conscientiousness to the job are absolute requirements. **8-62** How will the HNF ensure that this level of compliance is consistently applied by all personnel and contractors? **8-63** What steps will be taken to ensure that aerial applicators apply the herbicide according to label instructions and will not apply the herbicide to any species not listed on the label? When spaying range or lightly forested land, killing non-targeted and non-label species WILL happen no matter how careful the applicator is. It is the nature of the application method to completely and non-selectively cover large areas of land. **8-64** The HNF should query the Montana Department of Agriculture on the number and magnitude of pesticide damage claims against aerial applicators.

8-65 Finally, we would like to stress the importance of effectiveness monitoring. The Forest Plan requires weed infestation monitoring annually. Monitoring should include an honest evaluation of the effectiveness of treatment, the effects to other resources incurred as a result of treatment, any problems with the methods of treatment selected for a specific site and species, and suggestions on how to improve the program.

We were listed on page 5-3 in the DEIS as submitting our initial comments on behalf of the Montana Native Plant Society (MNPS). We signed our letter as individuals and did not indicate anywhere in the letter that we represented the Montana Native Plant Society. Even though many MNPS members will probably agree with our position, we are representing only ourselves.

Thank you for the chance to comment and we look forward to continued participation in the process.

Kathy Lloyd

Drake Barton

Kathy Lloyd and Drake Barton
314 Travis Creek Road
Clancy, MT 59634

12

Comment	Response
8-62	Please see response to comment 8-57.
8-63	The District/Forest actively oversees all treatment applications and will ensure that herbicides are administered properly, according to the label. Please also see response to comments 6-1 and 6-2.
8-64	The Forest Service will contact the Montana Department of Agriculture and consider pesticide damage claims along with other factors when selecting applicators. This will be done prior to contracting; evaluation of past performance is part of the bid evaluation process.
8-65	Please see response to comment 6-11. Districts monitor effectiveness on all target species (establish photopoints) and each treatment. Please also see response to comments 6-1 and 6-2.

LETTER 9 - ROGER LLOYD

RECEIVED
DEC 2 2003
Townsend Ranger District

December 1, 2003

Roger Lloyd
912 Granite Ave.
Helena, MT 59601

Dea Nelson
Helena National Forest
Townsend Ranger District
415 South Front
Townsend, MT 59644

Thank you for inviting me to comment on the draft environmental impact statement (DEIS) for the forest-wide noxious weed treatment project in the Helena National Forest (HNF). Such a project is necessary and long over due. Past half-hearted, ineffective efforts and the inability of the HNF to really deal with the problems of noxious weeds is, to a large degree, why the problem is as large as it is today. Because of this past, I remain skeptical of the HNF's commitment to truly address this problem in a meaningful way. Nevertheless, I support the project and offer the following comments. I have tried to stay out of the details and to offer comments at a higher, conceptual level.

1. Goals - The goals and objectives of the projects are conspicuously absent from the DEIS. [9-1] Those few that can be discerned from the text are inadequate and not clear. What exactly is it that is trying to be accomplished over the 12-year life of the project? The statement of reducing weed populations by 70 percent is a meaningless and overly optimistic statement given the few years that will be given to actual control efforts. Just killing 7 out of every 10 plants will do nothing. On how many acres will noxious weeds be eradicated? On how many miles of motorized routes will noxious weeds be eradicated? How much effort (acres, time) is planned for monitoring and follow up treatments?
2. Mindset - In order to control and eradicate noxious weeds, the HNF needs a whole new mindset. A true commitment to the eradication of noxious weeds is necessary for the success of this project. Although complete eradication won't be achieved with this project (although it can in certain areas which certainly should be one of the project goals), it is the mindset of eradication that is most important. The DEIS shows that the HNF has not quite yet reached this turning point. A more holistic view is required that [9-2] not only includes eradication, but prevention measures as well. What measures will be implemented to prevent or minimize the reintroductions or new introductions of noxious weeds? All activity on HNF land and all decisions affecting use of HNF land must be viewed with noxious weeds as one of the foremost items to consider. And not only for the life of this project, but on an on-going basis. Noxious weeds will not go away with the completion of this project. Without this mindset, the money and effort spent on this project will, in the long-run, be wasted.

Comment	Response
9-1	Please see response to comment 8-2.
9-2	Please see response to comment 8-14.

3. Funding – "Funding determines policy, policy determines funding". This is a common phrase in the state appropriations process. It means that the two are intricately intertwined. All the words put on paper and all the verbalized good intentions mean nothing without adequate funding to back it up. There probably should be an entire projected devoted to obtaining and retaining the required funds needed to make this project a success, because such an effort is what it will take to secure adequate funding over the 12 years of this project. Please address what it will take to obtain the necessary funding and how the HNF plans to do it. Noxious weeds are an issue of the entire HNF, not just an issue of any one activity. As such, funding should not be linked to the earmarking of funds and relied on from any particular activity (such as timber sales). If relied upon, the revenue variability of such funding sources will put the entire project at risk. Please address the risks of funding. **9-3**

4. Monitoring – The DEIS is weak on monitoring. Without monitoring the effectiveness of the control measures will not be known, no one will know if the goals and objectives have been met, and no one will know what follow up is necessary. **9-4**

5. Follow up - With any committed effort to eradicate noxious weeds, follow up plays a bigger role and requires a greater commitment than the initial application. Certain parts of the DEIS read like the initial herbicide application is expected to "control" the noxious weeds forever. Nothing can be further from the truth. An applicator will not spray 100 percent of the targeted weeds and not 100 percent of the weeds sprayed will die. Add to this the viable seeds remaining in the ground (even with the application of Tordon) and risks from reintroduction (vehicles, neighboring lands) and one can readily see that follow up measures are required for success of this project. Follow up visits should be schedule annually for all treated acres beginning with the year treated and last at least five years after the last live plant had been documented. This is how private landowners make a success of a noxious weed eradication project. **9-5**

Good luck for a successful completion of this long overdue project. If you are going to proceed with alternative A, proceed with commitment and determination and with adequate funding. Do it, but do it right.

Sincerely,

Roger Lloyd

Comment	Response
9-3	Weeds are an important issue and all allowed funding sources will be used. Please also see response to comment 8-51.
9-4	Please see response to comment 6-11. Please also see response to comments 6-1, 6-2, and 6-3.
9-5	Weed populations are monitored annually until they are eliminated.

APPENDIX A

PROPOSED TREATMENT ACREAGE BY WATERSHED

TABLE A-1
Alternative A Treatment Acres by Watershed

Stream	6th HUC No.[1]	Proposed Treatment Acreage	HUC Acres (Total / Forest)	Sensitivity Issues[2]
Belts/Dry Range LA – 4th HUC No. 10030101 (Upper Missouri River)				
Upper Battle Creek	020010		11,991 / 1	
Mike Day Creek	020020		7,433 / 854	
Faulkner Creek	020040	11-ground	6,546 / 1,137	
Hay Creek	020050		9,558 / 2,775	
Sherlock Creek	040010	1-ground	11,556 / 859	
Upper Sixteen Mile Creek	040020		25,802 / 0	Impaired
Middle Sixteen Mile Creek	040030		30,198 / 30	Impaired
Lower Sixteen Mile Creek	040040		19,126 / 0	Impaired
Upper Deep Creek	070010	218-ground	32,369 / 16,209	Burn 2000
Upper Deep Creek tributary	070020	18-aerial; 171-grnd	7,614 / 6,995	Burn 2000
Middle Deep Creek	070030	34-aerial; 3-ground	6,261 / 2,665	Burn 2000
Middle Deep Creek tributary	070040	22-ground	7,774 / 6,297	Burn 2000
Sixmile Creek	090010		27,912 / 507	
Dry Creek	090040	17-ground	30,797 / 6,801	Impaired; Burn 2000
Greyson Creek	090060	1-ground	15,497 / 2,012	
Cottonwood Creek	100010		21,976 / 280	
Ray Creek	100020	6-ground	25,893 / 3,421	Sensitive Fish Spp.[3]
Gurnett Creek	100030	23-ground	13,987 / 3,318	
Duck Creek	100040		20,488 / 6,796	Sensitive Fish Spp.
Confederate Gulch	100050	28-aerial; 184-grnd	33,007 / 18,692	Impaired Sensitive Fish Spp.
Upper Canyon Ferry area	100070		89,721 / 0	
White Gulch	110010	165-aerial; 291-grnd	20,450 / 12,436	Impaired Sensitive Fish Spp.
Avalanche Creek	110020	147-aerial; 226-grnd	25,018 / 22,456	Impaired Sensitive Fish Spp.
Hellgate Creek	110030	8-aerial; 54-ground	10,720 / 8,247	
Magpie Creek	110040	291-aerial; 237-grnd	16,249 / 15,600	Impaired; Burn 2000 Sensitive Fish Spp.
Cave Gulch and others	110050	883-aerial; 223-grnd	45,936 / 5,635	Impaired; Burn 2000; 20-25% treatment area
Upper Trout Creek	160010	20-aerial; 313-grnd	19,418 / 14,827	Impaired
Soup Creek	160020	20-aerial; 105-grnd	13,246 / 11,624	
Lower Trout Creek	160030	2889-aerial; 594-gnd	15,386 / 14,008	Impaired; 20-25% treatment area
Oregon Gulch	160040	977-aerial; 386-grnd	6,445 / 5,792	20-25% treatment area
Favorite Gulch	160060	103-ground	5,927 / 4,057	
Missouri River area	160070	15-aerial; 79-ground	21,436 / 1,786	
Upper Beaver Creek	170010	150-ground	21,017 / 12,673	
Hunters Gulch	170020	39-ground	5,700 / 5,697	
Middle Beaver Creek	170030	31-ground	2,582 / 2,582	
Big Log Gulch	170040	24-aerial; 29-ground	6,247 / 6,247	
Lower Beaver Creek	170050	64-aerial; 272-grnd	11,297 / 10,690	

TABLE A-1
Alternative A Treatment Acres by Watershed

Stream	6th HUC No.[1]	Proposed Treatment Acreage	HUC Acres (Total / Forest)	Sensitivity Issues[2]
Elkhorn Creek	180020		13,776 / 692	Sensitive Fish Spp.
Willow Creek	180030		10,046 / 7,993	
Missouri River area	180050	15-aerial; 88-ground	59,291 / 13,134	
Belts/Dry Range LA – 4th HUC No. 10030103 (Smith River)				
Upper Big Birch Creek	020010		8,987 / 7,223	
Little Birch Creek	020020		8,858 / 1,208	
Lower Big Birch Creek	020030	22-ground	12,944 / 2,328	
Upper Smith River area	020070		36,444 / 0	
Upper Camas Creek	050010	3-ground	21,672 / 14,858	Impaired Sensitive Fish Spp.
Thomas Creek	050020	44-ground	9,774 / 2,576	
Benton Gulch	050030	13-aerial; 23-ground	25,272 / 7,137	
Lower Camas Creek	050040		18,469 / 2,224	Impaired
Thompson Gulch	060040	15-aerial; 16-ground	46,583 / 1,190	Sensitive Fish Spp.
Beaver Creek	060050	6-aerial; 2-ground	31,187 / 6,464	
Smith River area	060060		13,621 / 555	Impaired
Upper Rock Creek	080010	185-aerial; 68-grnd	30,318 / 4,363	
Antelope Creek	080020	29-ground	15,895 / 3,022	
Ellis Canyon Creek	080040	4-ground	10,560 / 5,074	
Lower Rock Creek	080050		19,420 / 840	
Smith River area	100030		28,947 / 2,916	Impaired
Elk Creek	110010		11,074 / 0	Impaired
Middle Creek	110020		16,019 / 0	
Hound Creek	110030		17,870 / 0	Impaired
Elkhorn LA – 4th HUC No. 10030101 (Upper Missouri River)				
Upper Crow Creek	080010		15,395 / 15,090	Impaired Sensitive Fish Spp.
Middle Crow Creek	080020	32-aerial; 66-ground	21,168 / 20,605	Impaired Sensitive Fish Spp.
Upper Crow Creek tributary	080030	5-aerial; 23-ground	10,442 / 10,221	Impaired
Middle Crow Creek tributary	080040	123-aerial; 158-grnd	5,065 / 4,630	Impaired; 5-10% treatment area
Middle Crow Creek	080050		5,646 / 3,648	Impaired
Johnny Gulch	090030	7-aerial; 74-ground	21,245 / 4,815	
Lower Crow Creek	090050	54-aerial; 4-ground	67,254 / 0	Impaired
Indian Creek	090070	31-aerial; 10-ground	13,502 / 5,005	Impaired
Beaver Creek	100060	91-aerial; 73-ground	36,608 / 18,842	Impaired Sensitive Fish Spp.
Whitehorse Creek	100070	11-aerial; 93-ground	89,721 / 4,809	
Upper Prickly Pear Creek	120010		13,072 / 7,164	Impaired Sensitive Fish Spp.
Warm Springs Creek	120030	16-aerial; 50-grnd	13,264 / 9,087	Sensitive Fish Spp.
Middle Prickly Pear Creek	120050	41-aerial	15,535 / 3,752	Impaired Sensitive Fish Spp.

TABLE A-1
Alternative A Treatment Acres by Watershed

Stream	6th HUC No.[1]	Proposed Treatment Acreage	HUC Acres (Total / Forest)	Sensitivity Issues[2]
McClellan Creek	120070	161-aerial; 462-grnd	23,144 / 14,096	Public water supply for East Helena Sensitive Fish Spp.
Lower Prickly Pear Creek	120080	27-aerial; 12-ground	20,100 / 2,811	
Spokane Creek	160050	111-aerial; 56-grnd	37,421 / 3,103	
Elkhorn LA – 4th HUC No. 10020006 (Boulder River)				
Dry Creek	050030		25,372 / 6,321	Impaired
Continental Divide LA – 4th HUC No. 10030101 (Upper Missouri River)				
Spring Creek	120020		20,266 / 1,834	Impaired
Clancy Creek	120040	81-ground	20,988 / 7,169	Impaired Sensitive Fish Spp.
Lump Gulch	120060	402-ground	27,805 / 14,633	Impaired Sensitive Fish Spp.
Lower Prickly Pear Creek	120080		20,100 / 715	
Upper Tenmile Creek – south	130010	80-ground	26,116 / 21,011	
Upper Tenmile Creek – north	130020	124-aerial; 62-grnd	16,279 / 9,936	
Greenhorn Creek – south	130030	210-aerial; 76-grnd	12,914 / 7,746	
Greenhorn Creek – north	130040		7,785 / 2,287	Sensitive Fish Spp.
Middle Tenmile Creek	130050	44-ground	19,202 / 8,221	Impaired; public water supply for Helena
Lower Tenmile Creek	130070	1-ground	10,976 / 423	Impaired; public water supply for Helena
Upper Silver Creek	140010		10,949 / 918	Impaired Sensitive Fish Spp.
Grizzly-Orofino Gulch	150030	1503-ground	17,078 / 6,578	5-10% treatment area
Upper Little Prickly Pear Creek – south	190010	99-ground	15,078 / 10,068	
Upper Little Prickly Pear Creek – north	190020	149-aerial; 138-grnd	11,775 / 10,239	
Marsh Creek	190050	140-ground	17,216 / 5,152	
Continental Divide LA – 4th HUC No. 17010201 (Upper Clark Fork)				
Baggs Creek	050060		40,449 / 18,928	
Upper Little Blackfoot R. – south	060010	85-ground	18,016 / 17,949	Impaired TES Fish Spp.
Ontario Creek	060020	96-ground	12,829 / 12,643	TES Fish Spp.
Telegraph Creek	060030	154-ground	12,205 / 10,254	Impaired Sensitive Fish Spp.
Mike Renig Gulch	060040	49-ground	7,676 / 3,067	Sensitive Fish Spp.
Upper Little Blackfoot R. – north	060050	448-aerial; 331-grnd	13,066 / 9,177	Impaired; 5-10% treatment area TES Fish Spp.
Hope Creek	070010	117-aerial; 84-grnd	20,444 / 10,597	Sensitive Fish Spp.
Dog Creek	070020	5-aerial; 67-ground	16,714 / 3,148	Impaired Sensitive Fish Spp.
North Trout Creek	070030	10-ground	10,543 / 3,309	Sensitive Fish Spp.

