United States Department of the Interior
Bureau of Land Management

Finding of No Significant Impact (FONSI)
for
Release of Biological Control Agents
for Russian Knapweed
DOI-BLM-MT-LLMTL07000-2012-0010-EA

INTRODUCTION:

The Bureau of Land Management (BLM) has prepared this Environmental Assessment (EA) to analyze the effects of a potential release of *Aulacidea Acroptilonica* and *Jaapiella ivannikovi* as biological control for Russian knapweed in the Evans Bend area (T24N R09E Sec 2,3,4,10,11, & 15) with the intent to use this site as a possible source for future redistribution if one or both species establish viable populations and is deemed successful as a tool to manage Russian knapweed.

The potential release sites are located on what is known locally as Evan's Bend. This area is approximately 4 miles Northeast of Fort Benton, MT in Chouteau County. The sites are on river bottoms that once were cultivated (presumably for forage) with fingers of riparian forest separating the once disturbed open areas. These open areas host around 300 acres of Russian knapweed infestation.

Due to the limited access to this site and that Russian knapweed is a lower priority species (as outlined in the Upper Missouri River Breaks National Monument: Guidelines for Integrated Weed Management Plan), the management of this species in this area is difficult. Currently most of the public land infestations are not treated with the exception of an approximately 50-meter area immediately adjacent to the established recreation site. This area is treated with herbicides annually or semi-annually to help reduce movement of Russian knapweed and other species from this site by recreationists and to provide a better experience to those who stop at this site.

Because of the limited access and large amount of infestation, biological control would be of great benefit in managing Russian knapweed at this site.

The EA analyzes two alternatives that would either allow or disallow releases to be made on public lands in the Monument in the area described above. I have selected alternative B which would allow the release of both agents on public lands with the hope that benefits outlined in scenario 2 (see below) would be realized.

Alternative B addresses 3 possible outcome scenarios of a proposed release of one or both species:

Scenario 1 – Failure to establish viable populations
It is in the realm of possibility that conditions and microclimates at the proposed release sites would limit the ability of the insects to establish viable populations.

Scenario 2 – Successful establishment/desired effect
This scenario outlines a "best case" and desired outcome of the proposed action. Both agents have a mode of action that causes the plant to "sink" energy into developing a gall on the stem rather than expending energy on seed production or replenishing root reserves. Large populations of these gall forming insects

would theoretically infest most stems of Russian knapweed in the release area and thus would reduce viable seed production, plant biomass, and effect energy reserves

Scenario 3 – Successful establishment/no measureable effect
In some instances, promising biological control agents have behaved differently once introduced to North American field conditions than in green house and overseas field testing. In these cases, the insect/agent will establish viable overwintering populations and persist in the environment but have little to no effect on the target plant.

PLAN CONFORMANCE AND CONSISTENCY:

The Evans Bend Area is located within the Upper Missouri River Breaks National Monument (Monument). The Record of Decision and Approved Plan for the Upper Missouri River Breaks National Monument became effective on December 4, 2008 (Monument Plan). All actions approved or authorized by the BLM must conform to the Monument Plan.

The BLM will develop treatment strategies to contain and/or eradicate weed infestations throughout the Monument using integrated management methods. (Page 47)

FINDING OF NO SIGNIFICANT IMPACT DETERMINATION:

Based upon a review of this Environmental Assessment and supporting documents (Upper Missouri River Breaks National Monument: Guidelines for Weed Management Update, EAs prepared by APHIS-PPQ on field release of each agent), I have determined that Alternative B, is not a major federal action having a significant effect on the human environment, individually or cumulatively with other actions in the general area. For this reason no environmental impact statement needs to be prepared. This finding is based on the following rationale and discussion of context and intensity of the action.

Context:

The Selected Alternative, Alternative B, would initially occur on public lands in Evans Bend area (T24N R09E Sec 2,3,4,10,11, & 15), Lewistown Field Office, Upper Missouri River Breaks National Monument, and would have local impacts on the resources similar to and within the scope of those described and considered in the Record of Decision and Approved Plan for the Upper Missouri River Breaks National Monument (2008). If successful, any public land within the monument that is infested with Russian knapweed may be targeted for one or both of these biological control agents to be used as biological control.

Intensity:

The following discussion is based on the ten significant criteria described in 40 CFR 1508.27 and supplemental instruction memorandum, acts, regulation and executive orders. The following has been considered in evaluating this proposal:

1. Impacts may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

The Release of Biological Control Agents for Russian Knapweed EA analyzed the impacts to affected resources in Chapter 4. None of the environmental effects discussed in the EA and associated appendices are considered significant, nor do the effects exceed those described in the Record of Decision and Approved Plan for the Upper Missouri River Breaks National Monument (2008).

2. The degree to which the selected alternative will affect public health or safety.

No concerns were identified or known instances where public health or safety has been affected.

3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farm lands, wetlands, wilderness, wild and scenic rivers, or ecologically critical areas.

The proposed action was reviewed for potential impacts to cultural and paleontological resources, Native American Religious concerns, recreation resources, soils, vegetation, visual resources, and wildlife and Threatened & Endangered Species. No comments were received or resource issues, mitigation or design features identified through the internal scoping process.

4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.

Biological control is often deemed as a more acceptable method of invasive plant management than many other techniques because it has no non-target effect and does not cause disturbance to the soil and vegetation components of the release site.

5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

Biological control of invasive plants within the Monument is not unique or unusual and is a widespread action authorized by the BLM. The effects to the human environment were thoroughly analyzed in the EA. The predicted effects from implementing Alternative B are not considered to be highly uncertain or involve unique or unknown risks.

6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

The actions proposed in Alternative B do not set precedent for future actions with significant effects even though these agents will be redistributed outside the release area if they are deemed successful. The proposed action follows precedent established for other biological control programs within the state of Montana whereas initial releases were made with the goal of using them as collection sources for interagency redistribution to other sites of infestation.

7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts – which include connected actions regardless of land ownership.

An ID Team evaluated the proposed actions in Alternative B in context of past, present and reasonably foreseeable actions. A cumulative effects analysis was conducted as part of the EA, and it determined that there were no cumulatively significant effects identified or predicted with implementation of Alternative B.

8. The degree to which the action may adversely affect districts, sites, highways, structures, or other objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

There is no surface disturbance proposed or chemical being applied to affect/alter any possible Native American, historic, or archaeological sites.

9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (ESA) of 1973.

There are no threatened or endangered species present and no designated critical habitat for any listed species within the proposed release site. Pallid sturgeon (endangered) are present in the Missouri River adjacent to the Allotment, but would not be affected by Alternative B.

10. Whether the action threatens a violation of a federal, state, local, or tribal law, regulation or policy imposed for the protection of the environment, where nonfederal requirements are consistent with federal requirements.

Alternative B does not violate any known federal, state, local or tribal law or requirement imposed for the protection of the environment.

Zane Fulbright

Zane Fulbright, Upper Missouri River Breaks National Monument Manager

8/30/2012

Date

United States Department of the Interior
Bureau of Land Management
HiLine District

Environmental Assessment DOI-BLM-MT-LLMTL07000-2012-0010-EA
August 21, 2012

Release of Biological Control Agents for Russian Knapweed

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CHAPTER 1
PURPOSE AND NEED FOR THE PROPOSED ACTION

Introduction

The BLM is developing a Biological Control Release Proposal (BCARP) in anticipation of two new biological control agents for the control of Russian knapweed becoming available in the next 1-5 years. The BLM would initially use public lands in T24N R09E Sec 2,3,4,10,11, & 15 for initial release sites with the objective of establishing these agents and using these sites to develop insectories for further distribution in cooperation with county weed districts, other agencies, and private landowners in the area. These sites will also be used by researchers from Montana State University to collect post release data in development of release recommendations and to assess efficacy.

Purpose and Need

Russian knapweed is a very widespread and problematic invasive plant in central Montana. Biological control is a good fit for management as the abundance of Russian knapweed usually makes most other means of control impracticable due to economic and environmental constraints. The potential to have one or more biological agents with which to integrate into management programs for Russian knapweed would be of great benefit to land managers.

The Decision to be Made

The BLM Upper Missouri River Breaks National Monument Manager must decide or determine:

- Whether to allow the release and redistribution of the insects *Aulacidea Acroptilonica* and *Jaapiella ivannikovi* on public lands in the Upper Missouri River Breaks National Monument.

Scoping

An internal scoping request was sent to BLM resource specialists responsible for cultural and paleontological resources, Native American Religious concerns, invasive species, recreation resources, soils, vegetation, visual resources, and wildlife on April 27, 2012. Copies of the scoping request and the specialists' responses are filed in the administrative record for this environmental assessment (EA). The issues identified from the scoping responses are listed below.

Issues Identified for Analysis

The proposed action was reviewed for potential impacts to cultural and paleontological resources, Native American Religious concerns, recreation resources, soils, vegetation, visual resources, and wildlife and Threatened & Endangered Species. No comments were received or resource issues, mitigation or design features identified through the internal scoping process.

Issue 1) Invasive Species
The effect on North American populations of Russian knapweed is not yet understood for either of these agents in field conditions. The goal of this project is that these insects would provide another means of managing an invasive species that has very few management options to choose from.

If successful, one or both of these agents would reduce the amount of Russian knapweed in the area over time and would theoretically result in benefits in plant species composition and diversity, soil resources, and wildlife habitat. All of which can be negatively altered by large populations of Russian knapweed.

Issues Considered but Eliminated from Further Analysis (See NEPA Handbook - 6.4.2)

There were no other issues brought up during the scoping process.

CHAPTER 2
THE PROPOSED ACTION AND ALTERNATIVES

(See NEPA Handbook - 6.5 & 6.6)

Introduction

Alternatives were developed based upon National and State BLM direction and policy, existing conditions and resource issues. Resource issues are discussed in Chapter 1. Other factors that influenced alternative development are discussed in Chapter 3.

Alternative A - No Action

The BLM would not release *Aulacidea Acroptilonica* (gall wasp) and/or *Jaapiella ivannikovi* (gall midge) w/in the Monument and would continue to manage Russian knapweed as time and resources allow. Current management is outlined in the Upper Missouri River Breaks National Monument: Guidelines for Integrated Weed Management Plan (2012). (Appendix A).

Alternative B - Proposed Action

The BLM, in cooperation with Montana State University, USDA – APHIS PPQ, and the Chouteau County Weed District, would release both *Aulacidea Acroptilonica* and *Jaapiella ivannikovi*, on public lands in T24N R09E Sec 2,3,4,10,11, & 15 as each agent becomes available in the next 1- 5 years. These releases would be made with the intention of moving these agents to other infested areas within the Monument if successful populations establish.

Alternatives Considered but not Carried Forward for Analysis

There were no other alternatives considered for this assessment.

Conformance with Land Use Plan

The public lands in the project area are managed according to decisions in the Upper Missouri River Breaks National Monument Resource Management Plan (RMP) approved in 2008. This document can be accessed using the internet at:

http://www.blm.gov/mt/st/en/fo/lewistown_field_office/um_rmp_process/rod.html

The proposed action is in conformance with the Upper Missouri River Breaks National Monument RMP because it helps meet the following implementation objective outlined on page 47 of the Upper Missouri River Breaks National Monument Resource Management Plan.

> *The BLM will develop treatment strategies to contain and/or eradicate weed infestations throughout the Monument using integrated management methods*

Relationship to Statutes, Regulations, or other Plans

Upper Missouri River Breaks National Monument Resource Management Plan also states, "The management of noxious and invasive plants will continue as prescribed in the Upper Missouri River Breaks National Monument: Guidelines for Integrated Weed Management (BLM 2001) and subsequent updates." The latest update to this document (2012) states:

New insects/pathogens currently being developed will be addressed in the development of a Biological Control Agent Release Proposal and tiered to this and other NEPA documentation developed by the USDA-Animal & Plant Health Inspection Service – Plant Protection and Quarantine (APHIS-PPQ) and the Montana Dept. of Agriculture (MDA).

This document tiers to the analysis completed for each agent in the following Environmental Assessments:

Field Release of Jaapiella ivannikovi (Diptera: Cecidomyiidae), an Insect for Biological Control of Russian Knapweed (Acroptilon repens), in the Continental United States Environmental Assessment, December 2008 (USDA – APHIS)

Field Release of Aulacidea acroptilonica (Hymenoptera: Cynipidae), an Insect for Biological Control of Russian Knapweed (Acroptilon repens), in the Continental United States Environmental Assessment, January 22, 2008 (USDA – APHIS)

This document is also tiered to a programmatic EA developed to address integrated weed management within the Monument:

Implementation of Integrated Weed Management (IWM) in the Upper Missouri River Breaks National Monument. Environmental Assessment MT- 066-08-08 Feb. 11, 2008 (BLM)

The following BLM Manuals also provide guidance for the use of biological control on public lands:
- BLM Manual 9014 – Use of Biological Control Agents of Pests on Public Lands – This Manual Section outlines policy, defines responsibilities, and provides guidance for the release, maintenance, and collections of Biological Control Agents for Integrated Pest Management programs on the lands administered by the BLM.
- BLM Manual 9220 – Integrated Pest Management – This Manual Section outlines policy, defines responsibilities, and provides guidance for implementing Integrated Pest Management programs on lands administered by the BLM.
- BLM Manual 9015 – Integrated Weed Management – This manual section sets forth the BLM's policy relating to the management and coordination of noxious weed activities among activities of the BLM, organizations, and individuals.

CHAPTER 3
AFFECTED ENVIRONMENT

(See NEPA Handbook – 6.7.1)

Introduction

The affected environment section describes the existing condition and trend of issue-related elements of the human environment that may be affected by implementing the proposed action or an alternative. This discussion is organized by the resource issues that were identified in Chapter 1 and provides the baseline for comparison of impacts/consequences described in Chapter 4.

General Setting

The potential release sites are located on what is known locally as Evan's Bend. The sites are on river bottoms that once were cultivated (presumably for forage) with fingers of riparian forest separating the once disturbed open areas. These open areas host many acres of Russian knapweed infestation. Other vegetation is a mix of native and exotic shrubs, forbs, and grasses. There is a primitive recreation site that is signed from the river. Access is difficult to some of the public land and can only be reached by OHV or boat.