TABLE A-1
Alternative A Treatment Acres by Watershed

Stream	6th HUC No.[1]	Proposed Treatment Acreage	HUC Acres (Total / Forest)	Sensitivity Issues[2]
Snowshoe Creek	070040	49-ground	11,588 / 3,545	Impaired Sensitive Fish Spp.
Elliston Creek	070050	8-aerial; 117-ground	20,295 / 4,919	Impaired TES Fish Spp.
Ophir Creek	070060	365-aerial; 117-grnd	16,786 / 5,748	Sensitive Fish Spp.
Trout Creek	070070	110-aerial; 36-grnd	12,469 / 2,969	Sensitive Fish Spp.
Spotted Dog Creek – west	080010	2-ground	8,128 / 238	Impaired
Spotted Dog Creek – east	080020	128-aerial; 156-grnd	8,801 / 5,094	Impaired Sensitive Fish Spp.
Threemile Creek	080040		14,373 / 4,662	Impaired Sensitive Fish Spp.
Continental Divide Landscape – 4th HUC No. 10020006 (Boulder River)				
High Ore Creek	030040		11,346 / 1,574	Impaired Sensitive Fish Spp.
Blackfoot Landscape – 4th HUC No. 17010203 (Blackfoot River)				
Upper Landers Fork	010010	9-ground	18,673 / 18,576	Sensitive Fish Spp.
Bighorn Creek	010020	14-ground	23,965 / 23,934	Sensitive Fish Spp.
Upper Copper Creek	010030	82-aerial; 137-grnd	16,863 / 16,740	TES Fish Spp.[4]
Lower Landers Fork	010040		11,235 / 5,175	TES Fish Spp.
Lower Copper Creek	010050	37-aerial; 64-ground	13,446 / 8,425	TES Fish Spp.
Alice Creek	020010	10-aerial; 47-ground	12,618 / 11,194	Sensitive Fish Spp.
Upper Blackfoot River	020020	108-ground	10,084 / 8,884	Sensitive Fish Spp.
Willow Creek	020030	49-ground	12,370 / 8,009	Impaired Sensitive Fish Spp.
Upper Blackfoot River tributary	020040	14-ground	7,136 / 2,128	
Bartlett Creek	020050		11,376 / 3,808	TES Fish Spp.
Hogum Creek	020060	73-aerial; 69-ground	7,613 / 6,862	Sensitive Fish Spp.
Horsefly Creek	020070	23-aerial; 2-ground	12,650 / 3,275	TES Fish Spp.
Poorman Creek	030010	468-aerial; 198-grnd	26,396 / 23,518	Impaired TES Fish Spp.
Humbug Creek	030020	123-aerial; 28-grnd	12,150 / 5,326	Sensitive Fish Spp.
Keep Cool Creek	030030	93-aerial; 170-grnd	22,802 / 13,313	Sensitive Fish Spp.
Beaver Creek	030040	30-aerial; 92-ground	11,582 / 8,841	TES Fish Spp.
Middle Blackfoot River	030050		12,150 / 2,989	TES Fish Spp.
Willow Creek	030060	72-aerial; 130-grnd	12,152 / 5,852	Impaired Sensitive Fish Spp.
Sauerkraut Creek	030070	43-ground	8,518 / 4,922	Sensitive Fish Spp.
Lincoln Gulch	030080	74-aerial; 155-grnd	9,406 / 5,711	TES Fish Spp.
Arrastra Creek	030090	50-ground	15,463 / 8,221	Impaired TES Fish Spp.
Moose Creek Area	030100	789-aerial; 141-grnd	19,783 / 8,332	Sensitive Fish Spp.
Upper Nevada Creek	040010	387-aerial; 110-grnd	25,180 / 17,852	Impaired TES Fish Spp.
Washington Creek	040030		7,998 / 4,966	Impaired Sensitive Fish Spp.

TABLE A-1
Alternative A Treatment Acres by Watershed

Stream	6th HUC No.[1]	Proposed Treatment Acreage	HUC Acres (Total / Forest)	Sensitivity Issues[2]
Jefferson Creek	040040	28-aerial; 27-ground	6,599 / 2,664	Impaired Sensitive Fish Spp.
Buffalo Gulch	040050	178-aerial; 148-grnd	9,162 / 4,856	Sensitive Fish Spp.
Chicken Creek area	040110	287-aerial; 211-grnd	18,096 / 4,089	Sensitive Fish Spp.
Wasson Creek area	040150	35-aerial; 76-ground	31,401 / 4,358	Sensitive Fish Spp.
Meadow Creek	060010	5-ground	12,163 / 11,872	
Mineral Creek	060020		9,485 / 9,485	
East Fork Blackfoot River	060030	41-ground	20,320 / 20,277	Sensitive Fish Spp.
Ward Creek	070020		7,821 / 1,795	Impaired
North Fork Blackfoot River	070040	99-aerial; 83-ground	25,198 / 12,474	Impaired TES Fish Spp.
Blackfoot LA – 4th HUC No. 10030101 (Upper Missouri River)				
Upper Canyon Creek	190030		15,189 / 8,567	Sensitive Fish Spp.
Virginia Creek	190040	7-aerial; 173-ground	19,383 / 13,466	Sensitive Fish Spp.
Upper Little Prickly Pear Creek	190050		17,216 / 5,152	Impaired
Sears Creek	190060		9,703 / 261	
Canyon Creek	190070		25,322 / 1,054	
Blackfoot LA – 4th HUC No. 10030102 (Upper Missouri River)				
Middle Fork Dearborn River	030000	15-ground	43,172 / 2,442	
South Fork Dearborn River	040010	24-ground	12,993 / 5,237	
Blackfoot LA – 4th HUC No. 17010201 (Upper Clark Fork)				
Sixmile Creek	080050		18,843 / 313	

Source: Montana DEQ 2002b

1 HUC = hydrologic unit code; HUCs reported in this table are 6th-Code.

2 "Impaired" means the stream or river segment is on the 1996, 1998, 2000, and/or 2002 303(d) Lists of impaired water bodies in Montana. "Burn 2000" indicates those areas that had significant timber burned within the watershed during 2000. "Percent Treatment Area" is the portion of the watershed that is proposed for ground and/or aerial weed treatment.

3 Sensitive Fish Spp. are westslope cutthroat trout.

4 TES Fish Spp. indicated westslope cutthroat trout or bull trout.

TABLE A-2 Alternative B Treatment Acres by Watershed				
Stream	**6th HUC No.[1]**	**Proposed Treatment Acreage**	**HUC Acres (Total / Forest)**	**Sensitivity Issues[2]**
Belts/Dry Range LA – 4th HUC No. 10030101 (Upper Missouri River)				
Upper Battle Creek	020010		11,991 / 1	
Mike Day Creek	020020		7,433 / 854	
Faulkner Creek	020040	11-ground	6,546 / 1,137	
Hay Creek	020050		9,558 / 2,775	
Sherlock Creek	040010	1-ground	11,556 / 859	
Upper Sixteen Mile Creek	040020		25,802 / 0	Impaired
Middle Sixteen Mile Creek	040030		30,198 / 30	Impaired
Lower Sixteen Mile Creek	040040		19,126 / 0	Impaired
Upper Deep Creek	070010	218-ground	32,369 / 16,209	Burn 2000
Upper Deep Creek tributary	070020	176-ground	7,614 / 6,995	Burn 2000
Middle Deep Creek	070030	33-ground	6,261 / 2,665	Burn 2000
Middle Deep Creek tributary	070040	22-ground	7,774 / 6,297	Burn 2000
Sixmile Creek	090010		27,912 / 507	
Dry Creek	090040	17-ground	30,797 / 6,801	Impaired; Burn 2000
Greyson Creek	090060		15,497 / 2,012	
Cottonwood Creek	100010		21,976 / 280	
Ray Creek	100020	6-ground	25,893 / 3,421	Sensitive Fish Spp.[3]
Gurnett Creek	100030	23-ground	13,987 / 3,318	
Duck Creek	100040		20,488 / 6,796	Sensitive Fish Spp.
Confederate Gulch	100050	212-ground	33,007 / 18,692	Impaired Sensitive Fish Spp.
Upper Canyon Ferry area	100070		89,721 / 0	
White Gulch	110010	414-ground	20,450 / 12,436	Impaired Sensitive Fish Spp.
Avalanche Creek	110020	323-ground	25,018 / 22,456	Impaired Sensitive Fish Spp.
Hellgate Creek	110030	61-ground	10,720 / 8,247	
Magpie Creek	110040	430-ground	16,249 / 15,600	Impaired; Burn 2000 Sensitive Fish Spp.
Cave Gulch and others	110050	809-ground	45,936 / 5,635	Impaired; Burn 2000; 20-25% treatment area
Upper Trout Creek	160010	319-ground	19,418 / 14,827	Impaired
Soup Creek	160020	125-ground	13,246 / 11,624	
Lower Trout Creek	160030	2135-ground	15,386 / 14,008	Impaired; 20-25% treatment area
Oregon Gulch	160040	1259-ground	6,445 / 5,792	20-25% treatment area
Favorite Gulch	160060	103-ground	5,927 / 4,057	
Missouri River area	160070	84-ground	21,436 / 1,786	
Upper Beaver Creek	170010	150-ground	21,017 / 12,673	
Hunters Gulch	170020	39-ground	5,700 / 5,697	
Middle Beaver Creek	170030	31-ground	2,582 / 2,582	
Big Log Gulch	170040	51-ground	6,247 / 6,247	
Lower Beaver Creek	170050	334-ground	11,297 / 10,690	

TABLE A-2 Alternative B Treatment Acres by Watershed				
Stream	6th HUC No.[1]	Proposed Treatment Acreage	HUC Acres (Total / Forest)	Sensitivity Issues[2]
Elkhorn Creek	180020		13,776 / 692	Sensitive Fish Spp.
Willow Creek	180030		10,046 / 7,993	
Missouri River area	180050	103-ground	59,291 / 13,134	
Belts/Dry Range LA – 4th HUC No. 10030103 (Smith River)				
Upper Big Birch Creek	020010		8,987 / 7,223	
Little Birch Creek	020020		8,858 / 1,208	
Lower Big Birch Creek	020030	22-ground	12,944 / 2,328	
Upper Smith River area	020070		36,444 / 0	
Upper Camas Creek	050010	3-ground	21,672 / 14,858	Impaired Sensitive Fish Spp.
Thomas Creek	050020	44-ground	9,774 / 2,576	
Benton Gulch	050030	34-ground	25,272 / 7,137	
Lower Camas Creek	050040		18,469 / 2,224	Impaired
Thompson Gulch	060040	31-ground	46,583 / 1,190	Sensitive Fish Spp.
Beaver Creek	060050	8-ground	31,187 / 6,464	
Smith River area	060060		13,621 / 555	Impaired
Upper Rock Creek	080010	253-ground	30,318 / 4,363	
Antelope Creek	080020	29-ground	15,895 / 3,022	
Ellis Canyon Creek	080040	4-ground	10,560 / 5,074	
Lower Rock Creek	080050		19,420 / 840	
Smith River area	100030		28,947 / 2,916	Impaired
Elk Creek	110010		11,074 / 0	Impaired
Middle Creek	110020		16,019 / 0	
Hound Creek	110030		17,870 / 0	Impaired
Elkhorn LA – 4th HUC No. 10030101 (Upper Missouri River)				
Upper Crow Creek	080010		15,395 / 15,090	Impaired Sensitive Fish Spp.
Middle Crow Creek	080020	93-ground	21,168 / 20,605	Impaired Sensitive Fish Spp.
Upper Crow Creek tributary	080030	28-ground	10,442 / 10,221	Impaired
Middle Crow Creek tributary	080040	280-ground	5,065 / 4,630	Impaired; 5-10% treatment area
Middle Crow Creek	080050		5,646 / 3,648	Impaired
Johnny Gulch	090030	80-ground	21,245 / 4,815	
Lower Crow Creek	090050	58-ground	67,254 / 0	Impaired
Indian Creek	090070	41-ground	13,502 / 5,005	Impaired
Beaver Creek	100060	142-ground	36,608 / 18,842	Impaired Sensitive Fish Spp.
Whitehorse Creek	100070	104-ground	89,721 / 4,809	
Upper Prickly Pear Creek	120010		13,072 / 7,164	Impaired Sensitive Fish Spp.
Warm Springs Creek	120030	64-ground	13,264 / 9,087	Sensitive Fish Spp.
Middle Prickly Pear Creek	120050	41-ground	15,535 / 3,752	Impaired Sensitive Fish Spp.

TABLE A-2
Alternative B Treatment Acres by Watershed

Stream	6th HUC No.[1]	Proposed Treatment Acreage	HUC Acres (Total / Forest)	Sensitivity Issues[2]
McClellan Creek	120070	622-ground	23,144 / 14,096	Public water supply for East Helena Sensitive Fish Spp.
Lower Prickly Pear Creek	120080	35-ground	20,100 / 2,811	
Spokane Creek	160050	167-ground	37,421 / 3,103	
Elkhorn LA – 4th HUC No. 10020006 (Boulder River)				
Dry Creek	050030		25,372 / 6,321	Impaired
Continental Divide LA – 4th HUC No. 10030101 (Upper Missouri River)				
Spring Creek	120020		20,266 / 1,834	Impaired
Clancy Creek	120040	81-ground	20,988 / 7,169	Impaired Sensitive Fish Spp.
Lump Gulch	120060	402-ground	27,805 / 14,633	Impaired Sensitive Fish Spp.
Lower Prickly Pear Creek	120080		20,100 / 715	
Upper Tenmile Creek – south	130010	80-ground	26,116 / 21,011	
Upper Tenmile Creek – north	130020	177-ground	16,279 / 9,936	
Greenhorn Creek – south	130030	252-ground	12,914 / 7,746	
Greenhorn Creek – north	130040		7,785 / 2,287	Sensitive Fish Spp.
Middle Tenmile Creek	130050	44-ground	19,202 / 8,221	Impaired; public water supply for Helena
Lower Tenmile Creek	130070	1-ground	10,976 / 423	Impaired; public water supply for Helena
Upper Silver Creek	140010		10,949 / 918	Impaired Sensitive Fish Spp.
Grizzly-Orofino Gulch	150030	1502-ground	17,078 / 6,578	5-10% treatment area
Upper Little Prickly Pear Creek – south	190010	99-ground	15,078 / 10,068	
Upper Little Prickly Pear Creek – north	190020	172-ground	11,775 / 10,239	
Marsh Creek	190050	140-ground	17,216 / 5,152	
Continental Divide LA – 4th HUC No. 17010201 (Upper Clark Fork)				
Baggs Creek	050060		40,449 / 18,928	
Upper Little Blackfoot R. – south	060010	85-ground	18,016 / 17,949	Impaired TES Fish Spp.
Ontario Creek	060020	96-ground	12,829 / 12,643	TES Fish Spp.
Telegraph Creek	060030	142-ground	12,205 / 10,254	Impaired Sensitive Fish Spp.
Mike Renig Gulch	060040	49-ground	7,676 / 3,067	Sensitive Fish Spp.
Upper Little Blackfoot R. – north	060050	760-ground	13,066 / 9,177	Impaired; 5-10% treatment area TES Fish Spp.
Hope Creek	070010	202-ground	20,444 / 10,597	Sensitive Fish Spp.
Dog Creek	070020	73-ground	16,714 / 3,148	Impaired Sensitive Fish Spp.
North Trout Creek	070030	10-ground	10,543 / 3,309	Sensitive Fish Spp.