Relevant Past and Ongoing Actions

Biological control has been used in this area for other invasive plant species for many decades with mixed results. The adjacent island was a very early release site for several of the flea beetle species used to manage leafy spurge. Just upstream on Shonkin and Baker Bars there are established populations of the spotted knapweed root weevil that recently starting to show impact on the overall plant population. The hemlock defoliating moth has also colonized poison hemlock along this stretch of river from releases made in the late 1990s.

The only other biocontrol agent released on Russian knapweed in North America is the nematode *Mesoanguina picridis*, which was introduced from central Asia. The nematodes attack the shoots as they grow up through the soil and cause galls to form on the stems and leaves. The galls look like tiny tennis balls, causing stunting and some mortality of Russian knapweed plants. However, this agent has been mostly ineffective due to its lack of mobility. The nematode had been released at several sites along the river in what is now the Monument in the late 1990s. These sites no longer show any evidence that the nematode has established at any of the release sites.

MSU and APHIS have already released the Russian knapweed gall midge, *Jaapiella ivannikovi,* in an area approximately 10 miles downstream on private lands as well as on the CM Russell National Wildlife Refuge near James Kipp Recreation Area (Fergus County). If successful, this species will find its way to infestations on BLM managed lands in the Monument. There are no known releases of the gall wasp on or near public lands in the UMRBNM.

The BLM currently uses herbicides to address infestations of exotic plants, including Russian knapweed, in and around the established recreation site to help minimize potential spread from its use by the public. Outlying infestations in this area are not managed due to limited access for equipment and higher priority infestations.

Resource Issues Brought Forward for Analysis

Resource Issue 1 – Invasive Species

There is approximately 300 acres of Russian knapweed infestations spread across both private and public land on the river bottoms in the area of proposed release. The infestations do not exist as solid monocultures, but rather as small patches (5 to 20 meters in diameter) in close proximity to each other. Russian knapweed tends to infest the open areas where as other invasive plants, such as houndstongue, burdock, Canada thistle, and poison hemlock, dominate the understory of the fingers of riparian forest that exist.

Due to the limited access to this site and that Russian knapweed is a lower priority species (as outlined in the Upper Missouri River Breaks National Monument: Guidelines for Integrated Weed Management Plan), the management of this species in this area is difficult. Currently most of the public land infestations are not treated with the exception of an approximately 50-meter area immediately adjacent to the established recreation site. This area is treated with herbicides annually or semi-annually to help reduce movement of Russian knapweed and other species from this site by recreationists and to provide a better experience to those who stop at this site.

CHAPTER 4
ENVIRONMENTAL EFFECTS

(See NEPA Handbook – 6.8)

Introduction

Potential effects include direct, indirect and cumulative effects. Direct effects are those which are caused by the action and occur at the same time and place. Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Cumulative effects result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.

Methodology and Analytical Assumptions

The effects analysis is based on scientific literature, professional judgment, experience, and field measurements. This analysis is organized by resource issues. Under each resource issue, the estimated effects common to the alternatives or those unique to a particular alternative are described. The analysis of effects focuses on the predicted or anticipated change to the resource impact indicator(s) identified for each resource issue.

Affects to Resource Issue 1 – Invasive Species.

Alternative A - No Action

There would not be measurable reductions in Russian knapweed due to the insects. Populations of knapweed would remain unmanaged for most of the area except for infestations immediately adjacent to the recreation site to help minimize potential spread from this site to others.

Although no releases will be made, the gall midge may colonize infestations on public lands due to the proximity of releases already made on private lands. This may also be the case if the gall wasp is released in infestations near public lands in the near future though that is currently not planned.

Alternative B - Proposed Action

The proposed action would allow BLM to intentionally make repeated releases in the attempt to establish a collectable population from which the agents could be redistributed to other infested sites within the Monument as well as helping to provide this agent to County Weed Districts to help manage infestations outside public ownership as well.

The potential affects to the environment are hypothetical due to the unpredictability of establishing self-sustaining populations of these insects. There are three possible scenarios that could result from these proposed introductions. Monitoring transects will be placed in the areas of release to help measure insect numbers and any change in the plant composition at the site. Researchers from MSU may also conduct similar studies to help better understand the agents and their relationships to this environment.

The site would be monitored using the protocols established by the BLM and Idaho Dept. of Agriculture. This methodology tracts both insect population and vegetation composition to help determine if the agent is having an effect on the target species and how other plant species are

responding to changes caused by the biological control agent. This protocol can be found on the internet at:

http://www.agri.state.id.us/Categories/PlantsInsects/NoxiousWeeds/Bio_Control.php

Scenario 1 – Failure to establish viable populations

It is in the realm of possibility that conditions and microclimates at the proposed release sites would limit the ability of the insects to establish viable populations. This may be unlikely for the gall midge as it has established an overwintering population at a similar site on the river on private lands. If both agents were unable to survive at the site, the effects would be the same as outlined in Alternative A with no measurable reductions in Russian knapweed.

Scenario 2 – Successful establishment/desired effect

This scenario outlines a "best case" and desired outcome of the proposed action. Both agents have a mode of action that causes the plant to "sink" energy into developing a gall on the stem rather than expending energy on seed production or replenishing root reserves. Large populations of these gall forming insects would theoretically infest most stems of Russian knapweed in the release area and thus would reduce viable seed production, plant biomass, and effect energy reserves. It is not known how long it would take to build a population large enough to show significant effects on Russian knapweed populations. In many cases, it can take decades to build a population to the point where it causes the target plant population to crash.

Scenario 3 – Successful establishment/no measureable effect

In some instances, promising biological control agents have behaved differently once introduced to North American field conditions than in green house and overseas field testing. In these cases, the insect/agent will establish viable overwintering populations and persist in the environment but have little to no effect on the target plant. In these cases, most agents become benign additions to the local area, but they may spread to other weed infestations from the initial release site. Impacts again would be similar to Alternative A with no measurable reductions in Russian knapweed.

Cumulative Impact Analysis (See NEPA Handbook – 6.8.3)

As stated before, there have been other releases of different species of insects to be used as biological control within the area over the past few decades. For those species of plants that are targeted by these insects, the impacts have been varied. However, insects in most cases have established overwintering populations.

It is not known to what extent both of the proposed agents will affect Russian knapweed. If the proposed action goes forward, there will be the opportunity to measure effects for each species and to explore if these agents will work synergistically when occurring in the same location. In other target plants, the combination of several agents have worked well to disrupt plant biology. In these instances, however, the different agents attacked different structures/processes within

the plant. Because the proposed agents are both stem galling agents, there may or may not be an added effect, and may be antagonistic.

Mitigation and Residual Impacts

The release of an exotic organism into a new environment is irreversible. There is little risk of major unintended or unforeseen effects from the release of either agent. Once the release is made, there is no way to remove the organism from the environment.

CHAPTER 5
CONSULTATION and COORDINATION

Introduction

A notice of availability regarding this EA was posted on the Lewistown Field Office NEPA log available online @ http://www.blm.gov/mt/st/en/info/nepa.html on 4/27/2012.

Persons, Groups, and Agencies Consulted

The following tribes, grazing lessees, individuals, organizations and agencies were consulted during the preparation of this document and were provided a copy of this environmental assessment.

Table 5.1 List of Persons Agencies and Organizations Consulted

Name/Title	***Purpose of Consultation***	***Findings &/or Results of Consultation***
Dr. Jeff Littlefield – Montana State University	*Coordination of availability and site characteristics for potential release*	*Several conversations via email, phone, and in person over the past two years on the potential for each agent to be released w/in the Monument.*
APHIS-PPQ MT Area Office	*Copies of APHIS prepared EAs for field release of each agent*	*APHIS-PPQ provided the EAs for proposed field release to which this EA tiers.*

The following individuals, organizations and agencies were provided an opportunity to participate in the planning process and were provided a copy of this environmental assessment.

Chouteau County Weed District – Craig Ferris Coordinator
Fergus County Weed District – Brady Cannon Coordinator
Phillips County Weed District – Greg Kelsey Coordinator
Blaine County Weed District – Pete Pula Coordinator

List of Preparers

Josh Sorlie – Soil Scientist
Tom Darington – Rangeland Management Specialist
Mitch Forsyth – Rangeland Management Specialist
Jody Peters – Wildlife Biologist
Mark Schaefer – Outdoor Recreation Planner
Chad Krause – Hydrologist
Zane Fulbright – Archeologist
Kenny Keever – Natural Resource Specialist

APPENDICES

A- UMRBNM: GUIDELINES FOR INTEGRATED WEED MANAGEMENT PLAN UPDATE 2012

B- Field Release of Jaapiella ivannikovi (Diptera: Cecidomyiidae), an Insect for Biological Control of Russian Knapweed (Acroptilon repens), in the Continental United States Environmental Assessment, December 2008 (USDA – APHIS)

C- Field Release of Aulacidea acroptilonica (Hymenoptera: Cynipidae), an Insect for Biological Control of Russian Knapweed (Acroptilon repens), in the Continental United States Environmental Assessment, January 22, 2008 (USDA – APHIS)

D- Implementation of Integrated Weed Management (IWM) in the Upper Missouri River Breaks National Monument. Environmental Assessment MT- 066-08-08 Feb. 11, 2008 (BLM)

Upper Missouri River Breaks National Monument: Guidelines for Integrated Weed Management

Plan Update 2012

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Upper Missouri River Breaks National Monument:
Guidelines for Invasive & Noxious Weed Management

This update to the UMRBNM Guidelines for Invasive & Noxious Weed Management Plan is approved for implementation within the Monument boundary, and shall remain in effect until amended as the need arises as outlined in the UMRBNM Resource Management Plan.

_____Date:_____
Lewistown Field Office Manager – Stan Benes

_____Date:_____
Upper Missouri River Breaks National Monument Manager –
Gary Slagel

The following resource specialists have reviewed and/or contributed to this document:
Montana State Office Weed Coordinator – John Simons

UMRBNM Weed Coordinator – Kenneth Keever

Riparian Resources – Chad Krause

Outdoor Recreation – Mark Schaefer

Wildlife Resources – Jody Peters

Range Resources – Mitch Forsyth

Range Resources – Tom Darrington

Archeologist – Zane Fulbright

Soil Resources - Josh Sorlie

The following external entities have reviewed and/or contributed to this document:

Montana Dept of Agricutlure
Chouteau County Weed District
Fergus County Weed District
Blaine County Weed District
Phillips County Weed District

DRAFT

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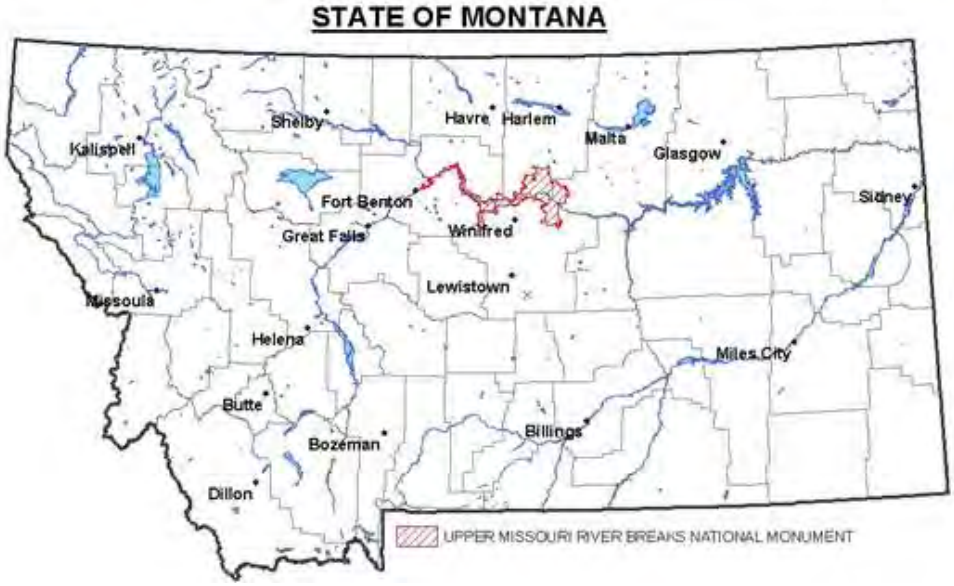
I. Introduction

The Upper Missouri River Breaks National Monument has had an invasive plant management plan in place since 2001. This plan is being created to evaluate and update that original plan, in accordance with the Upper Missouri River Breaks National Monument Record of Decision and Approved Resource Management Plant (BLM 2008).

The Upper Missouri River Breaks National Monument (Monument) has seen a steady increase in the amount and distribution of noxious weeds and invasive plants along the Missouri River and many of its major tributaries. Leafy spurge (*Euphorbia esula*), Russian and spotted knapweed (*Centaurea repens and C. stoebe*) and Canada thistle (*Cirsium arvense*) have become commonplace along the entire length of river – the same impressive landscape that Lewis and Clark described nearly two centuries ago. More recently, new invaders such as salt cedar, purple loosestrife and perennial pepperweed, have been spotted along river banks and in campgrounds and river bottoms. Clearly, this expansion and invasion of noxious weeds places many of the unique resources found within the Monument at risk. Invasive plants interfere with recreation activities and limit future opportunities, they replace distinct and important wildlife habitat unique to river ecosystems and they compete with riparian plant communities so critical to wildlife and recreation along this stretch of the Missouri River.

The importance of this area was recognized on January 17, 2001, when President Clinton officially added the Upper Missouri River Breaks National Monument to the Department of Interior's National Landscape Conservation System. The Monument includes about 375,000 acres of public land bordering the Missouri River from Fort Benton to James Kipp Recreation Area. Six wilderness study areas and two national historic trails lie within the Monument boundary. The east end of the Monument is joined by the Charles M. Russell National Wildlife Refuge covering the last 10 miles of river above James Kipp Recreation Area.



Certainly the core feature of the Monument is the Upper Missouri River which winds through the center of the management area. Congress designated this 149 mile stretch as a component of the National Wild and Scenic River System in 1976. This section begins at historic Fort Benton and ends at the Fred Robinson Bridge (James Kipp Recreation Area) where U.S. Highway 191 crosses the Missouri River. Both of these designations identify the spectacular diversity of biological, scientific, historic, wildlife, geological and cultural resources located along the Missouri River. Today, many of the natural settings and unique features of this historic treasure are threatened by the introduction and spread of invasive and noxious plant species.