TABLE A-2 Alternative B Treatment Acres by Watershed				
Stream	**6th HUC No.[1]**	**Proposed Treatment Acreage**	**HUC Acres (Total / Forest)**	**Sensitivity Issues[2]**
Snowshoe Creek	070040	49-ground	11,588 / 3,545	Impaired Sensitive Fish Spp.
Elliston Creek	070050	125-ground	20,295 / 4,919	Impaired TES Fish Spp.
Ophir Creek	070060	376-ground	16,786 / 5,748	Sensitive Fish Spp.
Trout Creek	070070	146-ground	12,469 / 2,969	Sensitive Fish Spp.
Spotted Dog Creek – west	080010	2-ground	8,128 / 238	Impaired
Spotted Dog Creek – east	080020	240-ground	8,801 / 5,094	Impaired Sensitive Fish Spp.
Threemile Creek	080040		14,373 / 4,662	Impaired Sensitive Fish Spp.
Continental Divide Landscape – 4th HUC No. 10020006 (Boulder River)				
High Ore Creek	030040		11,346 / 1,574	Impaired Sensitive Fish Spp.
Blackfoot Landscape – 4th HUC No. 17010203 (Blackfoot River)				
Upper Landers Fork	010010	9-ground	18,673 / 18,576	Sensitive Fish Spp.
Bighorn Creek	010020	14-ground	23,965 / 23,934	Sensitive Fish Spp.
Upper Copper Creek	010030	210-ground	16,863 / 16,740	TES Fish Spp.[4]
Lower Landers Fork	010040		11,235 / 5,175	TES Fish Spp.
Lower Copper Creek	010050	89-ground	13,446 / 8,425	TES Fish Spp.
Alice Creek	020010	56-ground	12,618 / 11,194	Sensitive Fish Spp.
Upper Blackfoot River	020020	108-ground	10,084 / 8,884	Sensitive Fish Spp.
Willow Creek	020030	49-ground	12,370 / 8,009	Impaired Sensitive Fish Spp.
Upper Blackfoot River tributary	020040	14-ground	7,136 / 2,128	
Bartlett Creek	020050		11,376 / 3,808	TES Fish Spp.
Hogum Creek	020060	114-ground	7,613 / 6,862	Sensitive Fish Spp.
Horsefly Creek	020070	25-ground	12,650 / 3,275	TES Fish Spp.
Poorman Creek	030010	410-ground	26,396 / 23,518	Impaired TES Fish Spp.
Humbug Creek	030020	125-ground	12,150 / 5,326	Sensitive Fish Spp.
Keep Cool Creek	030030	236-ground	22,802 / 13,313	Sensitive Fish Spp.
Beaver Creek	030040	119-ground	11,582 / 8,841	TES Fish Spp.
Middle Blackfoot River	030050		12,150 / 2,989	TES Fish Spp.
Willow Creek	030060	190-ground	12,152 / 5,852	Impaired Sensitive Fish Spp.
Sauerkraut Creek	030070	43-ground	8,518 / 4,922	Sensitive Fish Spp.
Lincoln Gulch	030080	216-ground	9,406 / 5,711	TES Fish Spp.
Arrastra Creek	030090	50-ground	15,463 / 8,221	Impaired TES Fish Spp.
Moose Creek Area	030100	672-ground	19,783 / 8,332	Sensitive Fish Spp.
Upper Nevada Creek	040010	235-ground	25,180 / 17,852	Impaired TES Fish Spp.
Washington Creek	040030		7,998 / 4,966	Impaired Sensitive Fish Spp.

TABLE A-2
Alternative B Treatment Acres by Watershed

Stream	6th HUC No.[1]	Proposed Treatment Acreage	HUC Acres (Total / Forest)	Sensitivity Issues[2]
Jefferson Creek	040040	14-ground	6,599 / 2,664	Impaired Sensitive Fish Spp.
Buffalo Gulch	040050	177-ground	9,162 / 4,856	Sensitive Fish Spp.
Chicken Creek area	040110	295-ground	18,096 / 4,089	Sensitive Fish Spp.
Wasson Creek area	040150	104-ground	31,401 / 4,358	Sensitive Fish Spp.
Meadow Creek	060010	5-ground	12,163 / 11,872	
Mineral Creek	060020		9,485 / 9,485	
East Fork Blackfoot River	060030	41-ground	20,320 / 20,277	Sensitive Fish Spp.
Ward Creek	070020		7,821 / 1,795	Impaired
North Fork Blackfoot River	070040	101-ground	25,198 / 12,474	Impaired TES Fish Spp.
Blackfoot LA – 4th HUC No. 10030101 (Upper Missouri River)				
Upper Canyon Creek	190030		15,189 / 8,567	Sensitive Fish Spp.
Virginia Creek	190040	180-ground	19,383 / 13,466	Sensitive Fish Spp.
Upper Little Prickly Pear Creek	190050		17,216 / 5,152	Impaired
Sears Creek	190060		9,703 / 261	
Canyon Creek	190070		25,322 / 1,054	
Blackfoot LA – 4th HUC No. 10030102 (Upper Missouri River)				
Middle Fork Dearborn River	030000	16-ground	43,172 / 2,442	
South Fork Dearborn River	040010	24-ground	12,993 / 5,237	
Blackfoot LA – 4th HUC No. 17010201 (Upper Clark Fork)				
Sixmile Creek	080050		18,843 / 313	

Source: Montana DEQ 2002b

5 HUC = hydrologic unit code; HUCs reported in this table are 6th-Code.

6 "Impaired" means the stream or river segment is on the 1996, 1998, 2000, and/or 2002 303(d) Lists of impaired water bodies in Montana. "Burn 2000" indicates those areas that had significant timber burned within the watershed during 2000. "Percent Treatment Area" is the portion of the watershed that is proposed for ground and/or aerial weed treatment.

7 Sensitive Fish Spp. are westslope cutthroat trout.

8 TES Fish Spp. indicated westslope cutthroat trout or bull trout.

TABLE A-3
Alternative C Treatment Acres by Watershed

Stream	6th HUC No.[1]	Proposed Treatment Acreage	HUC Acres (Total / Forest)	Sensitivity Issues[2]
Belts/Dry Range LA – 4th HUC No. 10030101 (Upper Missouri River)				
Upper Battle Creek	020010		11,991 / 1	
Mike Day Creek	020020		7,433 / 854	
Faulkner Creek	020040	11-ground	6,546 / 1,137	
Hay Creek	020050		9,558 / 2,775	
Sherlock Creek	040010	1-ground	11,556 / 859	
Upper Sixteen Mile Creek	040020		25,802 / 0	Impaired
Middle Sixteen Mile Creek	040030		30,198 / 30	Impaired
Lower Sixteen Mile Creek	040040		19,126 / 0	Impaired
Upper Deep Creek	070010	217-ground	32,369 / 16,209	Burn 2000
Upper Deep Creek tributary	070020	176-ground	7,614 / 6,995	Burn 2000
Middle Deep Creek	070030	33-ground	6,261 / 2,665	Burn 2000
Middle Deep Creek tributary	070040	22-ground	7,774 / 6,297	Burn 2000
Sixmile Creek	090010		27,912 / 507	
Dry Creek	090040	17-ground	30,797 / 6,801	Impaired; Burn 2000
Greyson Creek	090060		15,497 / 2,012	
Cottonwood Creek	100010		21,976 / 280	
Ray Creek	100020	6-ground	25,893 / 3,421	Sensitive Fish Spp.[3]
Gurnett Creek	100030	23-ground	13,987 / 3,318	
Duck Creek	100040		20,488 / 6,796	Sensitive Fish Spp.
Confederate Gulch	100050	212-ground	33,007 / 18,692	Impaired Sensitive Fish Spp
Upper Canyon Ferry area	100070		89,721 / 0	
White Gulch	110010	414-ground	20,450 / 12,436	Impaired Sensitive Fish Spp.
Avalanche Creek	110020	323-ground	25,018 / 22,456	Impaired Sensitive Fish Spp.
Hellgate Creek	110030	61-ground	10,720 / 8,247	
Magpie Creek	110040	398-ground	16,249 / 15,600	Impaired; Burn 2000 Sensitive Fish Spp.
Cave Gulch and others	110050	809-ground	45,936 / 5,635	Impaired; Burn 2000; 20-25% treatment area
Upper Trout Creek	160010	319-ground	19,418 / 14,827	Impaired
Soup Creek	160020	66-ground	13,246 / 11,624	
Lower Trout Creek	160030	1827-ground	15,386 / 14,008	Impaired; 20-25% treatment area
Oregon Gulch	160040	1259-ground	6,445 / 5,792	20-25% treatment area
Favorite Gulch	160060	103-ground	5,927 / 4,057	
Missouri River area	160070	79-ground	21,436 / 1,786	
Upper Beaver Creek	170010	150-ground	21,017 / 12,673	
Hunters Gulch	170020	23-ground	5,700 / 5,697	
Middle Beaver Creek	170030	31-ground	2,582 / 2,582	
Big Log Gulch	170040	41-ground	6,247 / 6,247	
Lower Beaver Creek	170050	328-ground	11,297 / 10,690	

TABLE A-3 Alternative C Treatment Acres by Watershed				
Stream	**6th HUC No.**[1]	**Proposed Treatment Acreage**	**HUC Acres (Total / Forest)**	**Sensitivity Issues**[2]
Elkhorn Creek	180020		13,776 / 692	Sensitive Fish Spp.
Willow Creek	180030		10,046 / 7,993	
Missouri River area	180050	47-ground	59,291 / 13,134	
Belts/Dry Range LA – 4th HUC No. 10030103 (Smith River)				
Upper Big Birch Creek	020010		8,987 / 7,223	
Little Birch Creek	020020		8,858 / 1,208	
Lower Big Birch Creek	020030	22-ground	12,944 / 2,328	
Upper Smith River area	020070		36,444 / 0	
Upper Camas Creek	050010	3-ground	21,672 / 14,858	Impaired Sensitive Fish Spp.
Thomas Creek	050020	44-ground	9,774 / 2,576	
Benton Gulch	050030	34-ground	25,272 / 7,137	
Lower Camas Creek	050040		18,469 / 2,224	Impaired
Thompson Gulch	060040	31-ground	46,583 / 1,190	Sensitive Fish Spp.
Beaver Creek	060050	8-ground	31,187 / 6,464	
Smith River area	060060		13,621 / 555	Impaired
Upper Rock Creek	080010	68-ground	30,318 / 4,363	
Antelope Creek	080020	29-ground	15,895 / 3,022	
Ellis Canyon Creek	080040	1-ground	10,560 / 5,074	
Lower Rock Creek	080050		19,420 / 840	
Smith River area	100030		28,947 / 2,916	Impaired
Elk Creek	110010		11,074 / 0	Impaired
Middle Creek	110020		16,019 / 0	
Hound Creek	110030		17,870 / 0	Impaired
Elkhorn LA – 4th HUC No. 10030101 (Upper Missouri River)				
Upper Crow Creek	080010		15,395 / 15,090	Impaired Sensitive Fish Spp.
Middle Crow Creek	080020	87-ground	21,168 / 20,605	Impaired Sensitive Fish Spp.
Upper Crow Creek tributary	080030	28-ground	10,442 / 10,221	Impaired
Middle Crow Creek tributary	080040	280-ground	5,065 / 4,630	Impaired; 5-10% treatment area
Middle Crow Creek	080050		5,646 / 3,648	Impaired
Johnny Gulch	090030	80-ground	21,245 / 4,815	
Lower Crow Creek	090050	58-ground	67,254 / 0	Impaired
Indian Creek	090070	41-ground	13,502 / 5,005	Impaired
Beaver Creek	100060	116-ground	36,608 / 18,842	Impaired Sensitive Fish Spp.
Whitehorse Creek	100070	62-ground	89,721 / 4,809	
Upper Prickly Pear Creek	120010		13,072 / 7,164	Impaired Sensitive Fish Spp.
Warm Springs Creek	120030	64-ground	13,264 / 9,087	Sensitive Fish Spp.
Middle Prickly Pear Creek	120050	35-ground	15,535 / 3,752	Impaired Sensitive Fish Spp.

TABLE A-3
Alternative C Treatment Acres by Watershed

Stream	6th HUC No.[1]	Proposed Treatment Acreage	HUC Acres (Total / Forest)	Sensitivity Issues[2]
McClellan Creek	120070	487-ground	23,144 / 14,096	Public water supply for East Helena Sensitive Fish Spp.
Lower Prickly Pear Creek	120080	35-ground	20,100 / 2,811	
Spokane Creek	160050	133-ground	37,421 / 3,103	
Elkhorn LA – 4th HUC No. 10020006 (Boulder River)				
Dry Creek	050030		25,372 / 6,321	Impaired
Continental Divide LA – 4th HUC No. 10030101 (Upper Missouri River)				
Spring Creek	120020		20,266 / 1,834	Impaired
Clancy Creek	120040	81-ground	20,988 / 7,169	Impaired Sensitive Fish Spp.
Lump Gulch	120060	402-ground	27,805 / 14,633	Impaired Sensitive Fish Spp.
Lower Prickly Pear Creek	120080		20,100 / 715	
Upper Tenmile Creek – south	130010	80-ground	26,116 / 21,011	
Upper Tenmile Creek – north	130020	78-ground	16,279 / 9,936	
Greenhorn Creek – south	130030	252-ground	12,914 / 7,746	
Greenhorn Creek – north	130040		7,785 / 2,287	Sensitive Fish Spp.
Middle Tenmile Creek	130050	44-ground	19,202 / 8,221	Impaired; public water supply for Helena
Lower Tenmile Creek	130070	1-ground	10,976 / 423	Impaired; public water supply for Helena
Upper Silver Creek	140010		10,949 / 918	Impaired Sensitive Fish Spp.
Grizzly-Orofino Gulch	150030	1502-ground	17,078 / 6,578	5-10% treatment area
Upper Little Prickly Pear Creek – south	190010	73-ground	15,078 / 10,068	
Upper Little Prickly Pear Creek – north	190020	156-ground	11,775 / 10,239	
Marsh Creek	190050	140-ground	17,216 / 5,152	
Continental Divide LA – 4th HUC No. 17010201 (Upper Clark Fork)				
Baggs Creek	050060		40,449 / 18,928	
Upper Little Blackfoot R. – south	060010	85-ground	18,016 / 17,949	Impaired TES Fish Spp.
Ontario Creek	060020	96-ground	12,829 / 12,643	TES Fish Spp.
Telegraph Creek	060030	123-ground	12,205 / 10,254	Impaired Sensitive Fish Spp.
Mike Renig Gulch	060040	49-ground	7,676 / 3,067	Sensitive Fish Spp.
Upper Little Blackfoot R. – north	060050	269-ground	13,066 / 9,177	Impaired; 5-10% treatment area TES Fish Spp.
Hope Creek	070010	153-ground	20,444 / 10,597	Sensitive Fish Spp.
Dog Creek	070020	73-ground	16,714 / 3,148	Impaired Sensitive Fish Spp.
North Trout Creek	070030	10-ground	10,543 / 3,309	Sensitive Fish Spp.