Weed Management Plan

The purpose of this update to the Monument weed management plan is to provide guidelines for the prevention, containment and eradication of invasive and noxious plants and to coordinate BLM, county, private and state weed management efforts over the next 10 -15 years. The plan describes the current status of invasive and noxious weeds within the Monument, past control efforts, and more importantly, recommends a combination of treatment strategies to suppress or eradicate existing invasive plant populations. This plan is based on the goals and strategies outlined in “Partners Against Weeds”, an action plan developed by the Bureau of Land Management in 1996 to prevent and control the spread of noxious weeds on public lands.

This plan also supports the Montana Weed Management Plan (2008) to strengthen, support, and coordinate private, county, state, and federal weed management efforts in Montana, and promote implementation of ecologically-based noxious weed management programs. This plan will be evaluated and revised as the need arises.

The Upper Missouri River Breaks National Monument Invasive Plant Management Plan includes an integrated weed management (IWM) approach. An integrated weed management plan incorporates education, prevention, early detection as well as cultural, biological, physical, and chemical controls. Mapping, evaluation, and revegetation are also components of an IWM plan. This management plan is designed to evaluate and adapt management actions to improve the chances of long-term weed management success.

A. Goals and Objectives

The goals of the Invasive and Noxious Plants Program are:

1) to control, contain, and if possible, eradicate invasive plants.

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2) to work cooperatively with private, county, state, and federal land managers to control invasive species and maintain and restore rangeland ecosystems; and

3) to provide invasive plant education and outreach materials, workshops, and meetings for internal and external audiences.

The following implementation objectives outlined in the Upper Missouri River Breaks National Monument Record of Decision and Approved Resource Management Plan (BLM 2008):

1) The BLM will designate the Monument as a weed management area to facilitate cooperation among landowners and various federal, state, and county agencies, and to secure funding to implement integrated weed management control measures.

2) The BLM will identify weed prevention areas and emphasize activities to keep weed seed and regenerative plant parts from being introduced into weed free areas. Implementation of an early detection and rapid response program would ensure new infestations are identified early and aggressively managed to protect and maintain uninfested areas.

3) The BLM will increase public awareness of invasive plant and weed species and develop treatment and prevention strategies to control noxious weeds in and around developed and primitive recreation use areas.

4) The BLM will develop treatment strategies to contain and/or eradicate weed infestations throughout the Monument using integrated weed management methods.

5) The BLM will cooperate with other federal, state, and county agencies in developing awareness and prevention programs for aquatic nuisance species such as hydrilla, Eurasian watermilfoil, and curlyleaf pondweed.

B. Statement of the Weed Problem

An invasive species as defined in Executive Order 13112 is “an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.” Furthermore, the State of Montana defines a Noxious Weed as “any exotic plant species established or that may be introduced in the state that may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities.”

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The BLM recognizes the state of Montana's Noxious Weed List which as of the writing of this plan is outlined in Appendix A. Montana has assigned a priority system to their noxious weed list to help meet the overall goals of the Montana Weed Management Plan. The BLM also has an invasive plants list that it maintains and manages (Appendix B). For the purpose of this management plan, the species found in the Monument will be prioritized for management within the Monument boundary and not necessarily coinciding with the priorities assigned by the state.

The history of invasion of noxious and invasive plants on public lands in the Monument can be traced as far back as the assessments conducted in 1975 and 1976 when the area was designated a Wild and Scenic River. These assessments showed that there were no known infestations of noxious or invasive plants along the river corridor at that time (George Hirschenberger, Retired BLM, personal communication). However, by 1983 the BLM had identified areas where noxious and invasive plants had colonized and took action to treat all infestations from Coal Banks Landing to the Fred Robinson Bridge. It is estimated they treated approximately 20 acres along that stretch of the river (John Fahlgren, Retired BLM, personal communication). The next snapshoot of the total extent of the problem was complied in 2001. This effort compared information that had been digitized from maps in the 1990's and remapped the corridor with GPS technology. This effort showed that the problem had become much more dispersed and that the BLM lands infested in the corridor was now over 600 acres.

black henbane (*Hyoscyamus niger*)

In 2009, BLM contracted the mapping of invasive plants along the open and seasonally open roads designated by the Upper Missouri River Breaks National Monument Resource Management Plan. Most of the infestations recorded occurred where roads crossed river bottoms that were already known to be infested. However, portions of the Knox Ridge road were found to have black henbane, whitetop, and Russian knapweed infestations. On the other side of the river, the Cow Island Trail was found to have infestations of leafy spurge nearby. Other upland infestations have been documented as part of range and riparian health assessments and compliance checks. Most upland infestations documented are either spots of Canada thistle under brush and/or near wet spots/reservoirs or field bindweed along roads and neighboring farm fields. Spotted knapweed has recently been documented at two upland sites in Right

Coulee and Lions Coulee. Dalmatian toadflax has been reported in upland areas in the Monument between Arrow Creek and the Judith River. Coordination with the Fergus County Weed District is ongoing to determine the extent of that infestation.

In 2010, the BLM completed a survey for noxious and invasive plant species along the entire river corridor to assess population growth compared to baseline data compiled in 2001. The table below shows the species that were documented on public lands and a preliminary comparison of the acres infested between 2001 and 2010.

Common Name	2001 BLM INFESTED ACRES	2010 BLM INFESTEDACRES	Difference
Russian knapweed	370	322	-48
absinth wormwood	NA	12	NA
common burdock	NA	2	NA
hoary cress	2	0	-2
musk thistle	0	0	0
spotted knapweed	19	46	27
Canada thistle***	14	280	266
bull thistle	NA	1	NA
filed bindweed***	0	9	9
poison hemlock***	0	11	11
Houndstongue***	0	40	40
Russian olive	NA	62	NA
leafy spurge	198	586	388
black henbane	<1	0	-<1
perennial pepperweed	12	5	-7
Dalmatian toadflax	0	<1	<1
Scotch thistle	<1	0	-<1
salt cedar	<1	<1	0
Total Acres	616	1377	761
***** Species were not completely documented in earlier surveys**			

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In addition to the species documented in the table, BLM was also looking for two other species that are known to infest areas along the Missouri River between the Carter Ferry and Fort Benton upstream from the Monument. These species are common tansy (*Tanacetum vulgare*) and purple loosestrife (*Lythrum spp*.). Although neither species was found, they are both potentially disruptive in riparian sites. Purple loosestrife was identified in the Eagle Creek Recreation Area in 2001 by an employee of the MT Natural Heritage Program while on vacation. However, BLM could not confirm the sighting and has monitored the area since to ensure that this species hasn't established at that site. Purple loosestrife does now occur approximately one mile upstream from the beginning of the Monument on private land near Roosevelt Island. This infestation is being intensively managed by the Chouteau County Weed District, and cooperative surveys in and outside the Monument have been conducted between the BLM and the County to ensure this infestation is not spreading.

purple loosestrife (*Lythrum spp*.)

Purple loosestrife is a robust, perennial forb that invades riparian areas and wetlands. It reproduces both by seed and buds on spreading roots. The aggressive, clonal growth habit of purple loosestrife crowds out native riparian plants important to wildlife and channel stability. Its stout spreading roots and prolific seed production make purple loosestrife difficult to control and eradicate. Purple loosestrife grows in a wide range of soil textures, both in calcareous and slightly acidic soils. In North America, it is invasive in habitats that support cattails (*Typha* spp.), reed canarygrass (*Phalaris arundinacea*), sedges (*Carex* spp.), rushes (*Juncus* spp.), willows (*Salix* spp), common reed (*Phragmites australis*), and bulrushes (*Scirpus* spp.) (Jacobs 2008).

Along with purple loosestrife, there are several species that are not yet abundant and/or dispersed throughout the river corridor. These species could have significant affects to riparian habitat if allowed to persist and expand their populations. These species include salt cedar, perennial pepperweed, Dalmatian toadflax, whitetop, absinth wormwood, and poison hemlock and are discussed further in the following pages.

One of the few clear successes of invasive plant management in the Monument is the prevention and management of salt cedar (*Tamarix spp*.). This species, also known by the common name tamarisk, is a long-lived, invasive deciduous shrub or small tree intentionally introduced to North America from Eurasia for ornamental, wind break, and erosion mitigating purposes in the early 1800s. The spread of this species, both vegetatively from submerged stems and root sprouts, and sexually by seed, is optimized in riparian habitats. Saltcedar is an early seral species with specific adaptations to flood and drought conditions. Although it requires moist, barren soil for germination, mature plants are facultative phreatopytes capable of drawing adequate water supplies, as circumstances demand, from either surface soil moisture or groundwater. Mature stands of saltcedar consume vast amounts of groundwater; neighboring obligate phreatopyte species such as cottonwoods and willows cannot survive when the groundwater level drops below that of their roots for any sustained period. These adaptations allow saltcedar to successfully colonize, establish and dominate along rivers, streams, lakes, irrigation ditches and reservoirs. Also, in mixed stands of native willow and saltcedar or cottonwood and saltcedar, beaver select native species over saltceder by a ratio of 10:1, giving saltcedar a further competitive advantage over the native species. Although saltcedar ecology is similar to that of cottonwood, it has a longer seed production and dispersal period. This allows it to take advantage of floods or flow releases of dammed river systems that occur throughout the summer. Saltcedar is also more deeply rooted than native species and more tolerant of salinity (Jacobs & Sing 2007).

salt cedar (*Tamarix spp*.) seedling

Early Detection and Rapid Response (EDRR) for salt cedar was initiated along the river corridor in 2001. Several individual trees had been documented to that point. From 2002 to 2005 all mature trees were identified and removed from the river corridor. However, in the years that followed, many new infestations were observed at the mouths of drainages along the lower reach of the river. These new infestations were all about 1-2 years old and ranged from several to several hundred individual plants. The plants were never more than 8-10 inches in height. New infestations were observed annually from 2005 to 2008, and were always treated by hand pulling and removing the plants from the sites. The sites

were monitored annually once the infestation was documented. The seed source for these infestations has not been specifically identified. Iit is suspected that waterfowl moving up the Missouri from the heavily infested Fort Peck Reservoir is the most likely cause. Field work in 2009 resulted in the absence of any new infestations and no reoccurrence at old sites. In 2010, only one salt cedar plant was found along the entire corridor.

perennial pepperweed (*Lepidium latifolium*)

Perennial pepperweed (*Lepidium latifolium*), also called tall whitetop and often confused with whitetop (*Cardaria draba*), is a rhizomatous perennial weed threatening riparian areas, irrigation ditches, and floodplain meadows. In the mustard family it spreads by creeping roots and rhizomes, and is prolific seed producer. Found most often in seasonally flooded areas, perennial pepperweed can also spread to upland and rangeland sites, and it is adapted to salt-affected soils. In Montana, perennial pepperweed occupies riparian habitats that are periodically flooded or have a moist soil surface, however it is adapted to dryer upland sites as well (Jacobs & Mangold 2007).

This species was one that was targeted for eradication by the BLM. However, this plant was more widespread than first anticipated. Locally, the plant is distributed along the entire river corridor though the number and density of infestations are higher above the PN Bridge. Most infestations occurring on the MONUMENT are very small consisting of 10-20 stems total. Many of infestations have been eradicated in the time between 2001 and now. However, there are new infestations being found annually suggesting that many infestations went undetected or that this species is rapidly spreading in the river corridor.

Whitetop, also called hoary cress, is a rhizomatous, long-lived perennial weed invading rangeland, pastures, moist meadows, and floodplain meadows in Montana. It is in the mustard family (Brassicaceae) and there are three species in Montana, the most common being heart-podded whitetop (*Cardaria draba*). All three species spread by creeping roots and rhizomes, and prolific seed production. They can form dense patches that compete with crops, forage plants, and riparian plants (Jacobs, 2007). It is not currently known which of the three species can be found in infested sites on the river corridor. The less common

species that could potentially be found in the Monument are hairy whitetop (*C. pubescens*) and lens-podded whitetop (*C.chalepensis*).

Although it infests very little public land in the Monument, whitetop is increasingly being spotted on private lands mainly in the upper stretch between Fort Benton and Loma. The distribution of this plant is unique in that it occurs at the upper most portions of the river corridor and at the very end of the corridor in the James Kipp Recreational Area. There are no documented infestations along the river in between.

Hoary Cress (*Cardaria draba*)

Absinth wormwood (*Artemisia absinthium*) is an herbaceous perennial that reproduces primarily through seed production, but can also spread by short roots. The plant is a prolific seed producer with seedlings emerging anytime from late spring to early fall. Most of the literature on this species shows the plant is more likely to be problematic on dryer sites even though it does seem to thrive in moist environments. It was first reported at Senuirs Reach Campground and in the Woodhawk area, but was soon found to be dispersed along the entire river corridor. It tends to be associated with disturbances caused by ice and flooding. However, it has spread to higher river terraces into mature cottonwood stands and sagebrush sites.

absinth wormwood (*Artemisia absinthium*)

This plant is an escaped ornamental herb that is known for its unique aroma and flavor when leaves or stems are broken. This odor is a key characteristic in differentiating this species from the odorless biennial wormwood. The oil derived from the young flower heads of this plant is used as in the preparation of vermouth and absinth and is also an active ingredient in some antiseptic liniments. However, wild populations tend to be very invasive, crowding out desired vegetation.

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Anecdotal observation would suggest that most of the poison hemlock (*Conium maculatum*) population is fairly static with the majority of infested acres found above Loma. It is often associated with burdock and houndstongue in heavily canopied riparian forest type sites and on islands. There is a leaf feeding moth (*Agonopterix alstroemeriana*) that has been released and is established on this species. This agent has expanded its range so that most hemlock infestations have been infested by the moth. We do not know to what extent the moth impacts hemlock populations in the Monument. As with many other invasive plants, hemlock is often found closely intermingled with desirable woody and herbaceous vegetation which limits management options.

poison hemlock (*Conium maculatum*)

The following descriptions correspond to those species that are very widespread throughout the river corridor and/or are spreading rapidly. These plants represent the majority of infested acres along the river corridor and may already be interfering with natural ecological function by altering soils and desirable plant communities.

Leafy spurge (*Euphorbia esula*) is a long lived, creeping perennial plant that has the ability to reproduce by seed and by vegetative root buds. The plant can easily adapt to local growing conditions and thrive in a variety of soil types and ecological settings. The root system of this plant is very extensive growing both vertically and laterally making it very competitive for resources across rooting depths. This vast root system also provides the plant with a large nutrient reserve making it extremely difficult to control. The plant produces a large number of seeds and underground shoot buds. These two reproductive techniques allow it to rapidly displace native species, and form a leafy spurge monoculture (Butterfield et al. 1996).

A leafy spurge hawk moth larva (*Hyles euporbiae*) feeding on leafy spurge (*Euphorbia esula*)

This species infests over 1500 acres throughout the river corridor on public, private and state owned lands. On BLM lands it increased from 198 acres in 2001 to 586 acres in 2010. This 295% increase is partially due to the difficulties associated with management including the plants affinity for and proximity to surface and ground water, and its tendency to grow under and amongst desirable plant species. To address these problems, various biological control insects have been released over the years. Many of these species have established and can be found in almost any infestation along the river corridor. However, populations of the insects have not impacted the plants population or spread as anticipated. There are some positive results in a few sites but throughout the corridor where there are sizable infestations of leafy spurge. The BLM plans to continue to augment the current populations in hopes that the increased populations of these agents will begin to show progress in decreasing plant populations.

Russian knapweed (*Acroptilon repens*) forms dense colonies that displace native species and reduce forage production (Whitson 1999). This species spreads by creeping horizontal roots and seed. Russian knapweed does not establish readily in healthy, natural habitats. It typically invades disturbed areas, forming dense single-species stands (Watson 1980). This holds true on the Missouri River as most dense infestations of Russian knapweed are found along steep and cut banks, drier sites on river terraces, and areas where disturbances have occurred. Russian knapweed appears to have allelopathic properties and has been shown to increase levels of zinc in soils up to eight times that found in un-infested sites (DiTomaso & Healy 2007). This ability to change soil chemistry may be of concern in recruiting desired plant species in riparian sites.

Selleck (1964) observed that Russian knapweed infestations increased in dry locations but decreased in moist locations due to competition with perennial grasses. Competition from problematic perennial non native grasses and the increase of leafy spurge in riparian zones may help explain why the population of Russian knapweed on BLM lands decreased by 13% from 2001 to 2010. This species is often misidentified as diffuse knapweed (*Centaurea diffusa*) due to the white flower buds that are present before and after flowering.

Russian knapweed (*Centaurea repens*)

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The extent of Canada thistle (*Cirsium arvense*) infestation was not completely documented between 1996 and 2001 so there is not enough data to make a meaningful comparison of infested acres to the 2010 data. On BLM lands, Canada thistle currently infests 280 acres throughout the river corridor. Although Canada thistle mainly invades disturbed areas, it does invade native plant communities (Rutledge and McLendon 1998). Canada thistle is adapted to a wide range of soil types and environmental conditions (FEIS 1996). It is best adapted to rich, heavy loam, clay loam, and sandy loam, with an optimum soil depth of 20 inches (FEIS 1996, Rutledge and McLendon 1998). Canada thistle can tolerate saline soils (up to 2% salt) and wet or dry soil (Rutledge and McLendon 1998). On the Missouri River, this species is problematic in riparian areas where it grows under and amongst desirable herbaceous and woody vegetation thus limiting management options. Like leafy spurge and Russian knapweed, this species reproduces by a creeping perennial root system which sometimes manifests as dense patches. This plant is diecious and infestations are often found to be all male or all female.

Spotted knapweed (*Centaurea stoebe*)

Spotted knapweed (*Centaurea stoebe*) is quickly spreading throughout the river corridor. On BLM land, It currently infests around 46 acres increasing 240% since 2001. New infestations are being observed and recorded every year in areas where this plant wasn't known to be before. Spotted knapweed is a perennial tap rooted species that spreads by seed. Spotted knapweed does not compete vigorously with grass species in moist areas, and densities of this plant tend to correlate to the degree of disturbance in invaded areas (Sheley et al 1999). Once it is able to create solid stands it is becomes very competitive because seedlings, rosettes and adult plants occupy different root zones. On the Missouri River, spotted knapweed is often associated with debris left from ice and water movement, and riprap near bridges and other structures. It is also found on exposed gravel bars and drier river terraces. Ice scours and water fluctuations are enough to create sufficient disturbance for spotted knapweed to colonize in riparian zones.

Biological control for spotted knapweed is being used on some larger infestations in between Fort Benton and Loma as well as Pablo Island. At the Black Bluff Rapids Site, the introduction of the spotted knapweed root weevil (*Cyphocleonus*

achates) is credited for almost eliminating about 5 acres of spotted knapweed. However, a contributing factor to the success was most likely competition from leafy spurge and downy brome that have taken over the site. Although most of the spotted knapweed infestations in the Monument are small, other biological controls that have been released usually find these satellite infestations before people do. The spotted knapweed seed head fly (Urophora spp.) and the lesser knapweed flower weevil (Larinus minutus) are both insects that attack and eat the developing seeds within the flower and are capable of significantly reducing seed production.

Russian olive (*Elaeagnus angustifolia*) has now become the fifth most abundant woody plant in riparian areas of the western U.S. (Friedman et al. 2005), and is abundant within the Missouri River corridor. Much of the increase in riparian forest in the Upper Reach can be attributed to an increase in invasive Russian olive (personal communication, G. Auble (USGS)). This plant infests over 500 acres along the river corridor. It is found mainly private lands and islands with about 62 acres currently found on public lands. Russian olive has significant affects on the recruitment and development of riparian shrubs and trees. This species can displace native trees and shrubs, from monotypic stands, and alter ecosystems (Lesica and Miles 2001). Russian olive increases nitrogen in the soils through symbiotic relationships with microorganisms. This change in soil nitrogen levels promotes other invasive species in the plant community. This becomes an issue when managing Russian olive. Removing the canopy and the available nitrogen are most likely contributing to the sudden spike of other perennial invasive species such as Canada thistle.

Russian olive (Elaeagnus angustifolia) on Roosevelt Island. The yellow box magnifies the purple loosestrife (Lythrum spp.) blooms peeking out from under the olive branches

Houndstongue (Cynoglossum officinale)

Houndstongue (*Cynoglossum officinale*) is a biennial or short-lived perennial originating from montane zones in western Asia and Eastern Europe. Houndstongue reproduces by seed only, and was probably introduced to North America as a grain seed contaminant. Houndstongue invades grasslands, pastures, shrublands, forestlands, croplands and riparian areas, and is an effective competitor that readily displaces desirable species, establishing monocultures and further degrading forage quality in disturbed habitats (Jacobs & Sing 2007).

Houndstongue is very common on upper stretches of the river corridor where older cottonwood, green ash, Russian olive and other tree species have created small riparian forest type habitats. This species is often associated with Canada thistle and common burdock, and to a lesser extent, poison hemlock. With its burr type seed, this plant is spread locally via livestock, wildlife and agricultural and recreational activities. Management for this species is very difficult because most infestations are in and amongst desirable vegetation. Because it is a tap rooted species, management is often limited to hand removal if the plants are accessible through dense woody and herbaceous vegetation.

There are two species that occur within the corridor that are managed by BLM but tend to be more problematic in dryer upland areas. They can, and in some cases, do infest riparian sites, but are most often limited by biological requirements and competition.

Dalmatian toadflax (*Linaria dalmatica*) is adapted to a wide variety of habitats from open grasslands and savannas, to open forest sites. Infestations are commonly found on well-drained, coarse-soils, and on steep slopes that are prone to erosion disturbance. The natural disturbance on these sites provides opportunities for competition-free establishment compared to heavier soils and level sites with competitive plant communities (Jacobs & Sing 2006). Dalmatian toadflax at this time does not infest riparian sites within the river corridor. There are only four known sites, 2 on BLM and 2 on private, that this species has been found. The two sites on private land are associated with the abandoned railway that runs near the river in the Coal Banks Landing and Boggs Island areas. On BLM lands this species once occurred near the Hole in the Wall Campground and now occurs only near an old homestead in the Monroe Island area. There

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are reports of more infestations in the upland areas between Arrow Creek and the Judith River, but these have yet to be confirmed.

Dalmatian toadflax (Linaria dalmatica)

Field bindweed (*Convolvulus arvensis*) is usually associated with areas near cultivated or once cultivated sites occuring along river bottoms. It occasionally infests cut banks and steep slopes without much other vegetation. It is not known to be a particular problem in riparian areas as it tends to favor dryer conditions. There may actually be more field bindweed on the Missouri River than was detected. It is also a very low profile plant and hard to distinguish unless it is noticeably climbing up other vegetation or in bloom.

With the exception of common burdock (*Arctium minus*), there are very few acres of infestation contributed from the other invasive species documented. All of these species are of concern to the BLM, but are easily identified and removed before they can establish. Common burdock is easily managed by manual removal and/or herbicide treatment. However, it is well established in areas that where access to individual plants is limited by non target species.

Although the survey did not document invasive and non-native and/or invasive grass species (reedcanary grass, downy brome, etc), it did attempt to create baseline information on the distribution and abundance of common reed (*Phragmites australis*). This species is found worldwide, but an invasive strain with origins in Europe has been introduced to parts of the U.S. It is currently unknown if the populations on this part of the Missouri River are of the “native” or “invasive” strains or a combination of both. Anecdotal observations suggest that common reed is becoming more abundant and dispersed in the river corridor. Collecting this information will help the BLM to monitor and determine if common reed will be an issue in riparian zones.

A common reed (Phragmites australis) rhizome near Iron City Island.

Eurasian watermilfoil (*Myriophyllum spicatum*) is a submersed aquatic macrophyte with branching stems growing two to 21 feet (0.5 - 7 meters) long and supporting whorls of featherlike leaves. Watermilfoil reproduces by seed and vegetative fragments, but colonization of new sites is mainly by vegetative

Eurasian watermilfoil (Myriophyllum spicatum)

fragments. It flourishes in eutrophic (low levels of dissolved oxygen, high levels of organic matter) lakes and waterways. Plants commonly grow in water three to 12 feet (0.5 - 3 meters) deep and form tangled weed beds that can competitively displace submerged plant communities in two to three years. Dense beds reduce recreational qualities of water bodies, reduce water flow, create favorable habitat for mosquitoes, and clog industrial, agricultural, and drinking water supplies (Jacobs & Mangold 2009).

Infestations on the Missouri River Watershed in Montana reported in 2010 include the lower Jefferson River, Toston and Canyon Ferry Reservoirs near Townsend, MT and Fort Peck Reservoir south of Glasgow, MT. With infestations both upstream and downstream, there is a chance this species may already occur in the river within the Monument.

While conducting surveys for Eurasian watermilfoil in 2011, another aquatic invasive plant was found near the Judith Landing Recreation Area. Curlyleaf pondweed (*Potamogeton crispus*) is a submersed aquatic plant that had not yet been reported in Chouteau County though it is known to infest waters along the

Missouri in upstream counties. The state of Montana lists this species as a Priority 1B plant and targets this plant for eradication where possible. Because it is known to infest the headwaters of the Missouri, it is assumed that the distribution of this plant can and is most likely along the entire watershed. The observation was of a single plant and was removed to the extent possible. BLM will continue to monitor this area and other similar areas along the river and in reservoirs to better understand this species distribution.

Curlyleaf pondweed (Potamogeton crispus)

C. RELATIONSHIPS TO STATUTES, REGULATIONS AND OTHER PLANS

Federal Laws, Regulations, and Polices -
Several laws provide for management and control of invasive vegetation. Two weed control laws, the **Carlson-Foley Act of 1968** and the **Plant Protection Act of 2000** (Public Law 106-224; includes management of undesirable plants on federal lands) authorize and direct the BLM to manage noxious weeds and to coordinate with other federal and state agencies in activities to eradicate, suppress, control, prevent, or retard the spread of any noxious weeds on federal lands. The **Federal Noxious Weed Act of 1974** established and funded an undesirable plant management program, implemented cooperative agreements with state agencies, and established integrated management systems to control undesirable plant species. The **Noxious Weed Control Act of 2004** established a program to provide assistance through states to eligible weed management entities to control or eradicate harmful, non-native weeds on public and private lands. The **Public Rangelands Improvement Act of 1978** requires the BLM to manage, maintain, and improve the condition of the public rangelands so that they become as productive as feasible**. Executive Order 13112**, Invasive Species, directs federal agencies to prevent the introduction of invasive species and provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause.

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The **Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)**, administered by the EPA, provides for the registration of pesticides, certification of applicators to apply restricted use pesticides, and enforcement of pesticide regulations. FIFRA also provides for individual states to obtain primacy for enforcement of FIFRA regulations as long as the states' requirements are at least equal to federal requirements.

Compliance with the National Environmental Policy Act (NEPA) -
A Record of Decision issued in September, 2007 for the **Vegetation Treatments on Bureau of Land Management Lands in 17 Western States** programmatic environmental impact statement (PEIS) has updated both the **Northwest Area Noxious Weed Control Program (1987)** and **Vegetation Treatment on BLM Lands in Thirteen Western States (1991) PEISs.** This document provides the programmatic environmental analysis for conducting vegetation treatments (including the use of herbicides) on federal lands administered by the BLM.

A programmatic environmental assessment, "**Implementation of Integrated Weed Management (IWM) in the Upper Missouri River Breaks National Monument**," was approved in February 2008. This document provides the programmatic environmental analysis for implementing an invasive plant management program within the Monument as well as ensuring conformance with the Vegetation Treatments on BLM Lands in 17 Western States PEIS/ROD. This EA tiers to the Judith-Valley-Phillips RMP (1994) and the West HiLine RMP (1998). The EA was written to allow the analysis to remain valid once the **Upper Missouri River Breaks National Monument RMP Record of Decision** was approved later that year (December 2008). The Monument RMP/ROD replaces the other RMPs for the public lands within the Monument boundary.

There may be requirements for further environmental analysis under provisions of the NEPA. Interdisciplinary impact analysis will be based on the above programmatic EIS and other related EISs such as resource management plans. The BLM will develop Pesticide Use Proposals and/or Biological Control Agent Release Proposals with narrative justification to evaluate the method and specifications needed on each project area. If this environmental assessment does not adequately address the onsite circumstances, issues, solutions and stipulations, a site-specific environmental assessment will be prepared.