TABLE A-3
Alternative C Treatment Acres by Watershed

Stream	6th HUC No.[1]	Proposed Treatment Acreage	HUC Acres (Total / Forest)	Sensitivity Issues[2]
Snowshoe Creek	070040	49-ground	11,588 / 3,545	Impaired Sensitive Fish Spp.
Elliston Creek	070050	117-ground	20,295 / 4,919	Impaired TES Fish Spp.
Ophir Creek	070060	228-ground	16,786 / 5,748	Sensitive Fish Spp.
Trout Creek	070070	39-ground	12,469 / 2,969	Sensitive Fish Spp.
Spotted Dog Creek – west	080010	2-ground	8,128 / 238	Impaired
Spotted Dog Creek – east	080020	140-ground	8,801 / 5,094	Impaired Sensitive Fish Spp.
Threemile Creek	080040		14,373 / 4,662	Impaired Sensitive Fish Spp.
Continental Divide Landscape – 4th HUC No. 10020006 (Boulder River)				
High Ore Creek	030040		11,346 / 1,574	Impaired Sensitive Fish Spp.
Blackfoot Landscape – 4th HUC No. 17010203 (Blackfoot River)				
Upper Landers Fork	010010		18,673 / 18,576	Sensitive Fish Spp.
Bighorn Creek	010020		23,965 / 23,934	Sensitive Fish Spp.
Upper Copper Creek	010030	146-ground	16,863 / 16,740	TES Fish Spp.[4]
Lower Landers Fork	010040		11,235 / 5,175	TES Fish Spp.
Lower Copper Creek	010050	89-ground	13,446 / 8,425	TES Fish Spp.
Alice Creek	020010	56-ground	12,618 / 11,194	Sensitive Fish Spp.
Upper Blackfoot River	020020	108-ground	10,084 / 8,884	Sensitive Fish Spp.
Willow Creek	020030	49-ground	12,370 / 8,009	Impaired Sensitive Fish Spp.
Upper Blackfoot River tributary	020040	14-ground	7,136 / 2,128	
Bartlett Creek	020050		11,376 / 3,808	TES Fish Spp.
Hogum Creek	020060	114-ground	7,613 / 6,862	Sensitive Fish Spp.
Horsefly Creek	020070	25-ground	12,650 / 3,275	TES Fish Spp.
Poorman Creek	030010	348-ground	26,396 / 23,518	Impaired TES Fish Spp.
Humbug Creek	030020	109-ground	12,150 / 5,326	Sensitive Fish Spp.
Keep Cool Creek	030030	189-ground	22,802 / 13,313	Sensitive Fish Spp.
Beaver Creek	030040	93-ground	11,582 / 8,841	TES Fish Spp.
Middle Blackfoot River	030050		12,150 / 2,989	TES Fish Spp.
Willow Creek	030060	130-ground	12,152 / 5,852	Impaired Sensitive Fish Spp.
Sauerkraut Creek	030070	43-ground	8,518 / 4,922	Sensitive Fish Spp.
Lincoln Gulch	030080	216-ground	9,406 / 5,711	TES Fish Spp.
Arrastra Creek	030090	50-ground	15,463 / 8,221	Impaired TES Fish Spp.
Moose Creek Area	030100	293-ground	19,783 / 8,332	Sensitive Fish Spp.
Upper Nevada Creek	040010	122-ground	25,180 / 17,852	Impaired TES Fish Spp.
Washington Creek	040030		7,998 / 4,966	Impaired Sensitive Fish Spp.

TABLE A-3 Alternative C Treatment Acres by Watershed				
Stream	**6th HUC No.[1]**	**Proposed Treatment Acreage**	**HUC Acres (Total / Forest)**	**Sensitivity Issues[2]**
Jefferson Creek	040040	14-ground	6,599 / 2,664	Impaired Sensitive Fish Spp.
Buffalo Gulch	040050	129-ground	9,162 / 4,856	Sensitive Fish Spp.
Chicken Creek area	040110	176-ground	18,096 / 4,089	Sensitive Fish Spp.
Wasson Creek area	040150	84-ground	31,401 / 4,358	Sensitive Fish Spp.
Meadow Creek	060010		12,163 / 11,872	
Mineral Creek	060020		9,485 / 9,485	
East Fork Blackfoot River	060030		20,320 / 20,277	Sensitive Fish Spp.
Ward Creek	070020		7,821 / 1,795	Impaired
North Fork Blackfoot River	070040	101-ground	25,198 / 12,474	Impaired TES Fish Spp.
Blackfoot LA – 4th HUC No. 10030101 (Upper Missouri River)				
Upper Canyon Creek	190030		15,189 / 8,567	Sensitive Fish Spp.
Virginia Creek	190040	180-ground	19,383 / 13,466	Sensitive Fish Spp.
Upper Little Prickly Pear Creek	190050		17,216 / 5,152	Impaired
Sears Creek	190060		9,703 / 261	
Canyon Creek	190070		25,322 / 1,054	
Blackfoot LA – 4th HUC No. 10030102 (Upper Missouri River)				
Middle Fork Dearborn River	030000	16-ground	43,172 / 2,442	
South Fork Dearborn River	040010	24-ground	12,993 / 5,237	
Blackfoot LA – 4th HUC No. 17010201 (Upper Clark Fork)				
Sixmile Creek	080050		18,843 / 313	

Source: Montana DEQ 2002b

9 HUC = hydrologic unit code; HUCs reported in this table are 6th-Code.

10 "Impaired" means the stream or river segment is on the 1996, 1998, 2000, and/or 2002 303(d) Lists of impaired water bodies in Montana. "Burn 2000" indicates those areas that had significant timber burned within the watershed during 2000. "Percent Treatment Area" is the portion of the watershed that is proposed for ground and/or aerial weed treatment.

11 Sensitive Fish Spp. are westslope cutthroat trout.

12 TES Fish Spp. indicated westslope cutthroat trout or bull trout.

APPENDIX B

SCIENTIFIC NAMES OF PLANT, FISH AND WILDLIFE SPECIES

PLANTS

Alpine meadowrue	*Thalictrum alpinum*
American vetch	*Vicia americana*
Arrowleaf balsamroot	*Balsamorhiza saggitata*
Arrow-leaf groundsel	*Senecio triangularis*
Austin's knotweed	*Polygonum douglasii var. austinae*
Baneberry	*Actea rubra*
Beargrass	*Xerophyllum tenax*
Big sagebrush	*Artemisia tridentata*
Bitterbrush	*Purshia tridentate*
Blue gramma	*Bouteloua gracilis*
Bluebunch wheatgrass	*Pascopyron spicatum (=Agropyron spicatum)*
Bluejoint reedgrass	*Calamogrostis canadensis*
Buffaloberrry	*Sheperdia canadensis*
Burdock	*Arctium minus*
California false-hellebore	*Veratrum californicum*
Canada thistle	*Cirsiumarvense*
Chokecherry	*Prunus virginianus*
Common horsetail	*Equisetum arvense*
Common juniper	*Juniperus communis*
Common snowberry	*Symphoricarpos albus*
Creeping juniper	*Juniperus horizontalis*
Cut-leaf groundsel	*Senecio streptanthifolius*
Death camas	*Zigadenus spp*
Diffuse knapweed	*Centaurea diffusa*
Dotted gayfeather	*Liatris punctata*
Douglas-fir	*Psuedotsuga menziesii*
Dwarf bilberry	*Vaccinium caespitosum*
Elk sedge	*Carex geyeri*
English sundew	*Drosera anglica*
Few flowered aster	*Canadanthus modestus (=Aster modestus)*
Fringed sage	*Artemisia frigida*
Giant helleborine	*Epipactis gigantean*
Globe huckleberry	*Vaccinium globulare*
Green needlegrass	*Nassella viridis (=Stipa virdula)*
Ground dogwood	*Cornus unalaskense (=Cornus canadensis)*
Grouse whortleberry	*Vaccinium scoparium*
Hall's rush	*Juncus hallii*
Heart-leaved arnica	*Arnica cordifolia*
Houndstongue	*Cynoglossum officinale*
Howells gumweed	*Grindelia howellii*
Idaho fescue	*Festuca idahoensis*
Kinnikinnik	*Arctostaphylos uva-ursi*
Labrador tea	*Ledum glandulosum*
Lackschewitz' milkvetch	*Astragalus lackschwetzii*

Leafy spurge	*Euphorbia esula*
Limber pine	*Pinus flexilis*
Linear-leaved sundew	*Drosera linearis*
Lodgepole pine	*Pinus contorta*
Longe-styled thistle	Cirsium longistylum
Low sagebrush	*Artemisia arbuscula*
Lupine	*Lupinus spp.*
Meadowrue	*Thalictrum occidentalis*
Menziesia	*Menziesii ferruginea*
Missoula phlox	*Phlox kelseyi var. missoulensis*
Mountain gooseberry	*Ribes montigenum*
Mountain mahogany	*Cercocarpus ledifolius*
Narrow-leaved sedge	*Carex filifolia*
Needle and threadgrass	*Hesperostipa comata (=Stipa comata)*
Oregon grape	*Berberis repens*
Oxeye daisy	*Leucanthemum vulgare (=Chrysanthemum leucanthemum)*
Paintbrush	*Castilleja spp.*
Pale sedge	*Carex livida*
Parry's rush	*Juncus parryii*
Peculiar moonwart	*Botrycium paradoxum*
Penstemon	*Penstemon spp.*
Pinegrass	*Calamogrostis rubescens*
Ponderosa pine	*Pinus ponderosa*
Poor sedge	*Carex paupercula*
Porcupinegrass	*Hesperostipa spartea (=Stipa spartea)*
Prairie junegrass	*Koeleria macrantha*
Rabbitbrush	*Ericameria nauseosa (=Chrysothamnus nauseosus)*
Red twig dogwood	*Cornus sericeus (=C. stolonifera)*
Redtop bentgrass	*Agrostis stolonifera*
Richardson needlegrass	*Achnatherum richardsonnii (=Stipa richarsonii)*
Rocky Mountain alder	*Alnus incana*
Rose	*Rosa spp.*
Rough fescue	*Festuca campestris (=F. scabrella)*
Round-leaved orchid	*Amerorchis rotundifolia*
Round-leaved violet	*Viola orbiculata*
Russian knapweed	*Centaurea repens*
Sandburg bluegrass	*Poa sandbergii*
Shiny-leaved spirea	*Spiraea betulifolia*
Short-styled columbine	*Aquilegia brevistyla*
Shreddy ninebark	*Physocarpus malvaceus*
Shrubby cinquefoil	*Pentafloides floribunda (=Potentilla fruticosa)*
Sitka alder	*Alnus sitchensis*
Sitka valerian	*Valerian sitchensis*
Small, yellow lady's slipper	*Cypripedium parviflorum*
Smooth woodrush	*Luzula hitchcockii*
Snakeweed	*Gutierrizea sarothrae*

Soft cinquefoil	*Potentilla gracilis*
Sparrow's egg lady's slipper	*Cypripedium passerinum*
Spotted knapweed	*Centaurea maculosa*
Spruce	*Picea englemanni x. glauca*
St. Johnswort	*Hypericum perfoliatum*
Starry Solomon's seal	*Smilicina stellata*
Sticky geranium	*Geranium viscossisimum*
Stink current	*Ribes hudsonianum*
Sulfur cinquefoil	*Potentilla recta*
Water birch	*Betula occidentalis*
Water bulrush	
Wavy moonwart	*Botrychium crenulatum*
Western mountain aster	*Symphyotrichum spathulatum (=Aster occidentalis)*
Western snowberry	*Symphoricarpos occidentalis*
White violet	*Viola renifolia*
Whitetop	*Cardaria draba*
Wolf willow	*Salix wolfii var. wolfii*

FISH

Bull trout	*Salvelinus confluentus*
Burbot (ling)	*Lota lota*
Westslope cutthroat trout	*Oncorhynchus clarki lewis*

WILDLIFE

American redstart	*Setophaga ruticilla*
Bald Eagle	*Haliaeetus leucocephalus*
Bighorn Sheep	*Ovis canadensis*
Black-backed Woodpecker	*Picoides arcticus*
Blue grouse	*Dendragapus obscurus*
Boreal Toad	*Bufo boreas*
Columbian Sharp-tailed Grouse	*Tympanuchus phasianellus columbianus*
Common garter snake	*Thamnophis sirtalis*
Common yellowthroat	*Geothlypis trichas*
Coyote	*Canis latrans*
Elk	*Cervus elaphus*
Fisher	*Martes pennanti*
Flammulated Owl	*Otus flammeolus*
Gopher snake	*Pituophis catenifer*
Gray Wolf	*Canis lupus*
Grizzly Bear	*Ursus arctor*
Hairy Woodpecker	*Picoides villosus*
Harlequin Duck	*Histrionicus histrionicus*
Leopard Frog	*Rana pipiens*
Lynx	*Lynx canadensis*
Macgillivray's warbler	*Oporornis tolmiei*
Mountain Plover	*Charadrius montanus*
Mule Deer	*Odocoileus hemionus*
Northern alligator lizard	*Elgaria coerulea*
Northern Bog Lemming	*Synaptomys borealis*
Northern Goshawk	*Accipiter gentilis*
Olive-sided flycatcher	*Contopus borealis*
Peregrine Falcon	*Falco peregrinus*
Pileated Woodpecker	*Dryocopus pileatus*
Pine Marten	*Martes americana atrata*
Racer	*Coluber constrictor*
Rubber boa	*Charina bottae*
Ruffed grouse	*Bonasa umbellus*
Sage grouse	*Centrocercus urophasianus*
Spruce grouse	*Dendragapus Canadensis*
Swift fox	*Vulpes velox*
Townsend's Big-eared Bat	*Corynorhinus townsendii*

Townsend's warbler	*Dendroica townsendi*
Warbling vireo	*Vireo gilvus*
Western rattlesnake	*Crotalus viridis*
Western skink	*Eumeces skiltonianus*
Western terrestrial garter snake	*Thamnophis elegans*
Willow flycatcher	*Empidonax traillii*
Wolverine	*Gulo gulo*
Yellow warbler	*Dendroica petechia*

APPENDIX C

SPILL PLAN AND PROCEDURES

The following equipment will be available with vehicles or pack animals used to transport pesticides and in the immediate vicinity of all spray operations.

1. A shovel
2. A broom (except backcountry operations)
3. 10 pounds of absorbent material or the equivalent in absorbent pillows
4. A box of large plastic garbage bags
5. Rubber gloves
6. Protective overalls
7. Rubber boots

The appropriate Material Safety Data Sheets (MSDSs) will be reviewed with all personnel involved in the handling of pesticides.

The following material from the U.S. EPA document entitled *Applying Pesticides Correctly: A Guide for Private and Commercial Applicators* will be reviewed with all personnel involved in handling pesticides.

CLEAN UP OF PESTICIDE SPILLS

MINOR SPILLS

Keep people away from spilled chemicals. Rope off the area and flag it to warn people. Do not leave unless someone is there to confine the spill and warn of the danger. If the pesticide was spilled on anyone, wash it off immediately.

Confine the spill. If it starts to spread, dike it up with sand or soil. Use absorbent material such as soil, sawdust, or absorbent clay to soak up the spill. Shovel all contaminated material into a leak-proof container for disposal. Dispose of it as you would excess pesticides. Do not hose down the area, because this spreads the chemical. Always work carefully and do not hurry.

Do not let anyone enter the area until the spill is completely cleaned up.

MAJOR SPILLS

The cleanup of a major spill may be too difficult for you to handle, or you may not be sure of what to do. In either case, keep people away, give first aid if needed, and confine the spill. Then call Chemtrec, the local fire department, and State pesticide authorities for help.