BLM Guidance For Invasive Plant Management
a. BLM Manual 9014 – Use of Biological Control Agents of Pests on Public Lands – This Manual Section outlines policy, defines responsibilities, and provides guidance for the release, maintenance, and collections of Biological Control Agents for Integrated Pest Management programs on the lands administered by the BLM.
b. BLM Manual 9220 – Integrated Pest Management – This Manual Section outlines policy, defines responsibilities, and provides guidance for implementing Integrated Pest Management programs on lands administered by the BLM.

c. BLM Manual 9011 and Manual Handbook H-9011-1, Chemical Pest Control – These manual and handbook sections outline policy and provide guidance for conduction pest control programs on public land.
d. BLM Manual 9015 – Integrated Weed Management – This manual section sets fourth the BLM's policy relating to the management and coordination of noxious weed activities among activities of the BLM, organizations, and individuals

State of Montana Laws, Regulations, and Policies -

Montana Dept. of Agriculture
Agricultural Sciences Division of Montana Department of Agriculture (MDA) provides services and assistance in areas of pest management, including aquatic weed management, biological weed control, general weed management, rodent and insect management, and pesticide applicator licensing and training.

a. The Montana Pesticides Act [80-8-101 through 80-8-405 MCA] provides authority to the Montana Department of Agriculture to regulate all pesticides and pesticide applicators, including aquatic pesticides. It also provides for training and education of pesticide applicators. The administrative rules of the Montana Pesticide Act require special training and management plan development for the use of aquatic herbicides [4.10.30 through 4.10.318 ARM].

b. The Montana Disease, Pest, and Weed Control Act - Control of Diseases and Insects in Nurseries [80-7-101 through 80-7-135 MCA] prohibits persons from selling or distributing plant pests, including aquarium plants. Plant pests are defined as an insect, fungus, virus, bacteria, or other organism that can directly or indirectly injure or cause damage in a plant or a product of a plant, including noxious weeds or other exotic weeds. Criteria as an established pest is determined by Department rule.

c. The Montana Quarantine and Pest Management Act [80-7-401 through 80-7-404 MCA] allows for the adoption of intra- and interstate quarantines to prevent the introduction and spread of plant pests.

d. The Montana Weed Control Act [80-7-701 through 80-7-720 MCA] provides for a Governor's proclamation of an embargo against the introduction of noxious weed seed and plant materials from other states. It authorizes the Department to provide technical assistance and services on the management and control of noxious weeds.

e. Montana County Weed Control Act [7-22-2101 through 7-22-2153 MCA] allows for the enforcement of noxious weed management programs at the county level. All counties are required to have a written management plan for the control of noxious weeds in the county. All counties have a commissioner appointed weed board and many counties hire full- or part-time staff to carry out the functions of the county weed program.

f. The Montana Aquatic Invasive Species Act [80-7-1001 through 80-7-1014] allows for the establishment of an invasive species fund to accomplish aquatic invasive species work. It also establishes a cooperative agreement among departments to accomplish work. MDA is given the authority to establish management areas for invasive plants in order to control and manage their spread. This also gives MDA authority to perform boat inspection stations within or adjacent to invasive species management areas.

Montana Department of Health and Environmental Sciences.
a. Montana Water Quality Act – The Water Quality Bureau of the Montana Department of Health and Environmental Sciences (MDHES) is responsible for administration of the Montana Water Quality Act (75-5-101 et seq., MCA). This law provides a framework for classification of surface and ground water, establishes surface and ground water quality standards, and provides for a permit program to control discharge of pollutants into state waters. State waters are required to be free of discharges that create toxic concentrations harmful to human, animal, plant, and aquatic life.

MDA & MDHES
a. Montana Agricultural Chemical Ground Water Protection Act – The Montana Agricultural Chemical Ground Water Protection Act (MACGPA) was adopted by the 1989 legislature and implemented on January 1, 1990. Administered jointly by the MDA and the MDHES, the act charges the MDA with the development of agricultural chemical ground water plans and monitoring programs and MDHES with adoption of ground water quality standards and ground water monitoring requirements. Each agency administers enforcement provisions under the Act.

Multiple State Agency Requirements when Dealing with Aquatic Species
a. Montana Pollutant Discharge Elimination System (MPDES)
The goal of the Montana Pollutant Discharge Elimination system (MPDES) program is to control point source discharges of wastewater such that water quality in state surface water is protected. Levels of water quality that are required to maintain the various beneficial uses of state surface waters are set forth in the Water Quality Standards (WQS).

All point sources of wastewater discharge are required to obtain and comply with MPDES permits. The effluent limitations and other conditions for certain categories of wastewaters are required to be treated to federally-specified minimum levels based on available and achievable water treatment technologies. Additonally, effluent limits and permit conditions are established to protect beneficial uses and applicable WQS.

The Nondegradation Rules are a part of the WQS that apply to new or increased sources of pollution. These rules prohibit significant increases in discharge of

toxic and deleterious materials to state waters, unless it is affirmatively demonstrated to the DEQ that a change is justifiable as a result of necessary economic or social development and will not preclude present and anticipated use of these waters.

Each MPDES permit issued is designed to protect the state surface water quality at the point of discharge. In addition, recognizing the dynamic nature of streams and the potential additive or cumulative effects of pollutants, MPDES permits also address stream reach or basin-wide pollution problems. A calculation process called total maximum daily load (TMDL) is used to apportion allowable pollutant discharge levels among the various dischargers. If reductions of a given pollutant in a stream reach or basin are found necessary to meet WQS, the TMDL process is used to apportion the reductions among the dischargers in that reach or basin.

The program is funded by application and annual permit fees. Activities of program staff include public education, reviewing applications, determining effluent limits and best management practices, environmental assessments, public participation and information retrieval, effluent and instream data review and management, field inspections, enforcement, regulation and guidance preparation, program planning and administration.

- The Montana Pesticide General Permit (PGP) is the permitting mechanism for anyone who applies pesticides into or over state surface water. The PGP is not a pesticide permit; it is a wastewater discharge permit regulated under the Montana Department of Environmental Quality (DEQ) Montana Pollution Discharge Elimination System (MPDES) program. Discharge of pollutants to state water without a permit is a violation of the Montana Water Quality Act in 75-5-605, Montana Code Annotated (MCA).

A Notice of Intent (NOI) submittal is required before pesticide is applied to or over surface water. The NOI is a legal notification by the owner/operator to DEQ that they will comply with the PGP. If the application of pesticides occurs within the boundaries of Indian Lands, the owner/operator will need to comply with the permit requirements of the EPA's Pesticide Program.

b. Other Permits Required for the Following Aquatic Plant Management Activities: Diver Dredge, Hand Removal[1], and Bottom Barriers *(C. Duncan: 10-6-2011 revision-2)*

All water bodies: A 318 permit for turbidity is required.
Streams and Rivers: A 310 or 124 permit is needed for manual/physical removal of aquatic invasive plants in any stream/river in Montana.
Specific Water Bodies: A 404 permit will be required for the Missouri, Yellowstone and Kootenai – see specific information below.
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Permit Information

318 DEQ permit (can be issued by FWP or DEQ): [Montana Water Quality Act]. For projects that cause turbidity in water. Includes any project in a state water (i.e. any body of water irrigation system, drainage system, wetlands, except irrigation tail-water).

- There is no fee if issued by FWP and may be approved in less time
- DEQ can only issue 318 permits for one year; FWP can issue a 318 for a longer period of time at their discretion.
- Can be permitted on a project basis which may cover multiple counties
- Project must provide GIS coordinates of infestations and a map showing location of proposed activities
- If the applicant does not go through FWP for a 124 permit or a conservation district for a 310 permit, FWP can still issue the 318 permit based on language in the Water Quality Act.
- A Programmatic EA is in place for 318 permits issued by FWP. Removal of noxious weeds by hand or diver suction fits under the programmatic EA so a checklist is not required

310 permit (issued by Conservation District [CD]): [Natural Streambed and Land Preservation Act]. Only needed on projects that do not have oversight/direction by a government entity (e.g. privately run projects). On projects requiring a 310, the CD's may issue a 10-yr permit.

- Does NOT require a checklist Environmental Assessment (EA).

124 permit (issued by FWP): [Stream Protection Act]: this is similar to the 310 permit but for government agency-oversight projects (i.e. county weed dist, DNRC, etc)

- Must be permitted annually
- Can be permitted on a project basis which may cover multiple counties [1]
  Note: A 124 (310) or 318 permit may not be required for isolated hand removal projects. Requirement for a permit for hand removal will be based on discretion of the issuing agency.
- Project must provide GIS coordinates of infestations and a map showing location of proposed activities
- Requires a checklist EA- it would be best to have a regional or statewide EA to cover these activities, otherwise a checklist EA is needed to accompany permit (see attached checklist)

404 permit (issued by Army Corp of Engineers):

- Required on the following rivers for physical/manual removal of aquatic invasive plants:
  - Missouri from Three Forks to ND border.
  - Yellowstone: from Emigrant to the ND border
  - Kootenai from Jennings Rapid to ID border
- Requires a checklist EA – it would be best if there was a regional or statewide EA to cover these activities, otherwise a checklist EA is needed to accompany permit (see attached checklist)

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Montana State Weed Summit Steering Committee
The federal, state, and local weed management agencies and other cooperative entities in Montana have committed to follow the guidelines developed in the **Montana State Weed Management Plan (2001, 2005, 2008)** and subsequent updates. This plan sets forth guidelines to facilitate consistent and coordinated approaches to IWM.

II. Management Priorities for Noxious Weeds & Invasive Plants

As stated earlier in this document, the management priorities assigned to species will be specific to their occurrence and distribution within the Monument. This plan borrows from the State of Montana's Prioritization system within this context. Species that appear on the state noxious weed list but are absent from the list below only indicates that those species do not occur and/or will not likely occur in Monument. Should any state listed species not listed in this plan be identified, it will be treated accordingly and assigned to one of the priority categories below. There are some species that do not occur on the state noxious weed list that have been prioritized below as they are included in the BLM's invasive species list.

Priority 1: These weeds are not present in the Upper Missouri River Breaks National Monument. Management criteria will require eradication if detected; education; and prevention.
- Yellow starthistle (*Centaurea solstitialis*)
- Eurasian watermilfoil (*Myriophyllum spicatum*)

Priority 2:These weeds have limited presence in or near the Upper Missouri River Breaks National Monument. Management criteria will require eradication or containment and education.
- Purple loosestrife (*Lythrum spp.*)
- Dalmatian toadflax (*Linaria dalmatica*)
- Saltcedar (*Tamarix spp.*)
- Common tansy (*Tanacetum vulgare*)
- Musk, Bull, and Scotch Thistles (*Carduus nutans, Cirsium vulgare, Onopordum acanthium*)
- Black henbane (*Hysocyamus niger*)
- Scentless chamomile (Anthemis arvensis)
- Curlyleaf pondweed (*Potamogeton crispus*)

Priority 3:These weeds are common in isolated areas of the Upper Missouri River Breaks National Monument. Management criteria will require containment or eradication where less abundant.
- Perennial pepperweed (*Lepidium latifolium*)
- Whitetop (*Cardaria draba*)
- Poison hemlock (*Conium maculatum*)
- Absinth wormwood (*Artemisia absinthium*)

Priority 4: These weeds are abundant and widespread in the Upper Missouri River Breaks National Monument. Management criteria will require containment and long term management.
- Canada thistle (*Cirsium arvense*)
- Field bindweed (*Convolvulus arvensis*)
- Leafy spurge (*Euphorbia esula*)
- Russian knapweed (*Centaurea repens*)
- Spotted knapweed (*Centaurea stoebe*)
- Houndstongue (*Cynoglossum officinale*)
- Hoary alyssum (*Berteroa incana*)
- Common burdock (*Arctium minus*)

Priority 5: Other Species of Concern. These species are of concern in certain areas or are already impacting sensitive areas such as riparian zones within the Upper Missouri River Breaks National Monument. These species will be managed on a project level basis.
- Annual bromes (*Bromus tectorum, B. arvensis*)
- Russian olive (*Elaeagnus angustifolia*)
- Common reed (*Phragmites australis*)
- Non – native and/or invasive species including but not limited to:
    - Reed canarygrass (*Phalaris arundinacea*)
    - Smooth brome (*Bromus inermis*)
    - Crested wheatgrass (*Agropyron cristatum*)
    - Quackgrass (*Elymus repens*)
    - Kentucky bluegrass (*Poa pratensis*)
    - Sweetclover (*Melilotus officinalis*)

III. Integrated Weed Management Strategies and Methods

A. Prevention (*Implementation Objectives 2 & 5*)

One of our objectives is to keep new invaders from entering the MONUMENT and prevent weeds from spreading to relatively "weed free" areas. Prevention, early detection and eradication are without a doubt the most practical, economical and effective means of accomplishing this. Implementing good prevention measures and educating public land users will allow us to identify and take action early against new invaders keeping important resource lands "weed free". Some of the common methods of anthropogenic introduction in the Monument include:

- Recreational users camping in infested areas are picking up seeds and plant parts on equipment and clothing and transporting them to other sites.
- Seed is transported by wildlife and livestock through feces and attached to hair and hooves.
- Contaminated hay, straw and feed used for camping and domestic animals.

- Vehicles from other parts of the state and other states are bringing in new invaders.
- Contaminated gravel used for road fill.
- Ornamental plantings at home sites.

Actions –

1) To curtail the introduction and spread of weeds, the MONUMENT staff will fully implement the prevention and treatment strategies listed in Appendix C. Incorporating these actions into day to day activities will be essential for recognizing new introductions and implementing Early Detection and Rapid Response (EDRR).
2) Conduct additional surveys to identify areas that qualify for Weed Prevention Areas. Once suitable areas are identified, solicit cooperation from landowners (if applicable) and develop an EDRR plan for the designated areas. The highest management priority will be given to conduct EDRR on infestations of Priority 1, 2 and in some instances 3 infestations.
3) Mitigation measures will be developed and required for activities on public lands that require a permit or other approval from BLM (i.e. development of existing oil and gas leases, ROW actions involving surface disturbance, recreational use, commercial harvest of public resources, archeological and/or paleological exploration and excavation, etc)

B. Education (*Implementation Objectives 1, 2, 3 & 5*)

The most effective prevention techniques for the Upper Missouri River are education and awareness. Because of the number of people who visit the Monument, there will be countless opportunities to increase the awareness of the weed problem within the MONUMENT. As with many things, noxious and invasive species is more of a people problem. Most of our management activities attempt to address the "symptoms" and not the causal factor. Education helps us address the human activities that contribute to the dispersal of these species.

Awareness of what noxious weeds are and the problems they cause will help land managers and the public-at-large understand why long-term weed management is so important. The more informed the public is about the problem, the more support they can provide in implementing solutions. Government staff at the federal, state and local levels also need to be informed on the impacts of invasive and noxious weeds as well as trained in the use of proper management techniques.

Actions –

1) Increase Public Awareness of Invasive & Noxious Weeds

To increase public awareness in the MONUMENT, the following strategies are suggested:

a. Brochures – noxious weed brochures will be included in river and Monument information packets mailed to the public. It will also be available to the public at put-in and take-out points and through campground hosts at developed recreation areas which includes the Fort Benton Visitor Center, Coal Banks Landing, Judith Landing, and James Kipp Recreational Area. Brochures will also be given to seasonal river employees and other field staff to distribute when in contact with the public.

b. Demonstration Projects – demonstration projects will be created as opportunities arise to illustrate the problem invasive plant species are causing along the river corridor as well as some of the techniques the BLM is using to contain and control different weed species.

The following guidelines should be considered when creating a demonstration project:

- Sustainability for long term efforts in the area.
- Accessibility to the public.
- Illustrate the impacts of weed species in the area.
- Types of control techniques being used
- How each control technique is impacting the area.
- Explain why the chosen technique is an acceptable choice in the area.

Field tours will be conducted at demonstration areas to gain support for what is being done and to show the benefits of cooperative weed management projects along the Missouri River.

c. Signage and interpretation may be employed as deemed appropriate at sights to highlight impacts and management.
d. Biological Control Collection – if current populations of biological control insects continue to grow, the BLM will hold collection days for private landowners and other state and federal agencies to collect and redistribute insects to suitable locations along the river. This provides an opportunity to further educate landowners about what the BLM is currently doing and to facilitate cooperative efforts.

e. Future Weed Managers – the BLM will look for opportunities to involve local youth in weed management activities. Contacts could be made with teachers or local group leaders such as Boy and Girl Scouts, FFA and 4-H to coordinate field days. Hands on activities could include biological control collection and release, evaluation of native verses invasive plants and even weed pulling contests. All of these activities have been very successful in other areas of the state.

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2) Increase Internal Awareness
The following strategies are suggested for increasing awareness within the BLM:

a. Newsletter – Montana State University Extension electronically distributes a monthly "Weed Post" newsletter. This newsletter addresses individual species or issues regarding invasive plants. This newsletter will be forwarded to BLM staff and when applicable, the invasive species coordinator will add information about what involvement BLM may have relating to the species or issue covered.

b. BLM Staff Training –

i. BLM training course 9000-5 will be presented to the Monument staff as needed. This course outlines the BLM's Invasive Species Program and how it should be integrated into the everyday work of the Bureau to help prevent, manage, and report invasive species issues.

ii. a workshop for all field and seasonal recreation staff will be held annually or as the need arises. The focus of the workshop will be identification, awareness and how to report new weed infestations.

1. *Identification* - staff will be taught to identify weeds, where they are most likely to be found and areas where they are likely to invade.
2. *Awareness* - staff will be trained to educate public land users on the impacts of invasive species and what prevention measures they can follow to reduce the risk of spreading weeds to other areas in the Monument.
3. *Reporting* - staff will be taught how to report new weed infestations, collect specimen materials in a way that does not promote the spread of weeds and show the public how to report infestations.

3) Training & Certification
In order for BLM personnel to implement effective measures to control invasive and noxious weeds, there are some training requirements that must be met to ensure employee safety.

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a. Pesticide Use:
In compliance with state and federal regulations, the weed coordinator will be certified in the safe handling and application of all pesticides, including herbicides used on public lands. The Invasive Species Coordinator for the Monument must be certified through BLM's 9000-01 Integrated Pest Management and Pesticide Application Certification Course every 3 years. Crews hired to implement herbicide/pesticide treatments must obtain a Government Applicators License through the Montana Dept. of Agriculture. Other staff may be allowed to apply herbicides/pesticides under the direct supervision of a Certified Employee. Grazing permittees must have a private applicators license on file with the BLM before applying pesticides to public land. Other commercial use permittees must have a commercial applicators license and/or have licensed contractors conduct any pesticide applications.

b. Specialized Equipment & Vehicle Operations:
Due to the rugged terrain and limited access to many areas along the river, many different types of equipment will be used to inventory infested areas, apply herbicides and monitor treatment areas. These include ATV's, UTV's, canoe, motorized boat, 4-wheel drive pickups, backpack sprayers, chainsaws, and pump spray units. BLM staff using this equipment will be trained and certified in their safe and proper use. The Coast Guard and many local ATV distributors are good sources for training if BLM courses are not available.

C. Mapping (*all implementation objectives*)

The foundation of any weed management program is the understanding of what weed species are present, where they are located and the severity of the problem. This baseline information is important to make effective management decisions. As identified in the Partners Against Weeds, all field offices are instructed to use the inventory and mapping procedures found in the Guidelines for Coordinated Management of Noxious Weeds: Development of Weed Management Areas (1999). When fully implemented, the BLM will transition to the National Invasive Species Information Management System (NISIMS) for delineating and documenting areas that have been surveyed, infestation location and size, treatment information, monitoring, and reporting.

To date, inventories have consisted of detailed mapping using GPS technology and organized weed surveys and spot sightings. Using standardized mapping procedures, the BLM and other organizations can integrate the baseline information recorded by different individuals and agencies. This allows the manager the use of common data to:

- Delineate weed infestations.
- Identify areas susceptible to future weed invasion.

- Assess potential and realized economic damage.
- Develop, implement, and evaluate treatment plans.
- Increase public awareness both visually and statistically.

Actions –

1) Implement NISMIS when available
2) Train and maintain technology w/in the program to support NISMS

D. Chemical (*Implementation objective 4*)

This method of treatment employs the use of herbicides to stress target plant biology. Herbicides that will be used have been evaluated and analyzed in the Vegetation Treatment on BLM Lands in 17 Western States. As part of this effort, these chemicals have been re-assessed for potential risk. These chemicals will be applied within the label restrictions, under guidance from BLM handbook 9011, and with consideration to site specific characteristics to minimize non target impacts.

The type of herbicide application will normally be spot spraying with a backpack or UTV mounted sprayer with a handgun. In some instances, broad jet sprayers mounted on an UTV will be used on larger infestations. Some areas will be treated aerially by fixed wing or helicopter. Other herbicide delivery options include the use of rope wick applicators and cut stump applications.

The following are the most commonly used herbicide active ingredients (by common name) used in the Monument: 2,4-D, picloram, chlorsulfuron, methsulfuron methyl, tryclopyr, clopyralid, diuron, glyphosate, dicamba, and imazapyr. Other chemistries that would most likely be incorporated if they are approved by the risk assessment process established in the 17 Western States EIS would include: aminopyralid, aminocyclopyrachlor, and others as they become available.

Actions –

1) Ensure that the proper environmental documents are in place for continued use of herbicides in IWM treatments.
2) Develop and continue to monitor areas of ongoing herbicide application to evaluate change over time.
3) See section IV Pesticide Management Goals

E. Biological Control (*Implementation objective 4*)

This method of treatment employs the use of living antagonists to stress a target invasive plant or group of invasive plants. Biological control is generally broken into two categories. These being: 1) the use of domestic animals to graze/browse invasive species (referred to as non-classical biological control), and 2) the use of organisms that specifically attack a target species(referred to as classical biological control). These organisms are usually insects and plant pathogens that have been imported from the geographic area where the invasive

species is believed to be native. In some cases local insects and pathogens can be utilized but tend to be less specific towards the target. Species specificity is determined by rigorous tests in quarantine facilities to ensure that non-target plants are not affected. The use of sheep or goats as a management tool will be restricted in areas where populations of big horn sheep occur. The use of domestic sheep and goats puts bighorn sheep at risk from pathogens that can be transmitted to wild sheep.

Augmentative biological control is the use of large numbers of biological control agents to impact a target plant. The goal of this augmentation is to either 1) supplement or rebuild an existing population of agents, or 2) use as a "bio herbicide" instead of establishing a slow growing population. The BLM will be using this method to accomplish both goals.

Only a handful of the invasive plant species occurring within the Monument have biological control insects available for use. These species are leafy spurge, Russian and spotted knapweed, Canada thistle, and poison hemlock. Most of the available insects have been released at some point in time within the planning area with varying success. The BLM will continue to distribute these species to infestations within the Monument. New insects/pathogens currently being developed will be addressed in the development of a Biological Control Agent Release Proposal and tiered to this and other NEPA documentation developed by the USDA-Animal & Plant Health Inspection Service – Plant Protection and Quarantine (APHIS-PPQ) and the Montana Dept. of Agriculture (MDA).

Action items –

1) Continue to obtain biological control agents when available to enhance and sustain populations.
2) Employee augmentative releases of leafy spurge flea beetle complex in riparian areas to manage leafy spurge. Explore this option w/ other agents for other plant species as well.
3) Incorporate the BLM/ID Dept of Ag Protocol for monitoring biological control releases (Appendix F)
4) Continue to assist the development of new agents for noxious weed control by participating in the MT Biological Control Working Group and in biological control consortiums.

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Bioloigcal Control Agents Released in the UMRBNM			
Weed Species	**Insect**	**Insect Common Name**	**Established(Yes/No)**
leafy spurge	Aphthona cyparissiae	brown dot leafy spurge flea beetle	?
	Aphthona czwalinae	black leafy spurge flea beetle	?
	Aphthona flava	copper leafy spurge flea beetle	Yes
	Aphthona lactertosa	brown-legged leafy spurge flea beetle	Yes
	Aphthona nigriscutis	black dot leafy spurge flea beetle	Yes
	Hyles euphorbiae	leafy spurge hawk moth	Yes
	Oberea erythrocephala	red-headed leafy spurge stem borer	Yes
	Spurgia esulae	leafy spurge tip gall midge	Yes
Canada & musk thistle	Ceutorynchus litura	Canada thistle stem weevil	?
	Urophora cardui	Canada thistle stem gall fly	Yes
	Rhincyllus conicus	thistle seed head weevil	Yes
Russian knapweed	Subanguina picridis	Russian knapweed gall nematode	?
	Jaapiella ivannikovi	Russian knapweed tip gall midge	?**
spotted knapweed	Agapeta zoegana	sulfur knapweed moth	No
	Bangasternus fausti	broad-nosed seed head weevil	?
	Cyphocleonus achates	knapweed root weevil	Yes
	Larinus minutus	lesser knapweed flower weevil	Yes*
	Larinus obtusus	blunt knapweed flower weevil	Yes*
	Sphenoptera jugoslavica	bronze knapweed root borer	No
	Urophora affinis	banded gall fly	Yes
	Urophora quadrifasciata	UV knapweed seed head fly	Yes
Poison hemlock	Agonopterix alstroemeriana	poison hemlock defoliating moth	Yes
Dalmatian toadflax	Mecinus janthinus	toadflax stem weevil	?**
* L.minutus and obtusus are hard to differentiate and one or both are established			
** These species were released on private lands an their status is unknown			

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Spotted knapweed root weevil (*Cyphocleonus achates*)

F. Physical Control (*Implementation objective 4*)
Physical control is the actual removal of all or part of the target plant species. This is usually broken up into the following three categories: 1) manual, 2) mechanical, and 3) prescribed fire.

Manual removal will occur periodically by hand pulling and cutting of certain invasive species as the need arises.

Mechanical treatments are unlikely to happen on a large scale, and would be most likely used to manipulate vegetation rather than control invasive species. Mechanical treatments, such as chiseling, disking, tilling, and mowing will need a site specific analysis prior to disturbance.

Prescribed fire may be used as a preparation treatment to clear decadent plant material and encourage efficacy of both biological and chemical treatments. The use of prescribed fire will also need to be addressed on a site specific basis. Fire may also be used to dispose of woody plant parts removed by mechanical means in slash piles. If in a recreation site, this material will be bucked and stacked for recreational use. In other areas, it may be burned.

Actions –
1) Ensure all large scale physical treatment proposals are adequately analyzed under NEPA.

G. Revegetation (*Implementation objective 4*)
Treatments to reclaim and revegetate would be implemented as needed. In most cases, however; there is enough remnant vegetation that will fill in after an invasive species is removed. In many cases any attempt to plant desired plant species will be done by broadcast seeding due to limited access to areas. Where possible, feasible, and environmentally sound, a range drill could be used.

Goals will be different on a species specific basis due to the various degrees of infestation and site characteristics in which infestations normally occur.

Actions –
1) Establish monitoring sites to help monitor response of native/desired plant species to treatment types.
2) Ensure on the ground reclamation and improvement projects use certified weed seed free seed and erosion materials when establishing vegetative cover.

IV. Pesticide Management Goals and Procedures

The Upper Missouri River Breaks National Monument is in compliance with the Montana Pesticide Act (Title 80, Chapter 8 Section 80-8-101 through 80-8-405). The control of pesticides and their use is essential for the protection of humans

and the environment. Pesticides are considered valuable and necessary to provide sufficient quantity of quality foods, protection of humans from vector borne diseases, and invasive plant species.

The pesticide management goals are:

1) to provide a safe work environment for the weed coordinator and all BLM staff; and

2) to ensure herbicides are safely applied and the pesticide label is followed to have a healthy environment.

The BLM has the following procedures when dealing with pesticides:

1) Water Quality Protection –
    a. Always adhere to the label instructions on distance to ground and surface water.
    b. Always recognize the buffers established in the Vegetation Treatments on BLM Lands in 17 Western States PEIS. (Appendix G)

2) Public and Worker Safety –
    a. Applicators will be certified/licensed as a government applicator by the state of MT and attend training events to maintain said qualification.
    b. All applicators will wear at least the minimum PPE required on the label and encouraged to use chemical resistant PPE provided by the BLM.
    c. Applicators are required to read the label of the product they intend to apply before any application of said chemical can occur.
    d. Applications made in areas of high public use will be signed to inform the public about the pesticide application and the safe re-entry period if applicable.

3) Equipment Selection and Maintenance –
    a. Equipment will be maintained annually and repairs made as soon as possible after breakdown.
    b. Equipment will be selected to minimize potential disturbance and interference w/ public use.
    c. Application equipment will be calibrated to ensure that herbicides are applied correctly.