Chemtrec stands for Chemical Transportation Emergency Center, a public service of the Manufacturing Chemicals Association. Its offices are located in Washington, D.C. Chemtrec provides immediate advice for those at the scene of emergencies.

Chemtrec operates 24 hours a day, seven days a week, to receive calls for emergency assistance. For help in chemical emergencies involving spills, leaks, fire, or explosions, call toll-free 800-424-9300 day or night. This number is for ***emergencies*** only.

If a major pesticide spill occurs on a highway, have someone call the highway patrol or the sheriff for help ***(carry these phone numbers with you).*** Do not leave until responsible help arrives.

In addition, the section from the *Northern Region Emergency and Disaster Plan* entitled "Hazardous Materials Releases and Oil Spills" will be reviewed with all appropriate personnel (see following pages). Notification and reporting requirements as outlined in this section will be followed in the unlikely event of a serious spill.

HAZARDOUS MATERIALS RELEASES AND OIL SPILLS

(Excerpted from the *Northern Region Emergency and Disaster Plan)*

AUTHORITY: Comprehensive Environmental Response, Compensation, and Liability Act (CER-CLA); and Superfund Amendments and Reauthorization Act of 1986 (SARA). Other statutes that may apply include Resource Conservation and Recovery Act (RCRA); Hazardous and Solid Waste Amendments (HSWA); Toxic Substances Control Act (TSCA); Federal Insecticide, Fungicide, and Rodentcide Act (FIFRA); Clean Water Act (CWA; and Clean Air Act (CAA).

DEFINITION: A hazardous materials emergency or oil spill is defined as any release or threat of release of a hazardous substance or petroleum product that presents an imminent and substantial risk of injury to health or the environment.

A release is defined as any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment.

Releases that do not constitute an immediate threat, occur entirely within the work place, are federally permitted, or are a routine pesticide application, are not considered to be an emergency and are not covered by this direction.

RESPONSIBILITY: The first person who knows of a release and is capable of appreciating the significance of that release has the responsibility to report the release.

Only emergency release response and reporting is covered by this direction. Appropriate RO staff specialists who should be notified directly of all non-emergency releases will accomplish non-emergency reporting.

An emergency release of a hazardous substance or petroleum product may be from a Forest Service operation or facility; from an operation on National Forest land by a permit holder, contractor, or other third party; or from a transportation related vehicle, boat, pipeline, aircraft, etc., crossing over, on, or under Forest Lands. Response and/or reporting by Forest Service employees will differ in each situation:

1. If the release is from a Forest Service facility or operation, the Forest Service and is employee(s) is clearly the "person in charge", and is fully responsible for all reporting. Immediate response action is limited to that outlined in emergency plans and only to the extent that personal safety is not threatened.

2. If the release is from a third party operation, the Forest Service will only respond and/or report the emergency if the third party fails to take appropriate action.

3. If the release is from a transportation related incident, the Forest Service will only respond and/or report the emergency if the driver or other responsible party is unable or fails to take appropriate action.

RESPONSE ACTION GUIDE: THE PRIMARY RESPONSIBILITY OF ANY FOREST EMPLOYEE(S) ENCOUNTERING A HAZARDOUS MATERIALS EMERGENCY OR OIL SPILL IS COMPLETE AND ACCURATE REPORTING TO APPROPRIATE AUTHORITIES IN A TIMELY MANNER.

Forest Service employee(s) will not assume an incident command role for any hazardous materials emergency or spill, but may provide support services as directed by an authorized Federal On-Scene Coordinator (OSC) or other State or local authorized authority.

Within the limits of personal safety, common sense, and recognition of the dangers associated with any hazardous materials emergency or spill, Forest Service employee(s) may provide necessary and immediate response action until an authorized OSC or other authority can take charge. These actions may include:

- Public warning and crowd control;
- Retrieval of appropriate information for reporting purposes.

Additionally, and only after verification of the type of hazardous material involved and its associated hazards, a Forest Service employee(s) may also take actions including:

- Rescue of persons in imminent danger;
- Limited action to mitigate the consequences of the emergency.

Under no condition shall a Forest Service employee(s):

- Place themselves or others in imminent danger.
- Perform or direct actions that will incur liability for the Forest Service

IF THERE IS ANY QUESTION THAT THE EMERGENCY MAY CONSTITUTE A THREAT TO PERSONAL SAFETY. LIMIT YOUR RESPONSE TO PUBLIC WARNING AND REPORTING OF THE INCIDENT.

PRECAUTIONS: When approaching the scene of an accident involving cargo, or other unknown or suspected hazardous material emergency including oil spills:

- Approach incident from an upwind direction, if possible;
- Move and keep people away from the incident scene;
- Do not walk into or touch any spilled material;
- Avoid inhaling fumes, smoke, and vapors even if no hazardous materials are involved;
- Do not assume that gases or vapors are harmless because of lack of smell; and,
- Do not smoke, and remove all ignition sources.

ORGANIZATIONS FOR EMERGENCY AND TECHNICAL ASSISTANCE

CHEMTREC – Chemical Transportation Emergency Center – 800-424-9300 (24 hour) (For assistance in any transportation emergency involving chemicals).

Rocky Mountain Poison Control Center – 800-525-5042 (24 hour); 303-629-1123 (24 hour).
National Agricultural Chemicals Association –202-296-1585 (for pesticide technical assistance and information referral).

Bureau of Explosives – 202-293-4048 (For explosives technical assistance).
Centers for Disease Control – 404-633-5313 (For technical assistance regarding etiologic agents).

EPA Region 8 (MT, ND, SD) Emergency Response Branch – 3030293-1723

EPA Region 10 (ID) Superfund Removal and Invest Section – 206-442-1196

Montana Department of Health and Environmental Sciences (24 hour) 406-444-6911

Water Quality Bureau – 406-444-2406

Solid Waste Management Bureau – 406-444-2821

North Dakota State Health Department

Environmental Engineering – 701-224-2348

Hazardous Waste Division –701-224-2366

Radiological Hazardous Substances – 701-224-2348

South Dakota Division of Environmental Quality

Office of Water Quality- 605-773-3296

Office of Solid Waste Management – 605-773-5047

Idaho Department of Health and Welfare

Water Quality Bureau – 208-334-5867

Solid Waste Bureau – 208-334-5879

HAZARDOUS MATERIALS RELEASES AND OIL SPILLS

CONTACT LIST AND IMMEDIATE ACTION GUIDE

Individual

Actions	Contacts
Do not expose yourself or others to any unknown material. Do not attempt rescue or mitigation until material has been identified and hazards and precautions noted. Warn others and keep people away. Approach only from upwind. Do not walk in or touch material. Avoid inhaling fumes and vapors. Do not smoke, and remove ignition sources.	District Ranger or Dispatcher
Report the incident. Complete "Reporting Action Guide" within reasonable limits of exposure and timeliness, and report information to District/Forest Dispatcher	
If there is any question that the incident is a threat to personal safety, limit response to public warnings and reporting.	

District

Actions	Contacts
Insure reporting individual is aware of hazards associated with incident.	Forest Dispatcher
Obtain as much information as possible, complete a copy of the "Reporting Action Guide" and relay all information to Forest Dispatcher.	
For fixed facilities, verify if possible, whether or not an emergency guide, Spill Prevention Control and Countermeasure Plan, or similar response plan is available for the specific emergency. If so, implement the response actions as indicated	
Dispatch additional help, communication systems, etc., to incident scene if incident is on National Forest land or is caused by Forest Service activity or facility. Otherwise support as requested by official in charge.	
If there is any question that the incident is a threat to personal safety, limit response to public warning and reporting.	

Forest

Actions	Contacts
Immediately contact the Forest Hazardous Materials Incident Commander who will take the following actions: Determine if the incident is a true emergency. Determine who is the responsible party for the incident, and whether appropriate actions and reporting have been accomplished. From available information, determine hazards and precautions, if possible, and relay further instructions to reporting individual through the District. Initiate appropriate local reporting actions, and coordinate responses with District. Arrange Forest support for on-scene coordinator and/or local emergency response officials as requested.	Forest Hazardous Materials Incident Coordinator who will determine extent of emergency. If incident is determined reportable, contact: National Response Center EPA Hazmat emergency response Regional Incident Dispatcher County sheriff and/or county disaster and emergency services coordinator State Emergency and Disaster organizations North Dakota State Fire Marshal for oil spills in ND only. Internal Forest Contacts
Make appropriate local emergency contacts as directed by Forest Hazardous Materials Incident Coordinator.	
Relay information from Forest Hazardous Materials Incident Coordinator back to District and up to Regional Office as appropriate.	

Regional Incident Dispatcher

Actions	Contacts
Immediately contact the Regional Hazardous Materials Incident Coordinator who will take the following actions: Personally work with Forest Hazardous Materials Incident Coordinator to determine extent of the emergency. If incident is reportable, implement the following actions: By computer mailing list notify: Regional Forester, Deputy Regional Foresters, Staff Directors, Attorney-in-charge (OGC). Contact other RO specialists, other agency personnel, etc., as necessary to determine scope of problem and appropriate actins. RO specialist contacts include: Regional Watershed Coordinator (water) Regional Reclamation Officer (mining) Regional Safety and Health Program Manager Regional Cooperative Forestry and Pest Management (pesticides) Arrange Regional Support for on-scene coordinator and/or local emergency response officials as requested. Arrange a Regional Investigation/follow-up team if determined necessary. Keep Regional Forester, Staff Directors and OGC advised of situation via routine computer updates	Regional Hazardous Materials Incident Coordinator
	Regional Emergency Coordinator
	If incident is determined to be reportable, verify the National Response Center and appropriate Federal, State, and local contacts have been made
	WO Engineering
	WO Personnel Management

Although reporting requirements vary depending on the type of incident, the responsibility of the employee(s) in the field is limited to collecting appropriate information and relaying it to the proper level of the organization in a timely manner. Following is a list of the information that should be collected, if possible; however, **it is more important to maintain personal safety and report in a timely manner than to collect all information.**

1. Date
   Time of release:
   Time discovered:
   Time Reported:
   Duration of release:

2. Location (include state, county, route, mílepost, etc)

3. Chemical name:
   Chemical identification number:
   Other chemical data:

NOTE: For transportation related incidents, this information may be available from the driver, placards on the vehicle, and/or shipping papers.

4. Known health risks:

5. Appropriate precautions if known:

6. Source and cause of release:

7. Estimate of quantity released:____________________ gallons
   Quantity reaching water: ______________________gallons
   Name of affected watercourse: _________________gallons

8. Number and type of injuries

9. Potential future threat to health or environment:

10. Your Name: ____

    Phone number for duration of emergency: _________________________

    Permanent phone number: ______________________________________

    For transportation related incidents, also report:

11. Name and address of carrier:

12. Railcar or truck number: *If there is any doubt whether an incident is a true emergency, or whether reportable quantities of hazardous materials or petroleum products are involved, or whether a responsible party has already reported the incident, always report the incident.*

APPENDIX D

RAVE/SITE EVALUATION FORM

FOREST SERVICE MANUAL
NORTHERN REGION (REGION 1)
MISSOULA, MT.

FSM 2000 – NATIONAL FOREST RESOURCE MANAGEMENT

ZERO CODE 2080 – NOXIOUS WEED MANAGEMENT

Supplement No.: R1 2000-2001-1

Effective Date: May 14, 2001

Duration: Effective until superseded or removed

Approved: KATHY A. MCALLISTER
Acting Regional Forester

Date Approved: 04/27/2001

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	16 Pages
Superseded Document(s):	None. (This is the first supplement to this Manual.)	0 Pages

Digest:

	This supplement implements an Integrated Weed Management approach for management of noxious weeds on National Forest System lands in Region 1.

2080.4 - Responsibility.

Encourage weed awareness and education in employee development and training plans and orientation for both field and administrative work.

2080.43 - Forest Supervisor.

Forest Supervisors are responsible for:

1. Emphasizing weed awareness and weed prevention in all fire training, especially resource advisors, fire management teams, guard school, and district orientation.

2. Adding weed awareness and prevention education to Fire Effects and Prescribed Fire training.

3. Giving helicopter managers training in weed prevention and mitigation measures.

4. Resource Advisors should provide briefings to identify operational practices to reduce weed spread.

5. Providing Field Observers with weed identification aids and striving to avoid weed infestations in fire line location.

2080.44 - District Rangers.

District Rangers are responsible for:

1. Providing weed prevention briefings for helibase staff.

2. Ensuring at least one permanent staff member per District is trained and proficient in weed management.

3. Applying weed treatment and prevention on all Forest Service administrative sites including Ranger Stations, trailheads, campgrounds, pastures, interpretive and historic sites.

2081 – MANAGEMENT OF NOXIOUS WEEDS.

2081.2 - Prevention and Control Measures.

1. Roads.

a. Required Objectives and Associated Practices.

(1) Incorporate weed prevention into road layout, design, and alternative evaluation. Environmental analysis for road construction and reconstruction will include weed risk assessment.

(2) Remove the seed source that could be picked up by passing vehicles and limit seed transport in new and reconstruction areas.

(a) Remove all mud, dirt, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the project area.

(b) Clean all equipment prior to leaving the project site, if operating in areas infested with new invaders as determined by the Forest Weed Specialist. Reference Contract Provision C/CT 6.626.

(3) Re-establish vegetation on bare ground due to construction and reconstruction activity to minimize weed spread.

(a) Revegetate all disturbed soil, except the travel way on surfaced roads, in a manner that optimizes plant establishment for that specific site, unless ongoing disturbance at the site will prevent weed establishment. Use native material where appropriate and available. Use a seed mix that includes fast, early season species to provide quick, dense revegetation. To avoid weed contaminated seed, each lot must be tested by a certified seed laboratory against the all State noxious weed lists and documentation of the seed inspection test provided.

(b) Use local seeding guidelines for detailed procedures and appropriate mixes. Use native material where appropriate and available. Revegetation may include planting, seeding, fertilization, and weed-free mulching as indicated by local prescriptions.

(c) Monitor and evaluate success of revegetation in relation to project plan. Repeat as indicated by local prescriptions.

(4) Minimize the movement of existing and new weed species caused by moving infested gravel and fill material. The borrow pit will not be used if new invaders, defined by the Forest Weed Specialist, are found on site.

(5) Minimize sources of weed seed in areas not yet revegetated. If straw is used for road stabilization and erosion control, it must be certified weed-free or weed-seed free.

(6) Minimize roadside sources of weed seed that could be transported to other areas during maintenance.

(a) Look for priority weed species during road maintenance and report back to District Weed Specialist.

(b) Do not blade roads or pull ditches where new invaders are found.

(c) Maintain desirable roadside vegetation. If desirable vegetation is removed during blading or other ground disturbing activities, area must be revegetated according to section (3) (a), (b), (c) above.

(d) Remove all mud, dirt, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. (This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the project area.)

(e) Clean all equipment prior to leaving the project site, if operating in areas infested with new invaders, as determined by the Forest Weed Specialist. Reference Contract Provision C/CT 6.626.

(f) Straw used for road stabilization and erosion control will be certified weed-free or weed-seed-free.

(7) Reduce weed establishment in road obliteration/reclamation projects. Revegetate according to section (3) (a), (b), (c) above.

b. <u>Recommended Objectives and Associated Practices.</u>

(1) Retain shade to suppress weeds. Consider minimizing the removal of trees and other roadside vegetation during construction, reconstruction, and maintenance, particularly on southerly aspects.

(2) Consider re-establishing vegetation on bare ground due to construction and reconstruction activity to minimize weed spread. Road maintenance programs should include scheduled fertilization to maintain vigor of competitive vegetation (3-year period suggested).

(3) Minimize the movement of existing and new weed species caused by moving infested gravel and fill material. All gravel and borrow sources should be inspected and approved before use and transport. The source will not be used if the weeds present at the pit are not found at the site of intended use. If weeds are present, they must be treated before transport and use.

(4) Minimize roadside sources of weed seed that could be transported to other areas. Weed infestations should be inventoried and scheduled for treatment.

(5) Ensure that weed prevention and related resource protection are considered in travel management. Consider weed risk and spread factors in travel plan (road closure) decisions.

(6) Reduce weed establishment in road obliteration/reclamation projects. Consider treating weeds in road obliteration and reclamation projects before roads are made undriveable. Monitor and retreat as indicated by local analysis and prescription.

(7) Evaluate and prioritize noxious weeds along existing Forest Service access roads leading to project area and treat as indicated by local analysis and prescriptions, before construction equipment moves into project area. New road construction must be revegetated as described in Weed Prevention measure, see Roads Required Objectives and Associated Practices section (3) (a), (b), (c) above.

2. Recreation, Wilderness, Roadless Areas.

a. Required Objectives and Associated Practices.

(1) Minimize transport and establishment of weeds on National Forest Service lands.

(a) Include environmental analysis for recreation and trail projects in weed risk assessment.

(b) Post and enforce statewide weed-free feed orders.

(c) Seed only when necessary at backcountry sites to minimize introduction of nonnative species and weeds. Reseed according to Roads (3) (a), (b), (c) above.

(2) Reduce weed establishment and spread from activities covered by Recreation Special Use Permits.

(a) Include Clause R1-D4, (or subsequent approved direction), in all new and reissued recreation special use permits, authorizations, or other grants involving ground-disturbing activities. Include this provision in existing ground-disturbing authorizations, which are being amended for other reasons.

(b) Revegetate bare soil resulting from special use activity according to Roads (3) (a), (b), (c) above.

(3) Prevent weed establishment resulting from land and float trail use, construction, reconstruction and maintenance activities.

(a) Clean all equipment prior to leaving the project site, if operating in areas infested with new invaders (as determined by the Forest Weed Specialist).

b. Recommended Objectives and Associated Practices.

(1) Minimize transport and establishment of weeds on National Forest System (NFS) lands.

(a) Encourage backcountry pack and saddle stock users to feed only weed-free feed for several days prior to traveling off roads in the Forest. Before entering NFS land, animals should be brushed to remove any weed seed.

(b) Stock should be tied and/or held in the backcountry in such a way as to minimize soil disturbance and avoid loss of native/desirable vegetation.

(c) Maintain trailheads, boat launches, outfitter and public camps, airstrips, roads leading to trailheads, and other areas of concentrated public use in a weed-free condition.

(d) Motorized and/or mechanized (such as mountain bikes) trail users should inspect and clean their vehicles prior to using NFS lands.

(2) Consider reducing weed establishment and spread from activities covered by recreation, special use permits. Consider including Clause R1-D4, (or subsequent approved direction), by amending existing ground-disturbing authorizations as indicated by local prescriptions.

(3) Prevent weed establishment resulting from land and float trail use, construction, reconstruction, and maintenance activities.

(a) All trail crews should inspect, remove, and properly dispose of weed seed and plant parts found on their clothing and equipment.

(b) Inspect and approve all gravel and borrow sources before use and transport. The source will not be used if the weeds present at the pit are not found at the site of intended use. If weeds are present, they must be treated before transport and use.

3. Cultural Resources.

Required Objectives and Associated Practices. Reduce weed establishment and spread at archeological excavations.

Revegetate bare soil resulting from cultural resource excavation activity according to the Roads (3) (a), (b), (c) section above.

4. Wildlife, Fisheries, and Botany.

Required Objectives and Associated Practices. Incorporate weed prevention into wildlife, fisheries, and botany project design.

a. Include weed risk assessment in environmental analysis for wildlife, fish and botany projects with ground disturbing actions.

b. Revegetate bare soil resulting from wildlife and fish project activity according to the Roads (3) (a), (b), (c) section above.

c. Remove all mud, dirt, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. (This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the project area.)

d. Clean all equipment prior to leaving the project site, if operating in areas infested with new invaders (as determined by the Forest Weed Specialist).

5. Range.

a. Required Objectives and Associated Practices.

(1) Ensure weed prevention and control are considered in management of all grazing allotments.

(a) Include weed risk assessment in environmental analysis for rangeland projects.

(b) When other plans do not already address noxious weeds, include practices and control measures in Annual Operating Plans.

(2) Minimize ground disturbance and bare soil.

(a) Revegetate, where applicable, bare soil from grazing activities according to the Roads (3) (a), (b), (c) section above.

(b) Check areas of concentrated livestock use for weed establishment and treat new infestations.

(3) Minimize transport of weed seed into and within allotments.

(a) Remove all mud, dirt, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. (This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the project area.)

(b) Clean all equipment prior to leaving the project site, if operating in areas infested with new invaders (as determined by the Forest Weed Specialist).

(c) Straw used for road stabilization and erosion control will be certified weed-free or weed-seed-free.

b. Recommended Objectives and Associated Practices.

(1) Transport of weed seed into and within allotments should be minimized.

(a) Avoid driving vehicles through off-road weed infestations.

(b) Feed certified weed-free feed to livestock for several days prior to moving them onto the allotment to reduce the introduction of new invaders and spread of existing weed species. Consider using transitional pastures when moving animals from weed infested areas to the National Forest. (Transitional pastures are designated fenced areas that can be logistically and economically maintained.)

(c) Consider excluding livestock from sites with new invaders or treat new invaders in these areas before entry by livestock.

(2) Maintain healthy desirable vegetation that is resistant to noxious weed establishment.

(a) Consider managing forage utilization to maintain the vigor of desirable plant species as described in the Allotment Management Plan.

(b) Minimize or exclude grazing on restoration areas until vegetation is well established.

6. Timber.

a. Required Objectives and Associated Practices.

(1) Ensure that weed prevention is considered in all pre-harvest timber projects.

(a) Include weed risk assessment in environmental analysis for timber harvest projects.

(b) Remove all mud, dirt, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. (This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the project area.) Reference Contract Provision C/CT6.26

(c) Clean all equipment prior to leaving the project site, if operating in areas infested with new invaders (as designated by the Forest Weed Specialist). Reference Contract Provision C/CT6.261

(2) Minimize the creation of sites suitable for weed establishment. Revegetate bare soil as described in the Roads (3) (a), (b), (c) section above.

b. Recommended Objectives and Associated Practices.

(1) Ensure that weed prevention is considered in all timber projects.

(a) Consider treating weeds on roads used by timber sale purchasers. Reference Contract Provision C/CT6.26.

(b) Treat weeds on landings, skid trails and helibases that are weed infested before logging activities, where practical.

(2) Minimize the creation of sites suitable for weed establishment. Soil disturbance should be minimized to meet harvest project objectives.

(3) Consider monitoring for weeds after sale activity and treat weeds as indicated by local prescriptions.

(a) Consider trust, stewardship, or other funds to treat soil disturbance or weeds as needed after timber harvest and regeneration activities.

(b) Consider monitoring and treating weed infestations at landings and on skid trails after harvest.

7. Minerals.

a. Required Objectives and Associated Practices.

(1) Minimize weed establishment in mining, oil and gas operations, and reclamation.

(a) Include weed risk assessment in environmental analysis for minerals and oil and gas projects.

(b) Include weed prevention measures in operation and/or reclamation plans.

(c) Retain bonds until reclamation requirements are completed.

(d) Revegetate bare soil as described in the Roads (3) (a), (b), (c) section above.

(2) Remove seed source and limit seed transport into new or existing mining and oil and gas operations. Remove all mud, dirt, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. (This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the project area.)

(3) Minimize weed spread caused by moving infested gravel and fill material.

(a) The borrow pit will not be used if new invaders (as defined by the Forest Weed Specialist) are found on the site.

(b) Remove all mud, dirt, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. (This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the project area.)

(c) Do not establish new gravel and fill material sources in areas where new invaders are present on National Forest Service lands. Where widespread weeds occur at new pit sites strip at least the top 8" and stockpile contaminated material. Treat weeds at new pits where widespread weeds are present.

b. Recommended Objectives and Associated Practices.

(1) Consider removing seed source and limiting seed transport into new or existing mining and oil and gas operations. Where applicable, treat weeds on project access routes. Reference Contract Provision C/CT6.27.

(2) Minimize weed spread caused by moving infested gravel and fill material.

(a) Inspect and approve all gravel and borrow sources before use and transport. The source should not be used if the weeds present at the pit are not found at the site of intended use. If weeds are present, they should be treated before transport and use.

(b) Consider maintaining stockpiled material in a weed-free condition.

(c) Check the area where pit material is used to ensure that no weed seeds are transported to the use site.

8. Soil and Water.

a. Required Objectives and Associated Practices.

(1) It is required that integrated weed prevention and management be used in all soil, watershed, and stream restoration projects.

(a) Include weed risk assessment in environmental analysis for soil, watershed, and stream restoration projects with ground disturbing actions.

(b) Revegetate bare soil resulting from excavation activity according to the Roads (3) (a), (b), (c) section above.

(c) Remove all mud, dirt, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. (This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the project area.)

(d) Clean all equipment prior to leaving the project site, if operation in areas infested with new invaders (as designated by the Forest Weed Specialist).

(e) Straw used for road stabilization and erosion control will be certified weed-free or weed-seed-free.

b. Recommended Objectives and Associated Practices.

Integrate weed prevention and management in all soil, watershed, and stream restoration projects by considering treating weeds in road obliteration and reclamation projects before roads are made undriveable. Monitor and retreat as indicated by local prescriptions.

9. Lands and Special Uses.

a. Required Objectives and Associated Practices.

(1) Incorporate weed prevention provisons in all special use permits, road use permits, and easements.

(a) Include weed risk assessment in environmental analysis for land projects with ground disturbing actions.

(b) Revegetate bare soil as described in the Roads (3) (a), (b), (c) section above, as a condition of the authorization.

(c) Include approved special use provision R1-D4, see FSH 2709.11, chapter 50, (or subsequent approved direction) in all new and reissued special use permits, authorizations, or other grants involving ground disturbing activities. Include this provision in existing ground disturbing authorizations, which are being amended for other reasons .

(d) Include noxious weed prevention and control measures as indicated by local prescriptions in new or reissued road permits or easements granted pursuant to FLPMA (P.L. 94579 0/2/76), FRTA (P.L. 88657 0/3/64) or subsequent authorities. This includes FLPMA Private and Forest Road Permits and Easements; FRTA Private and Forest Road Easements; Cost Share Easements; and Road Use (commercial haul) Permits (7730). (While the approved terms and conditions of certain permits or easements may not provide for modification, the necessary weed prevention and control provisions may be included in written plans, specifications, stipulations and /or operation and maintenance plans attached to and made a part of the authorization.)

(e) Clean all equipment prior to leaving the project site, if operating in areas infested with New Invaders (as designated by the Forest Weed Specialist).

(2) Minimize weed spread caused by moving infested gravel and fill material.

(a) Do not establish new gravel and fill material sources on National Forest Service lands in areas where new invaders are present. Where widespread weeds occur at new pit sites strip at least the top 8" and stockpile contaminated material. Treat weeds at new pits where widespread weeds are present.

(b) Remove all mud, dirt, and plant parts from all off-road equipment before moving into project area. Cleaning must occur off National Forest lands. (This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the project area.)

b. Recommended Objectives and Associated Practices.

(1) Incorporate weed prevention provisions in all special use permits, road use permits and easements.

(a) Consider including special use provision R1-D4 by amending existing ground disturbing authorizations as indicated by local prescriptions.

(b) Consider including noxious weed prevention and control provisions by amending existing ground disturbing authorizations when determined to be necessary by the authorized officer. (While the approved terms and conditions of certain permits or easements may not provide for modification, the necessary weed prevention and control provisions may be included in written plans, specifications, stipulations and/or operation and maintenance plans attached to and made a part of the authorization.)

(2) Minimize weed spread caused by moving infested gravel and fill material. All gravel and borrow sources should be inspected and approved before use and transport. The source should not be used if the weeds present at the pit are not found at the site of intended use. If weeds are present, they should be treated before transport and use.

10. Fire.

a. Required Objectives and Associated Practices.

(1) Increase weed awareness among all fire personnel. Include weed risk factors and weed prevention considerations in the Resource Advisor duties on all Incident Management Teams and Fire Rehabilitation Teams during pre-fire, pre-incident training.

(2) Mitigate and reduce weed spread during wild fire activities

(a) Initiate establishment of a network of helibases, camps and staging areas that will be maintained in a noxious weed-free condition.

(b) Minimize weed spread in camps by incorporating weed prevention and containment practices such as mowing, flagging or fencing weed patches, designating weed-free travel routes and washing equipment.

(c) Inspect all fire going vehicles regularly to assure that undercarriages and grill works are kept weed seed free. All vehicles sent off Forest for fire assistance will be cleaned before they leave or return to their home.

(3) Minimize weed spread during smoke jumper operations.

(a) Inspect, remove, and properly dispose of weed seed and plant parts found on clothing and equipment.

(b) Coordinate with Weed Specialist(s) to locate and/or treat practice jump areas.

(4) Mitigate and reduce weed spread in Air Operations.

(a) Initiate establishment of a network of helibases that will be maintained in a noxious weed-free condition.

(b) Minimize weed spread at helibases by incorporating weed prevention and containment practices such as mowing, flagging or fencing weed patches, designating weed-free travel routes.

(c) Provide weed prevention briefings for helibase staff.

(d) Inspect, and if necessary clean, contract fuel and support vehicles before and after each incident when travelling off road or through weed infestations.

(e) Inspect and remove weed seed and plant parts from all cargo nets.

(5) Mitigate and reduce weed spread from Logistics Operations activities.

(a) Look for weed-free camps, staging, drop points and parking areas.

(b) Regularly inspect and clean fire vehicles as necessary to assure that undercarriages and grill works are kept weed seed free.

(6) Integrate weed prevention and management in all prescribed burning. Mitigate and reduce weed spread during prescribed fire activities.

(a) Include weed risk assessment in environmental analysis for prescribed fire projects.

(b) Coordinate with local Noxious Weed Management Specialist to utilize helibases that are maintained in a weed-free condition, whenever possible.

(c) All crews should inspect, remove, and properly dispose of weed seed and plant parts found on their clothing and equipment.

(d) Add weed awareness and prevention education to Fire Effects and Prescribed Fire training.

(7) Encourage desirable vegetation during rehabilitation activities.

(a) Revegetate only erosion susceptible and high risk areas (as defined in Regional Risk Assessment Factors and Rating protocol) as described in the Roads (3) (a), (b), (c) section above.

(b) Straw used for road stabilization and erosion control will be certified weed-free or weed-seed-free.

b. Recommended Objectives and Associated Practices.

(1) Mitigate and reduce weed spread during fire activities.

(a) Initiate establishment of a network of helibases, camps, and staging areas on private land that will be maintained in a noxious weed-free condition.

(b) Consider checking and treating weeds that establish at cleaning sites after fire incidents, during rehabilitation.

(c) Emphasize Minimum Impact Suppression Tactics (M.I.S.T.) to reduce soil and vegetation disturbance.

(2) Minimize weed spread during smokejumper operations. Travel through weed infested areas should be avoided or minimized.

(3) Mitigate and reduced weed spread from Logistics Operations activities. Traffic should be routed through camps to avoid weed infested areas.

(4) Integrate weed prevention and management in all prescribed burning. Mitigate and reduce weed spread during prescribed fire activities.