4) Pesticide Selection –
    a. Application – herbicides will be selected based on the efficacy, non-target effects, any potential impacts to exposed people. Mitigations to minimize human contact can be found in the Vegetation Treatments on BLM Land in 17 Western States PEIS

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Record of Decision (BLM 2007). Applicators will adhere to the label and these mitigations to minimize exposure.

b. Mixing & Loading – Herbicides will be mixed and loaded at the site of application. Employees will try to mix only what is needed to complete the task. All appropriate PPE as required on the label will be used. An air gap will be employed to protect water sources from being contaminated during loading.
c. Storage and disposal – Pesticides will be stored at the BLM pesticide storage facilities in Havre and Lewistown and in some instances stored at the supplier until the product is needed. Small amounts of herbicide may be temporarily stored in the utility buildings at recreation sites and at facilities in Fort Benton. Unused, expired, and spoiled herbicide material would be disposed of at the proper facilities. In most cases the BLM will utilize disposal events conducted around the state to gather these materials.

V. Special Management Zones and Requirements

A. Recreational Areas

Designated recreational areas are a high priority for management in the Monument because these areas are where we can address the major anthropogenic means of dispersal. Every recreation site along the river corridor has infestations of invasive plants. Upland sites are less likely to be infested, but there are sites that need to be monitored for potential introductions. The attached table (Appendix D) outlines site specific strategies for the recreation sites along the river corridor. Upland sites would continue to be monitored and treated if there are infestations found. Treatment options would be planned once an infestation is discovered.

B. Wilderness Study Areas (WSAs)

All of the 6 WSAs are infested with invasive plant species. Most infestations are located where the WSA is bordered by the Missouri River. Management in these areas has been and will continue to be to contain infestations to the river bottoms and prevent movement to upland areas. Of particular management concern is the sporadic infestations of salt cedar that occur on the Dog Creek South, Stafford, and Ervin Ridge WSAs. These areas are monitored annually to remove slat cedar plants that occur as part of an Early Detection and Rapid Response program for this species. BLM will follow the Interim Management Protocol for WSAs in conducting weed treatments.

C. Roads and Trails

Roads and trails are a common starting point for new infestations. In 2009, the BLM contracted a survey of the open and seasonally open roads within the Monument and found very few infestations along the transportation and trail system. Most infestations were found where the road passed through a river

bottom that was already known to have a problem. Most of the upland areas are relatively free of noxious weeds. Of current concern are the small infestations of whitetop, black henbane, and Russian knapweed along the Knox Ridge Road in north Fergus County and leafy spurge along the Cow Island Trail in southern Blaine County because of their upland locations. BLM will work with private landowners and county governments to address weed management along roads and trails so that infestations are addressed and that these infestations are monitored for potential spread to other upland sites.
Actions-

1) Coordinate w/ County Weed Districts to ensure that county roads within the Monument are adequately addressed
2) Map and treat infestations known to occur on BLM roads and cooperate with other landowners on roads that cross property lines.

D. Riparian Zones

1) Upland Reservoirs – Off river reservoirs are of particular concern due to the reoccurring presence of salt cedar along the river itself. In other areas of Montana and elsewhere in the US, salt cedar is being discovered at small ponds and reservoirs. It is thought that migratory waterfowl are moving seed from infested waterways to these types of sites. This is also the current theory of where infestations on the river corridor are coming from. Large infestations of salt cedar are documented just downstream around Fort Peck Reservoir. Waterfowl that use the reservoir also use the river upstream and likely land at upland stock reservoirs as well.
Actions –

1) Ensure that field staff are trained in invasive plant identification and know how to report infestations if found
2) Begin conducting surveys of upland riparian areas associated with reservoirs to determine the presence or absence of salt cedar and other priority species.

2) Missouri River Corridor – Riparian assessments recently conducted along the river corridor have identified invasive plants as an issue that may impair riparian function. Of concern are noxious and invasive forbs, Russian olive, and the abundance of invasive grass species such as smooth brome and reed canarygrass. In terms of riparian function, the invasive grass species pose the greatest threat to these areas. However, management options are limited because of the proximity to water.
Actions –

1) Set up monitoring sites to determine if these species are increasing and if desirable riparian species are decreasing
2) If a suitable site and cooperator can be found, set up a grazing study to see if cultural management can be used effectively to manage invasive grasses.

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E. Upland Expansion of Annual Bromes

Annual bromes (commonly referred to as cheatgrass) seem to be spreading in areas of the Monument. Although this statement is anecdotal, there is a concern as to why we seem to be seeing these grass species take over on some sites. There are currently no plans to address these species. This plan will allow for individual projects to be proposed to at a future time.

VI. Estimated Budget for Weed Management Program

In order to operate and maintain an effective prevention and management program for invasive species in the Monument, the following resources would be required. Due to inadequate appropriations, funding levels are difficult to maintain at a level where real progress can be made against entrenched infestations in the Monument. This is why priorities and prevention are highlighted in this plan.

Labor				
Item	*Est. Cost*	*Average Funding*	*Difference*	*Description*
PFT Weed Coordinator (GS11)	$65,000	$32,500	$32,500	This position is split between the UMRBNM and another Field Office
6-7 Month Career Seasonal(GS07)	$40,000	$0	$40,000	This position is split between the UMRBNM and another Field Office and is paid for by the other Field Office
Labor Totals	**$105,000**	**$32,500**	**$72,500**	
Operations				
Item	*Est. Cost*	*Average Funding*	*Difference*	*Description*
Seasonal Crew	$40,000	$27,000	$13,000	Funding for these items comes from projects and is subsidized as needed w/ Range Improvement Funding or is left unfunded.
PPE	$1,500	$1,500	$0	
Training/Certifications	$1,500	$750	$750	
Travel/PerDiem	$1,500	$1,500	$0	
Herbicides/adjuvants	$6,000	$2,500	$3,500	
BioControl	$5,000	$2,500	$2,500	
Contracts/Agreements	$2,500	$0	$2,500	
Operations Totals	**$58,000**	**$35,750**	**$22,250**	
Equipment				
Item	*Est. Cost*	*Average Funding*	*Difference*	*Description*
Vehicle	$12,000	$6,000	$6,000	Cost is split with another Field Office
Seasonal Vehicle	$6,000	$6,000	$0	Funding for these items comes from projects and is subsidized as needed w/ Range Improvement Funding or is left unfunded.
Maintain Equipment	$3,000	$1,500	$1,500	
Fuel/oil	$3,000	$1,500	$1,500	
supplies/other	$2,000	$1,000	$1,000	
Equipment Totals	**$26,000**	**$16,000**	**$10,000**	
Annual Budget Est	***$189,000***	**$84,250**	**$104,750**	

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VII. Plan Implementation and Evaluation

The key to success of this plan is dependent on the ability of stakeholders to implement action items identified in the Plan. The table below identifies key action items within the plan, responsible entity for implementing the proposed action, and an estimated date for completion.

Evaluation of progress on action items is critical to determine whether modifications or additions to the plan are necessary to improve facilitation and implementation. This plan will be reviewed periodically by stakeholders. Status of action items will be reviewed, updated as needed, and suggestions identified for facilitation of the Plan.

Action	Responsibility	page #	Scheduled FY												
Prevention															
Implement Prevention Schedule	All BLM Staff	25	13	14	15	16	17	18	19	20	21	22	23	24	25+
Identify Weed Prevetnion Areas	ISC	25	13	14	15	16	17	18	19	20	21	22	23	24	25+
Mitigation Development Review	ISC	25	13	14	15	16	17	18	19	20	21	22	23	24	25+
Education - Public Awarness															
Brochures	ISC & Recreation Staff	26	13	14	15	16	17	18	19	20	21	22	23	24	25+
Demonstration Projects	ISC	26	As identified and funded by BLM and/or partners												
Signage	ISC	26													
Biological Control Projects	ISC	26													
Youth Projects	ISC	26													
Education - Internal Awareness															
Newsletter	ISC	27	13	14	15	16	17	18	19	20	21	22	23	24	25+
BLM Course 9000-5	ISC	27	13	14	15	16	17	18	19	20	21	22	23	24	25+
Seasonal/volunteer workshop	ISC	27	13	14	15	16	17	18	19	20	21	22	23	24	25+
BLM Course 9000-1	ISC & Career Seasonal	28	13	14	15	16	17	18	19	20	21	22	23	24	25+
MT Pesticide Licensing	Weed Seasonals	28	As Needed												
Equipment Training	Weed Seasonals	28													
Mapping															
NISIMS Implementation	ISC	29	Will occur once the program is online												
Chemical Control															
Environmental documentation	ISC	29	13	14	15	16	17	18	19	20	21	22	23	24	25+
Monitoring	ISC	29	13	14	15	16	17	18	19	20	21	22	23	24	25+
Biological Control															
Obtain agents for release	ISC	30	When available												
Implement augmentive releases	ISC	30	13	14	15	16	17	18	19	20	21	22	23	24	25+
Implement monitoring protocal	ISC	30	13	14	15	16	17	18	19	20	21	22	23	24	25+
Physical Control															
Environmental documentation	ISC or Project Lead	32	As Needed												
Revegetation															
Establish/read monitoring sites	ISC or Project Lead	32	13	14	15	16	17	18	19	20	21	22	23	24	25+
Use of "weed free" products	ISC & Law Enforcemetn	32	As Needed												
Special Management - Recreaion Areas - See Appendix D															
Special management - Wilderness Study Areas															
Continue EDRR for salt cedar	ISC	34	13	14	15	16	17	18	19	20	21	22	23	24	25+
Containment treatments	ISC	34	13	14	15	16	17	18	19	20	21	22	23	24	25+
Special Management - Roads & Trails															
County Coordination	ISC	35	13	14	15	16	17	18	19	20	21	22	23	24	25+
Develop/implement coop. management	ISC	35	13	14	15	16	17	18	19	20	21	22	23	24	25+
Special Management - Riparian Zones (Upland Reservoirs)															
EDRR Surveys	ISC & Field Personnel	35	13	14	15	16	17	18	19	20	21	22	23	24	25+
Special Management - Riparan Zones (River Corridor)															
investigate invasivity of grass species	ISC & Range Staff	35	As time and resources allow or if this becomes priotiry												
Design experimental treatment options	ISC & Range Staff	35													
Special Management - Annual Bromes															
document spread	ISC & Range Staff	36	As time and resources allow or if this becomes priotiry												
Design experimental treatment options	ISC & Range Staff	36													

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IX. Appendices

A. MT Noxious Weed List
B. BLM List of Invasive Plants
C. Monument Weed Prevention Schedule
D. Treatment Strategies for Recreation Sites
E. Implementation of Integrated Weed Management in the Upper Missouri River Breaks National Monument EA (2008).
F. Biological Control Monitoring Protocol
G. Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programatic Envirionmental Impact Statement – Record of Decision (Sept 2007)
H. Approved Herbicide Formulations and Adjuvant Tables

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Appendix A –
Montana Noxious Weed List

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Montana Noxious Weed List

Effective: September 2010

Priority1A

These weeds are not present in Montana. Management criteria will require eradication if detected; education; and prevention.

- Yellow starthistle (*Centaurea solstitialis*)

Priority1B

These weeds have limited presence in Montana. Management criteria will require eradication or containment and education.

- Dyer's woad (*Isatis tinctoria*)
- Flowering rush (*Butomus umbellatus*)
- Japanese knotweed complex (*Polygonum spp.*)
- Purple loosestrife (*Lythrum spp.*)
- Rush skeletonweed (*Chondrilla juncea*)
- Eurasian watermilfoil (*Myriophyllum spicatum*)
- Scotch broom (*Cytisus scoparius*)
- Curlyleaf pondweed (*Potamogeton crispus*)

Priority2A

These weeds are common in isolated areas of Montana. Management criteria will require eradication or containment where less abundant. **Management shall be prioritized by local weed districts.**

- Tansy ragwort (*Senecio jacobaea*)
- Meadow hawkweed complex (*Hieracium spp.*)
- Orange hawkweed (*Hieracium aurantiacum*)
- Tall buttercup (*Ranunculus acris*)
- Perennial pepperweed (*Lepidium latifolium*)
- Yellowflag iris (*Iris pseudacorus*)
- Blueweed (*Echium vulgare*)
- Hoary alyssum (*Berteroa incana*)

Priority2B

These weeds are abundant in Montana and widespread in many counties. Management criteria will require eradication or containment where less abundant. **Management shall be prioritized by local weed districts.**

- Canada thistle (*Cirsium arvense*)
- Field bindweed (*Convolvulus arvensis*)
- Leafy spurge (*Euphorbia esula*)
- Whitetop (*Cardaria draba*)
- Russian knapweed (*Centaurea repens*)
- Spotted knapweed (*Centaurea stoebe* or *maculosa*)
- Diffuse knapweed (*Centaurea diffusa*)
- Dalmatian toadflax (*Linaria dalmatica*)
- St. Johnswort (*Hypericum perforatum*)
- Sulfur cinquefoil (*Potentilla recta*)
- Common tansy (*Tanacetum vulgare*)
- Oxeye daisy (*Chrysanthemum leucanthemum or Leucanthemum vulgare*)
- Houndstongue (*Cynoglossum officinale*)
- Yellow toadflax (*Linaria vulgaris*)
- Saltcedar (*Tamarix spp.*)

Priority3

Regulated Plants: (NOT MONTANA LISTED NOXIOUS WEEDS)

These regulated plants have the potential to have significant negative impacts. The plant may not be intentionally spread or sold other than as a contaminant in agricultural products. The state recommends research, education and prevention to minimize the spread of the regulated plant.