(a) Consider treating high risk areas (as defined in Regional Risk Assessment Factors and Rating protocol) with weed infestations (such as roads, disturbed ground) before burning and check and retreat after burning if necessary.

(b) Consider avoiding ignition and burning in high risk areas (as defined in Regional Risk Assessment Factors and Rating protocol) that cannot be treated before or after prescribed fire.

(5) Encourage desirable vegetation during rehabilitation activities.

(a) Check and treat weeds at cleaning sites and all disturbed staging areas.

(b) Treat weeds within the burned area as part of rehabilitation plan to reduce weed spread.

(c) Check weed spread resulting from fire and fire suppression activities.

(d) Consider applying for restoration funding for treatment of weed infestations within the fire area.

11. Administration.

a. Required Objectives and Associated Practices.

(1) Ensure all Forest Service employees are aware of and knowledgeable about noxious weeds.

(a) Train Line Officers in noxious weed management principles and practices.

(b) Each unit will have access to Weed Specialist at the Ranger District or Supervisor's Office.

(2) Ensure all Forest workers are reducing the chance of spreading noxious weeds. All Forest workers will inspect, remove, and properly dispose of weed seed and plant parts found on their clothing and equipment including Forest Service vehicles.

b. Recommended Objectives and Associated Practices.

Consider a reward program for weed awareness, reporting, and beating new invaders.

2082 - COOPERATION.

1. Required Objectives and Associated Practices. Coordinate road maintenance activities with herbicide applications to maximize efficacy. Ensure road blading and roadside herbicide applications are coordinated chronologically to minimize herbicide use and increase effectiveness.

2. Recommended Objectives and Associated Practices. Consider providing Plans Section with weed control contact familiar with weeds in the fire area.

2082.2 - Methods of Cooperation.

6. Region 1 Required Objectives and Associated Practices.

a. Reduce weed establishment and spread at archeological excavations. Passports In Time programs and other Cultural Resource workers shall be given weed briefings and will inspect, remove, and properly dispose of weed seed and plant parts found on their clothing and equipment.

b. Promote weed awareness and prevention efforts among range permittees. Discuss weed awareness and prevention practices at annual permittee meetings.

APPENDIX F

PROCEDURES FOR MIXING, LOADING, AND DISPOSAL OF PESTICIDES

PROCEDURES FOR MIXING, LOADING, AND DISPOSAL OF PESTICIDES

1. The following measure will apply to all pesticide applications, where on-site mixing is required:
2. All mixing of pesticides will occur at least 100 feet from surface waters or well heads.
3. Dilution water will be added to the spray container prior to addition of the spray concentrate.
4. All hoses used to add dilution water to spray containers will be equipped with a device to prevent back-siphoning.
5. Applicators will mix only those quantities of pesticides that can be reasonably used in a day.
6. During mixing, mixers will wear all necessary personal protective equipment as required by the pesticide label.
7. All empty containers will be triple rinsed and rinsate disposed of by spraying near the application site at rates that do not exceed those on the spray site.
8. All unused pesticide will be stored in a locked building in accord with pesticide storage regulations contained in Forest Service Handbook 2109.13.
9. All empty and rinsed pesticide containers will be punctured and properly disposed of. Disposal records will be maintained using a container disposal log.

APPENDIX G
PAST ACTIVITIES

Past Activity	General Effects of Past Activity	Result
Historic Livestock Grazing Early days: Large numbers of livestock with little restriction on season of use. 1930's-1950's reduction in numbers. Season of use limited primarily to June 15 - Oct. 15 season. 1960's grazing systems were introduced. 1980 approximately. 48,600 AUM authorized on ~ 100 allotments, ~ 13,300 head of cattle & 10,900 sheep, & ~ 120 permittees.	**Soils Resource:** Early days: overgrazing with heavy utilization of forage, leading to bare soil and accelerated soil erosion. Contemporary grazing: utilization standards implemented to retain soil cover / minimize soil erosion, and to maintain plant material for nutrient cycling. **Wildlife Resource:** By the late 1800s, heavy stocking of sheep, cattle, and horses led to chronically overgrazed ranges: reduction in biomass and vegetative diversity in grass/forb/shrub communities. In recent decades, rest/rotation grazing and lower stocking levels have reversed negative trends on many sites. **Fishery and Aquatic Resource:** Substantial effects to fish habitat in some drainages where habitat is susceptible to being damaged by livestock: especially meadow type habitats. Some direct loss of fish due to mortality associated with livestock trampling fish eggs or fry. **Vegetation/Sensitive Plants:** Some grazing allotments have populations of sensitive plants. *Phlox kelseyi* var. *missoulensis* is known from 2 allotments; *Polygonum douglasii* var. *austinae* is known from 1 active	**Soils Resource:** Early days: probable impaired soil productivity resulting from reduced soil nutrient cycling with loss of plant inputs of organic material and soil erosion. Contemporary grazing: probable trend for improving soil productivity compared to conditions during "early days". **Wildlife Resource:** Heavy livestock grazing left meager forage supplies for native herbivores in many areas; severe reduction in habitat structure for ground-nesting birds and small mammals; but improved habitat opportunity for species adapted to short-grass environment. Suitable habitat now available for native herbivores and ground nesting species. The alternatives could improve foraging habitat as noxious weed infestations are reduced. **Fishery and Aquatic Resource:** Loss of overhanging streamside vegetation and reduced shading from loss of willows. Elevated levels of sediment delivery and elevation of sediment in salmonid spawning gravels with subsequent reductions in egg survival. In some locations direct mortality of fish eggs and fry due to livestock trampling. Although impacts are somewhat less currently than in earlier years fish habitat is still impacted on many allotments on the Forest Adverse effects to fish are occurring on at least four allotments. **Vegetation/Sensitive Plants:** May impact, not likely to cause listing.

Past Activity	General Effects of Past Activity	Result
	allotment; *Botrychium paradoxum* is known from 2 grazing allotments. The surveys that located these populations indicated that the populations were in good health and that light to no grazing was occurring. Continued grazing similar to past patterns would not be expected to adversely affect sensitive plant populations. **Range Resource:** Historic grazing levels in some areas may have reduced species diversity of native plant communities. In some cases it may have made the landscape more susceptible to weed invasions by opening up vegetation cover. Recent, since the 1990's, allotment planning efforts have addressed grazing impacts, particularly in riparian areas and areas of historic high use. Structural improvements have improved livestock distribution. In areas impacted by livestock grazing soil may have been disturbed, and weed invasion became possible. Most noxious weeds did not become established until the 1960's **Water Resource:** By the late 1800s, heavy stocking of sheep, cattle and horses resulted in heavy utilization of forage, leading to accelerated erosion and sedimentation. Heavy bank trampling occurred resulting in stream segments that were either nonfunctional or functioning at risk. Later improvements in grazing systems often improved the uplands, but riparian areas continued to be impacted. More recently riparian guidelines and bank trampling guidelines have been implemented on new allotments resulting in some streams tending toward proper functioning condition. **Minerals Resource:** No quantifiable impacts to the minerals resource.	**Range Resource:** While historic grazing impacts were often detrimental to the vegetative resources, new allotment plans coupled with a better understanding of ecosystem management have put many allotments into an upward trend. In addition, many allotment stocking rates are nearing a proper, balanced carrying capacity. Better livestock management results in healthier range sites, thereby lessening the potential for weed spread. **Water Resource:** The result is that in general allotments still have streams that are characterized as nonfunctional and functioning at risk. There is a trend towards proper functioning condition in allotments where new riparian guidelines are implemented. Sedimentation from upland sources is reduced significantly, but accelerated stream bank erosion due to excessive bank trampling is still a problem **Minerals Resource:** No quantifiable impacts to the minerals resource.
Historic Timber Harvest	**Soils Resource:** Individual tree harvest / removal with minimal	**Soils Resource:** Minimal soil effects, not expected to

Past Activity	General Effects of Past Activity	Result
(late 19th and early 20th centuries prior to National Forest Management) Acres are difficult to determine, however there was extensive logging related to mining activity, human development of home sites and communities, water transport flume systems, firewood, fence posts, and fuel for kilns, heat, and steam generation.	road construction and use of horses to yard logs. No site preparation. **Wildlife Resource:** Typically, the largest and best-formed trees were harvested—including those with old growth character. **Fishery and Aquatic Resource:** Stream channel degradation due to excessive tree harvest in some drainages. In some cases extensive harvest occurred in conjunction with mining activity. Elevated sediment delivery and loss of streamside trees that provide shade and wood recruitment to the streams. Some drainages not as impacted due to lack of access **Vegetation/Sensitive Plants:** It is possible that sensitive plant populations were disturbed during these activities. **Range Resource:** Timber harvest in the mid to late 20th. Century used mostly tractor type equipment. Skid trails, landings, and hauling roads were required for this type of harvest. Many of the noxious weeds in the treatment area are located on these historic logging roads and trails due to the soil disturbing activities associated with road building **Water Resource:** Historic timber harvest tended to over-harvest certain watersheds. In particular near mining operations and towns.	persist under present conditions. **Wildlife Resource:** The result has been the loss of sustainable, open-grown old-growth forest habitat; gradual incursion of denser second-growth forests with habitat more conducive to interior forest wildlife species. The alternatives retain this condition. **Fishery and Aquatic Resource:** Overall reduction in fish habitat quality from a variety of reasons including elevated levels of sediment in spawning and rearing habitats. Instream habitat such as pools has been reduced and fish populations fragmented from barriers formed by stream crossing culverts **Vegetation/Sensitive Plants:** May impact, not likely to cause listing **Range Resource:** Noxious weeds became established during the 1960's to 1989. The most common weeds to establish were Canada thistle, musk thistle and knapweed. Weed treatment was limited to chemical herbicides applied by ground treatment methods generally truck and ATV mounted sprayers. Roadsides and recreation areas were the focus of weed treatment at that time. **Water Resource:** This resulted in accelerated erosion and sedimentation from hillslopes and often a "denuding" of vegetation in riparian zones. The effects of this past harvest are quite diminished now due to second growth that has

Past Activity	General Effects of Past Activity	Result
	Minerals Resource: No quantifiable impacts to the minerals resource.	come into areas that were previously harvested. **Minerals Resource:** No quantifiable impacts to the minerals resource.
Historic Timber Harvest (under National Forest Management) Early indications of timber management on the Forest indicate management as far back as 1908.More formal management of an timber program began in the late 1950's or early 1960's. Approximate harvest levels were: 1960-1970 ~ 19,000 Acres 1970-1980 ~ 9,000 Acres 1980-1990 ~ 11,000 Acres 1990-current~13,400 Acres	**Soils Resource:** Industrial-scale tree harvest / removal with construction of roads and log landings, and use of heavy equipment to yard logs. Site preparation for tree planting or natural tree regeneration by machine piling and burning surface organic material, or broadcast burning. **Wildlife Resource:** Harvest has impacts on forest structure, successional stage, and patch size. Alteration has mixed effects depending on species and habitat needs. **Fishery and Aquatic Resource:** Extensive road building to access timber with many miles of stream affected by channel alteration and constriction. Continued harvest of streamside trees until the 1970s. Hundreds of stream crossings installed many of which altered stream hydrology and blocked fish passage **Vegetation/Sensitive Plants:** It is possible that sensitive plant populations	**Soils Resource:** Possible reduced soil nutrient cycling resulting from removal of tree biomass and surface organic material. Probable soil compaction, rutting, displacement, severe burning, accelerated erosion or mass wasting resulting from logging roads, skid trails, log landings and site preparation. Soil effects resulting from past harvest can persist for several decades following management actions. Thus, residual soil impacts may be present in past harvest units under existing conditions. **Wildlife Resource:** Habitat effectiveness has been reduced for some species and has been enhanced for others. **Fishery and Aquatic Resource:** Stream gravels in many drainages have elevated levels of sediment in spawning and rearing habitats. Instream habitat such as pools has been reduced and fish populations fragmented from barriers formed by stream crossing culverts. **Vegetation/Sensitive Plants:** May impact, not likely to cause

Past Activity	General Effects of Past Activity	Result
	were disturbed during these activities. **Range Resource:** The general effects of these more recent projects had little effect on noxious weed invasion and establishment as the projects were much smaller in scope. Weed mitigation measures were being implemented at this time and the first bio-control agents were introduced in the Cabin Gulch area in 1990. Not all harvest acres are invaded by noxious weeds. Usually just a small percentage of the units are invaded, these are often the areas where soils are disturbed by road building or by slash pile burning. **Water Resource:** The percent of watersheds harvested diminished under Forest management (Ave. of 6.6% per Implementation Area), but a tremendous number of roads were added to the system. It was not until about 1990 that the state SMZ law came into effect reducing riparian harvest and implementing BMPs on roads **Minerals Resource:** No quantifiable impacts to the minerals resource.	listing **Range Resource:** Noxious weed treatment was increased in 1990 and more funding and planning time was devoted to noxious weed management in the early 1990's. **Water Resource:** The result is that due to the tremendous number of roads that were added they tended to became chronic sources of sediment due to lack of BMPs being implemented. While harvest was not excessive per watershed, riparian harvest did occur and often times BMPs were not implemented fully, resulting in sedimentation to the streams. After the SMZ law and the Montana BMPs for Forest Practices came into effect improvements were made in terms of sediment reduction from timber harvest practices. We are still dealing with legacy roads and sedimentation from those roads. **Minerals Resource:** No quantifiable impacts to the minerals resource.
Wildfire, Fire Suppression, and Prescribed Fire (turn of century to present) Burned acre calculations are not an exact science particularly the	**Soils Resource:** Soils subject to effects of periodic fire, such as volatilization of organic material and accelerated erosion, with the magnitude and extent of effects being variable depending on ecological setting and climate / weather variables during burning.	**Soils Resource:** Possible impaired soil productivity on sites affected by high intensity fire resulting in severe soil burning and accelerated soil erosion. Probable soil productivity not impaired on sites affected by low to

Past Activity	General Effects of Past Activity	Result
further back in the past you go. It is estimated that major fires have affected more than 25% of the Forest between 1870 and 1980. Burns prior to 1910 have been estimated from old maps and vegetation age samples. Roughly 60,000 acres burned between 1910 and 1980. For the period 1972-1982 there were approximately 430 fires, with an average of approximately 375 acres burned annually. Approximate acreages Burned by Time Period are: 1870-1909 ~ 195,000 1910-1919 ~ 26,000 1920-1929 ~ 3,700 1930-1939 ~ 4,700 1940-1949 ~ 5,700 1950-1959 ~ 2,600 1960-1969 ~ 2,900 1970-1979 ~ 2,600 More recently fires have increased in size and intensity, including the North Hills Fire, Warm Springs Creek Fire, Maudlow-Toston Fire, Cave Gulch Fire, Snow Talon Fire, Moose Wasson Fire, Jimtown Fire, and The High Ore Fire.	**Wildlife Resource:** Effective fire prevention and suppression since about 1910, and particularly since the 1930s, has allowed conifer ladder fuels to develop, stand densities to increase, needle mats to accumulate, and grass/forb/ shrub associations to decline. Risk of intense stand-replacing fire has risen substantially. **Fishery and Aquatic Resource:** Some increases in sediment delivery associated with the increased intensity of fires in some habitat types followed by flooding and debris flows. Fireline construction and ground disturbance associated with suppression has also added to elevated sediment delivery. Some loss of stream side trees during fireline construction or removal as hazard trees. Loss of fish through retardant entering streams channels **Vegetation/Sensitive Plants:** Most forbs and graminoids are not adversely affected long term by fire. These species have evolved with fire in the ecosystem. The highest danger to sensitive plant populations is associated with fire suppression activities such as the use of dozers. No sensitive plant populations are known to have been adversely affected in wildfires since 1984 (Olsen, pers obs). **Range Resource:** Fire suppression efforts from the 1970's to present used existing roads and trails to access the fire with equipment, firefighters, and support people. Suppression efforts also created hand lines (firelines), dozer lines, and sometimes roads. These ground disturbing activities and others related to firefighting open the soil and create optimum conditions for weed invasion. In the past care was not taken to pre-wash vehicles, dozers, etc. and related equipment so weeds were deposited	moderate intensity fire. **Wildlife Resource:** Structural complexity of wildlife habitats has increased; vegetative diversity has declined. Closed-forest species are favored over open-forest and grassland species. Long-term sustainability of wildlife habitat at risk from wildfire. The alternatives retain this condition. **Fishery and Aquatic Resource:** Direct mortality of fish through more intense fires near streams as well as loss of fish due to retardant entry to streams. Reduction in habitat quality in the short term due to elevated sediment levels from debris flows following fires as well as sediment delivery from the ground disturbance from firelines **Vegetation/Sensitive Plants:** May impact, not likely to cause listing. **Range Resource:** Noxious weeds have become established in areas where fires and suppression efforts occurred. **Water Resource:**

Past Activity	General Effects of Past Activity	Result
	in the areas impacted by wildfires. **Water Resource:** While fire suppression has been relatively successful this has, to some extent, set the stage for larger more recent fires to burn uncharacteristically hot resulting in burned landscapes that have contributed to debris flows and large quantities of sediment being delivered to streams. **Minerals Resource:** No quantifiable impacts to the minerals resource.	The result of this past fire suppression is that we now have landscapes with uncharacteristic high fuel loading and when they do burn they burn with such intensity and magnitude that we have debris flows and large amounts of sediment delivered to streams within the burned areas. To what extent this can be attributed to fire suppression is still being debated. **Minerals Resource:** No quantifiable impacts to the minerals resource.
Mining (late 19th and early 20th centuries) Mineral extraction has occurred on the lands of the Helena Forest since prior to its designation as a forest reserve. Early hard rock miners explored and developed the gulches and lode mines of the Big Belts, Unionville, Ruddville, east Elkhorns, Lincoln, Marysville, Tenmile and Little Blackfoot areas, looking for precious and base metals. The hard rock mines were primarily developed on favorable geologies, largely associated with emplacement of the Boulder Batholith, which is centered on Butte, and associated hydrothermal activity areas. The resulting mined landscapes were 'inherited' by the Helena Forest in the early 1900's. Placer Activities Small scale placer prospecting activities account for the bulk of the hard rock minerals projects on the forest from	**Soils Resource:** Soil displacement and accumulation of mine tailings, sometimes contaminated with heavy metals. **Wildlife Resource:** Surface mining throughout the Big Belts, including the Jimtown area, has altered local topography and stream flow patterns, generated erosion, sometimes left toxic wastes **Fishery and Aquatic Resource:** Extreme modification of stream channels and or loss of perennial flow by placer mining or dredging. Chemical pollution via milled tailings entering streams. Elevated sediment delivery from large amount of ground disturbance, disruption of spawning and rearing habitat via suction dredging and diversion of water	**Soils Resource:** Probable impaired soil productivity in areas with displaced soils and in areas contaminated with heavy metals. Accelerated erosion may still be present in areas of bare soil under existing condition. **Wildlife Resource:** Some of the irregularity of the local land surface, old road networks comes from mining activities. No current problems for wildlife. The alternatives would not add to the effects of surface mining. **Fishery and Aquatic Resource:** Direct mortality of fish from chemical pollution or loss of water table. Also direct mortality of fish from suction dredging operations. Severe reductions in fish habitat quality due to the extensive stream channel modifications. An estimated 100 to 150 miles of stream have been impacted on Forest. More

Past Activity	General Effects of Past Activity	Result
the mid 1990's to the present. Disseminated Gold Exploration Activities During the late 1970's through the mid-1990's a number of exploration drilling projects occurred on the Forest in search of disseminated, or low grade high tonnage gold deposits. Several areas were extensively explored, including the Mike Horse area, York-Bar Gulch area, Miller Mountain area, eastern Elkhorns, Little Blackfoot area, 7-Up Pete area and Lincoln gulch area. Since 2000 there has been only one exploration drilling project for a low grade gold deposit (at Miller Mountain in the Big Belts). That project was completed and most of the bond released in the Fall of 2005. Mineral Materials Small scale road material and other material pits are scattered near forest roads across the forest. These are generally small (less than 200 ft x 200 ft.). These pits are used periodically when road reconstruction or heavy maintenance/repairs are needed. Oil and Gas activities During the early 1980's there was a significant amount of exploration activities for oil and gas deposits. These activities included vibroseis operations, ground seismic operations and one exploration drilling project on Hogback Mountain.	**Vegetation/Sensitive Plants:** It is possible that sensitive plant populations were disturbed during these activities. **Range Resource:** Noxious weeds are often located on overburden piles, in disturbed areas along streams, and in areas that were dredged. **Water Resource:** Past historic placer mining has occurred on many streams within the Helena National Forest. Many roads were built adjacent to streams to access various mining claims. Some streams were subjected to hydraulic mining **Minerals Resource:** These mined landscapes included disturbances from spoil piles as well as from placer mining where drainages were exhumed and overburden placed on benches or washed downstream, roads, and modified drainage bottoms. Many mining claims were patented which resulted in mixed landownership within the proclaimed forest boundary. Subsequent era's of aggressive mineral pursuits resulted in additional exploration and development work, primarily in already discovered areas. Noxious weeds occur within areas that have historic placer mining activity and are problematic for proposed new small projects in these same areas as it is difficult to keep local weeds out once an area is disturbed. Small scale miners are required to spray for weeds on their disturbed areas and following reclamation as part of their project permits and bond.	recently reclamation efforts have partially restored streams in a number of locations Ontario, Vosburg, Whites Gulch, Charter Oak. **Vegetation/Sensitive Plants:** May impact, not likely to cause listing. **Range Resource:** Noxious weeds may have established in areas of mining disturbance. **Water Resource:** The result of this is that the Helena National Forest is left with many legacy problems due to past mining. Over 59 streams on the Helena are on the State's impaired stream list. Some of this is due to severe habitat alteration from past placer mining and sedimentation from past mining roads. Many streams have heavy metals contamination due to toxic tailings and adit discharge. Progress is being made in terms of abandoned mine clean-up. **Minerals Resource:** Disturbances from many of the historical mining areas are still apparent today. The forest administers between 50-75 small placer projects per year with 6-10 new projects annually as well a similar number that are reclaimed and closed. These projects are generally a small scale (less than ½ acre per project on average) and other FS land uses do not affect the project permitting and scope. The exploration and drilling projects from the late 70's through the mid 90's resulted in construction of high density exploration roads and drill pads. Before the late 1980's the

Past Activity	General Effects of Past Activity	Result
		roads were not restored to original contour and these remain on the landscape in various states of revegetation. There are approximately 30 miles of these types of roads on the forest. The projects that were permitted after the late 1980's (probably about 20 miles of roads and pads) required restoration of the roads to contour and revegetation. Many of these are no longer recognizable as revegetation and earthwork has been highly successful. The last exploration drill road and pad was reclaimed in 2005 on the Miller Mountain project near Confederate Gulch.
Extirpation and Reintroduction of Wildlife Species	**Soils Resource:** No quantifiable impacts to soils. **Wildlife Resource:** Subsistence hunting and trapping eliminated most local populations of game animals, predators, furbearers, and game birds by the early 20th century. Many, but not all, were re-established through re-introduction by the mid 20th century. **Fishery and Aquatic Resource:** Large reductions in the distribution and abundance of native fish such as westslope cutthroat and bull trout from introductions of brook, brown and rainbow trout. **Vegetation/Sensitive Plants:**	**Soils Resource:** No quantifiable impacts to soils. **Wildlife Resource:** In the north Big Belts, populations of elk, deer, bighorn sheep, grouse, black bears, mountain lions, bobcats, coyotes, red fox, badgers are now viable. Wolverine, marten, lynx, beaver, and moose have returned in low numbers. Grizzly bears, wolves remain extirpated. Mtn goats are now present. The alternatives would not affect the viability of any of these species groups. **Fishery and Aquatic Resource:** East of the continental divide replacement of westslope cutthroat trout by rainbow cutthroat hybrids and or brook and brown trout ahs occurred. West of the divide bull trout have mostly been replaced by brook and brown trout. Westslope cutthroat trout west of the divide have suffered decreases in abundance and distribution but not to the severity that has occurred east of the divide

Past Activity	General Effects of Past Activity	Result
	Wild ungulates are the most likely to have adverse impacts on sensitive plant populations. None of these species are particularly palatable and wild ungulate grazing or trampling would cause a minor, if any impact. **Range Resource:** No quantifiable impacts to the range resource. **Water Resource:** Many non native fish have been introduced into many of the streams on the Forest **Minerals Resource:** No quantifiable impacts to the minerals resource.	**Vegetation/Sensitive Plants:** May impact, not likely to cause listing. **Range Resource:** No quantifiable impacts to the range resource. **Water Resource:** While this has not affected water quality per se, it has affected the native fish species of many streams on the Forest. Since water quality is tied to the beneficial use, where habitat is diminished this often leads to a competitive advantage for the non native fish species. **Minerals Resource:** No quantifiable impacts to the minerals resource.
Local Settlement, Road Construction, Recreation, and Other Human Activities. (mid 19th century to present)	**Soils Resource:** Road and trail construction, OHV use, and recreational camping cause soil displacement and compaction, and create areas of bare soil leading to accelerated soil erosion. **Wildlife Resource:** Intense human activity in late 19th and early 20th century associated with mining operations and settlement throughout the Forest. Current human presence: scattered rural settlement; more concentrated local settlement in numerous small communities. Increasing dispersed recreation yearlong. **Fishery and Aquatic Resource:** Elevated sediment delivery, dewatering of stream channels, unplanned introductions of	**Soils Resource:** Probable impaired soil productivity in areas affected by road and trail construction, OHV use, and recreational camping. **Wildlife Resource:** Early human settlement and other activity resulted in severe alteration of local habitats and extirpation of many species. Current activity results in some mortality but does not threaten population viability of any species. Rather, local disturbance and displacement are main concerns. The alternatives retain the existing condition. **Fishery and Aquatic Resource:**

Past Activity	General Effects of Past Activity	Result
	non-native fishes, fish barriers due to small ponds or dams or culverts, loss of beaver habitats due to trapping	Direct mortality of fish through water diversion (below the forest), channelization and downcutting of streams, fragmentation of fish habitat through barriers, reductions or loss of native fish populations
	Vegetation/Sensitive Plants: It is possible that sensitive plant populations were disturbed during these activities. Most of these activities are relatively small scale or linear and would not affect multiple populations.	**Vegetation/Sensitive Plants:** May impact, not likely to cause listing.
	Range Resource: All of these human activities created optimum sites for weed invasion. Many areas were invaded by noxious weeds during this time.	**Range Resource:** Noxious weeds invaded and began to expand.
	Water Resource: Many roads were constructed for past timber harvest and mining activities. Currently we have some motorized trails being constructed by OHV users on the forest. The Helena has a fair amount of dispersed camping that takes place.	**Water Resource:** The result of this is that we have chronic sedimentation problems from roads that were constructed on the Forest. Efforts to accomplish Forest travel planning will most likely lead to a reduction in the number of roads and better implementation of BMPs on existing roads. While there is a fair amount of dispersed camping on the Forest the total acreage disturbed is quite small, albeit much of this occurs in areas adjacent to streams. Local settlement, especially in the Helena Valley, has contributed to numerous water quality problems in the watersheds off the Forest. This includes ground water contamination and depletion as well as storm water runoff problems.
	Minerals Resource: Increased populations and activity increase the amount of mineral exploration and activity that occurs.	**Minerals Resource:** More commercial and part time mineral activity occurs as population and access increases. Mineral price also influences level of activity on the Forest.

Past Activity	General Effects of Past Activity	Result
Noxious Weed Treatment Program 1980 – two spray trucks and backpack sprayer. 2005 – three land tamers, 3 ATV's, 1 Kabota ATV, 6 pickup mounted sprayers, 1 water tender. 1980 approximately 430 acres treated. 2005 approximately 4,500 acres treated. .	**Soils Resource:** Noxious weeds tend to occur in areas of soil disturbance resulting from previous management activities, such as livestock grazing, timber harvest, road or trail construction and recreation use, as well as areas affected by fire. **Wildlife Resource:** Past noxious weed treatments may have affected the wildlife and their habitats depending on the chemicals in use and their concentrations. However, it is assumed that little to no effects remain on the landscape as a result of those treatments **Fishery and Aquatic Resource:** Some low levels of herbicides likely enter streams during precipitation events following herbicide application **Vegetation/Sensitive Plants:** It is possible that sensitive plant populations were adversely during these activities. A study by Barton and Crispin(2002) specifically investigated sensitive plant populations in relation to noxious weed populations. *Cirsium longistylum*, now	**Soils Resource:** Probable impaired soil productivity resulting from noxious weeds reducing soil organic matter and water infiltration capacity, and increasing bare soil and soil erosion. Noxious weed treatment to improve soil productivity may be limited by cumulative soil effects from past activities. Where residual soil impacts from past management activities are minimal and are not limiting to soil productivity, noxious weed treatment should improve soil conditions. Where residual soil impacts from past activities are limiting to soil productivity, noxious weed treatment would not have benefits for improving soil conditions. **Wildlife Resource:** Past noxious weed treatments may have affected some of the wildlife species through disturbance and potential chemical effects associated with herbicides in use at that time. These treatments may have also improved some of the native habitat components. The alternatives should continue to improve native vegetation with associated benefits to wildlife. There may be some short term impacts associated with disturbance and chemical application. **Fishery and Aquatic Resource:** No known impacts, but unlikely that adverse impacts have occurred due to the low levels applied in specific drainages **Vegetation/Sensitive Plants:** May impact, not likely to cause listing

Past Activity	General Effects of Past Activity	Result
	removed from the sensitive list, was the most common species found in conjunction with noxious weed populations. 1 populations of *Phlox kelseyi* var. *missoulensis* and 1 populations of *Polygonum douglasii* var. *austinae* are known to be adjacent to noxious weed populations. **Range Resource:** Past weed treatment efforts have increased with better equipment availability as well as new and safer chemicals. With this, treated acres and numbers of biological control sites have increased annually. Better prevention and awareness education. Funding in 1995 was $130,000 and is presently between $350,000 and $400,000. Peak funding following severe fire years was $1.8 million. Funding has often been supplemented by grants from agencies and private foundations. **Water Resource:** Noxious weeds have tended to occur where there have been past management activities such as livestock grazing, timber harvest, and road construction. Past weed treatment has only been partially successful in controlling the spread of noxious weeds. **Minerals Resource:** No quantifiable impacts to .the minerals resource.	**Range Resource:** Application of increasing weed control efforts has enabled the HNF to keep weed populations at bay. However, until there is new technology, weeds will never be eradicated and new weed species will continue to spread into the area. The HNF is involved in research and monitoring efforts with universities and individuals. New species of biological controls are introduced as they become available. **Water Resource:** The result of this is that we have areas with accelerated erosion and some, albeit slight, increases in sedimentation. This is most notable along roads that are adjacent to streams. While we can not totally rule out the effects of herbicides in surface waters on the Helena, there have been no reported problems associated with herbicide application in terms of water quality. None of the streams on the Helena that are on the State's impaired list are listed because of herbicides. **Minerals Resource:** No quantifiable impacts to the minerals resource.

* NATIONAL AGRICULTURAL LIBRARY
1022557689