- Cheatgrass (*Bromus tectorum*)
- Hydrilla (*Hydrilla verticillata*)
- Russian olive (*Elaeagnus angustifolia*)

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Appendix B –
BLM National List of Invasive Weed Species of Concern

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Scientific Name	Common Name	Family
Grasses		
Aegilops cylindrica	jointed goatgrass	Poaceae
Ammophila arenaria	European beachgrass	Poaceae
Arundo donax	giant reed	Poaceae
Bromus diandrus	ripgut brome	Poaceae
Bromus japonicus	Japanese brome	Poaceae
Bromus rubens	red brome	Poaceae
Bromus tectorum	downy brome	Poaceae
Cenchrus longispinus	longspine sandbur	Poaceae
Cortaderia jubata	Andean pampas grass	Poaceae
Cortaderia selloana	pampas grass	Poaceae
Cynodon dactylon	bermudagrass	Poaceae
Ehrharta calycina	veldt grass	Poaceae
Elytrigia repens	quackgrass	Poaceae
Eragrostis lehmanniana	Lehmann lovegrass	Poaceae
Nardus stricta	matgrass	Poaceae
Panicum miliaceum	wild proso millet	Poaceae
Pennisetum setaceum	crimson fountain grass	Poaceae
Schismus arabicus	schismus	Poaceae
Schismus barbatus	mediterranean grass	Poaceae
Sorghum halepense	johnsongrass	Poaceae
Taeniatherum caput-medusae	medusa-head	Poaceae
Forbs		
Acroptilon repens	Russian knapweed	Asteraceae
Anthemis arvensis	scentless chamomile	Asteraceae
Anthemis cotula	mayweed chamomile	Asteraceae
Arctium minus	common burdock	Asteraceae
Bassia hyssopifolia	bassia Basellaceae	Asteraceae
Brassica nigra	black mustard	Brassicaceae
Brassica tournefortii	wild turnip	Brassicaceae
Caesalpinia gilliesii	Mexican bird-of-paradise	Fabaceae
Cardaria chalepensis	lens-podded whitetop	Brassicaceae
Cardaria draba	hoary cress	Brassicaceae
Cardaria pubescens	hairy whitetop	Brassicaceae
Carduus acanthoides	plumeless thistle	Asteraceae

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Carduus nutans	musk thistle	Asteraceae
Carduus pycnocephalus	Italian thistle	Asteraceae
Carduus teniflorus	slender-flowered thistle	Asteraceae
Carpobrotus edulis	hottentot fig	Aizoaceae
Carpobrotus chilensis	sea iceplant	Aizoaceae
Carthamus lantus	distaff thistle	Asteraceae
Carum carvi	common caraway	Apiaceae
Centaurea calcitrapa	purple starthistle	Asteraceae
Centaurea cyanus	cornflower	Asteraceae
Centaurea diffusa	diffuse knapweed	Asteraceae
Centaurea iberica	Iberian starthistle	Asteraceae
Centaurea jacea	brown knapweed	Asteraceae
Centaurea macrocephala	bighead knapweed	Asteraceae
Centaurea maculosa	spotted knapweed	Asteraceae
Centaurea melitenisis	malta starthistle	Asteraceae
Centaurea montana	mountain cornflower	Asteraceae
Centaurea nigra	black knapweed	Asteraceae
Centaurea nigrescens	Vochin knapweed	Asteraceae
Centaurea pratensis	meadow knapweed	Asteraceae
Centaurea squarrosa	squarrose knapweed	Asteraceae
Centaurea solstitialis	yellow starthistle	Asteraceae
Centaurea trichocephala	feather-headed knapweed	Asteraceae
Chondrilla juncea	rush skeletonweed	Asteraceae
Chrysanthemum leucanthemum	ox-eye daisy	Asteraceae
Cichorium intybus	chicory	Asteraceae
Cirsium arvense	Canada thistle	Asteraceae
Cirsium vulgare	bull thistle	Asteraceae
Clematis orientalis	Chinese clematis	Ranunculaceae
Conium maculatum	poison hemlock	Apiaceae
Convolvulus arvensis	field bindweed	Convoluvaceae
Crepis setosa	bristly hawkweed	Asteraceae
Crupina vulgaris	common crupina	Asteraceae
Cynara cardunculus	artichoke thistle	Asteraceae
Cynoglossum officinale	houndstongue	Boraginaceae
Digitalis purpurea	foxglove	Scrophulariaceae
Dipsacus fullonum	common teasel	Dipsacaceae
Echium vulgare	blueweed	Boraginaceae

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Egeria densa	Brazillian waterweed	Hydrocharitaceae
Eichhornia crassipes	water hyacinth	Hydrocharitaceae
Erechtites glomerata	Australian fireweed	Asteraceae
Euphorbia cyparissias	cypress spurge	Euphorbiaceae
Euphorbia esula	leafy spurge	Euphorbiaceae
Euphorbia myrsinites	myrtle spurge	Euphorbiaceae
Foeniculum vulgare	fennel	Apiaceae
Galega officinalis	goats rue	Fabaceae
Gypsophila paniculata	babys breath	Caryophyllaceae
Halogeton glomeratus	halogeton	Chenopodiaceae
Hesperis matronalis	dames's rocket	Brassicaceae
Hieracium aurantiacum	orange hawkweed	Asteraceae
Hieracium pilosella	mouseear hawkweed	Asteraceae
Hieracium pratense	yellow hawkweed	Asteraceae
Hydrilla verticillata	hydrilla	Hydrocharitaceae
Hyoscyamus niger	black henbane	Solanaceae
Hypericum perforatum	common St. Johnswort	Hypericaceae
Hyposhaeris radicata	common catsear	Asteraceae
Isatis tinctoria	dyer's woad	Brassicaceae
Knautia arvensis	blue buttons	Dipsacaceae
Lathyrus latifolius	everlasting peavine	Fabaceae
Lepidium latifolium	perennial pepperweed	Brassicaceae
Linaria genistifolia spp. dalmatica	dalmation toadflax	Scrophulariaceae
Linaria vulgaris	yellow toadflax	Scrophulariaceae
Lysimachia vulgaris	garden loosestrife	Primulaceae
Lythrum salicaria	purple loosestrife	Lythraceae
Lythrum virgatum	wand loosestrife	Lythraceae
Madia sativa	Chilean tarweed	Asteraceae
Myriophyllum spicatum	Eurasian watermilfloil	Haloragaceae
Onopordum acanthium	Scotch thistle	Asteraceae
Onopordum taricum	Scotch thistle	Asteraceae
Peganum harmala	African rue	Zygophyllaceae
Potentilla recta	sulphur cinquefoil	Rosaceae
Salvia aethiopsis	Mediterranean sage	Lamiaceae
Saponaria officinalis	bouncing bet	Caryophyllaceae
Senecio jacobaea	tansy ragwort	Asteraceae
Senecio mikanoides	German ivy	Asteraceae

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Solanum dulcamara	bitter nightshade	Solanaceae
Sonchus arvensis	perennial sowthistle	Asteraceae
Sphaerophysa salsula	swainsonpea	Fabaceae
Tanacetum vulgare	common tansy	Asteraceae
Zygophyllum fabago	Syrian bean caper	Zygophyllaceae
Shrubs and Trees		
Ailanthus altissima	tree-of-heaven	Simaroubaceae
Alhagi pseudalhagi	camelthorn	Fabaceae
Cytisus junceum	Spanish broom	Fabaceae
Cytisus monspessulanas	French broom	Fabaceae
Cytisus scoparius	Scotch broom	Fabaceae
Cytisus striatus	Portugese broom	Fabaceae
Elaeagnus angustifolia	Russian olive	Elaeagnaceae
Ficus carica	edible fig	Moraceae
Lespedeza cuneata	Himalayan bush clover	Fabaceae
Retama monosperma	bridal veil broom	Fabaceae
Rubus discolor	Himalaya blackberry	Rosaceae
Schinus terebrinthifolius	Brazillian pepper	Anacardiaceae
Tamarix aphylla	athel	Tamaricaceae
Tamarix chinensis	tamarisk	Tamaricaceae
Tamarix gallica	French tamarisk	Tamaricaceae
Tamarix parviflora	small flower tamerisk	Tamaricaceae
Tamarix pentanda	tamarisk	Tamaricaceae
Tamarix ramosissima	salt cedar	Tamaricaceae
Ulex europaeus	gorse	Fabaceae
Ulmus pumila	Siberian elm	Ulmaceae

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Appendix C –
Upper Missouri River Breaks National Monument Weed Prevention Schedule

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Prevention Activity	When	Who is Responsible
Strategies Common to All Activities		
UMRBNM weed coordinator will review all activity plans to ensure weed prevention and treatment strategies are integrated into them.	Continuous	Weed Coordinator
Develop clauses in all contracts that include the use of certified "weed free" seed for reclamation and rehab of disturbed areas. Construction equipment will be cleaned before moving on site.	All Activities	UMRBNM Manager & Project Contract Inspector
Train UMRBNM field staff in the identification and reporting of noxious weed infestations. Maintain accurate records.	Before Each Field Season	UMRBNM Manager & Weed Coordinator
Ensure UMRBNM employees keep vehicles clean, including ATV's, and avoid driving through weed infested areas. "FLUSH & BRUSH"	Continuous	UMRBNM Manager
Continue to develop partnerships and cooperative agreements with other federal and state agencies and private landowners.	As Needed	Weed Coordinator
Prevent transport of seeds by motor vehicles. Keep all vehicles on established roads and trails.	As Designated	UMRBNM Manager & Law Enforcement
Continue to inventory and survey areas that have a high potential for introduction of noxious weeds.	Field Season	All UMRBNM Employees
Incorporate weed management strategies into road layout, design and construction.	All Projects	UMRBNM Manager
Reestablish vegetation on all disturbed and bare ground areas to minimize introduction and establishment of noxious weeds.	Immediately	All Programs & Activities
Ensure weed prevention strategies are incorporated into UMRBNM travel plan - road closures, restricted use areas and road maintenance.	Continuous	UMRBNM Manager
Report weed infestations to weed coordinator.	Continuous	All UMRBNM Employees
Rangeland Management		
Design timing of livestock movement from weed infested areas to "weed free" areas to avoid transporting noxious weed seeds.	All Year	UMRBNM Range Staff
Enforce proper management of livestock use in weed infested areas to improve competition from desirable species.	All Year	UMRBNM Range Staff
Recreation, WSA's, ACEC's, ONA's, Backcountry Byways		
Minimize transport of weed seed by pack and saddle stock.	Continuous	UMRBNM Recreation Staff

Distribute weed awareness and education brochure to public land users on how to identify weeds and prevent their spread.	Available at visitor center, put-in and take-out points and recreation sites.	UMRBNM Recreation Staff & Weed Coordinator
Ensure recreation site treatment plans are implemented and effective (Coal Banks Landing, Eagle Creek, Judith Landing, Kipp Park)	Annually	UMRBNM Recreation Staff & Weed Coordinator
FLUSH OR BRUSH before moving equipment from an area infested with weeds to a "weed free" area (mowing).	Annually	UMRBNM Recreation Staff & Weed Coordinator
Ensure commercial outfitters use certified weed free hay and feed.	Continuous	UMRBNM Recreation Staff & Weed Coordinator
Wildlife		
Incorporate weed prevention strategies into all habitat improvement projects.	All Projects	UMRBNM Wildlife Biologist & Contract Inspector
Timber		
Incorporate weed prevention strategies and best management practices into all timber sales.	All Projects	UMRBNM Manager
Realty		
UMRBNM weed coordinator will review all land acquisition, disposal and exchange proposals and easements for presence of noxious weeds and the use of herbicides.	All Actions	UMRBNM Weed Coordinator
Prevention Activity	**When**	**Who is Responsible**
Realty		
Stipulate in all ROW's the use of certified weed free seed for reclamation and designate responsibility for weed control.	All Actions	Realty Specialist
Stipulate in all Agricultural Permits the requirement for controlling weeds.	All Permits	Realty Specialist
NEPA		
All actions on public land will be reviewed by the UMRBNM weed coordinator for their potential to introduce or spread noxious weeds.	All Actions	Project Initiator and Weed Coordinator
Minerals		
Include weed prevention strategies and weed treatment guidelines in exploration and mining plans. Retain bonds until site is "weed free" and meets reclamation requirements.	All Actions	Minerals Staff
All gravel pits will be inspected and cleared for contamination by noxious weeds before a permit is issued. Mining equipment will be cleaned before entering a public gravel pit. Reclamation plans will include weed control measures.	All Permits	Authorized Officer

Stipulate in all seismic permits that equipment will be cleaned before entering public land and designate responsibility for weed control.	All Permits	Authorized Officer
Fire		
FLUSH & BRUSH equipment and vehicles before going to and returning from fire activities (suppression, prescribed fire, project work).	All Activities	Fire Management & Control Officer
Consider the potential for introducing and spreading noxious weeds when developing prescribed burn plans and rehabilitation plans following wildfire.	All Activities	Fire Management & Control Officer

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Appendix D –
Treatment Strategies for Recreation Sites

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Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
Fort Benton Visitors Center	NA	Priority 1	None					
		Priority 2	purple loosestrife*	annual monitoring for prevention of this species which occurs upstream from the visitors center	Hand pull or physical removal if only a few plants are found. Spot applications of herbicide may be required.	If needed, an aquatic labeled herbicide can be selectively applied.	Timing of potential herbicide application will be determined at the time of discovery w/ consideration of potential herbicides to be used.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. Extreme care should be taken to apply herbicides selectively to the target species
		Priority 3	None					
		Priority 4	leafy spurge, Canada thistle, field bindweed, common burdock	treat leafy spurge in the trail area w/ inundative releases of aphthona beetles. Other species may be spot treated w/ herbicide in the trail area. Field bindweed in turf and ornamental plantings would be hand pulled and/or treated by a turf and ornamental specialist	Aphthona beetles would be released in June/July as they become available. Herbicides will be applied w/ UTV handguns, backpack sprayers, or hand pump type sprayers	A broadleaf post emergent herbicide will be used in the walking trial/natural area. Herbicide applications in turf and ornamental plantings will be determined by the professional hired to do the work.	The walking trail site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	other invasive plants	management for these species will occur on project specific basis				
Evans Bend	6.5	Priority 1	None					
		Priority 2	None					
		Priority 3	poison hemlock	hemlock occurs mainly under the canopy of the cottonwood galleries on this bottom. Biological control with the defoliating moth will be released and spot treatments of herbicide may be employed	herbicides will be applied w/ UTV handguns, backpack sprayers, or hand pump type sprayers	sulfonylurea compounds such as chlorsulfuron and metsulfuron methyl are effective on this species.	hemlock is best treated in the spring before the plant bolts.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 4	Canada thistle, field bindweed, leafy spurge, Russian knapweed, Spotted knapweed, houndstongue, common burdock	The area around the designated recreation site will be the first priority to help reduce site to site movement via camping. Russian knapweed is very prevalent in the open areas between the islands of trees. When available, new biological control agents would be proposed for release. The other species are mainly found in the wooded areas.	Herbicides will be applied w/ UTV handguns, backpack sprayers, or hand pump type sprayers. In the open areas, broadjet or boom buster type sprayers may be used for the Russian knapweed infestations.	Picloram is the herbicide that would be most effective across this spectrum of species and the only one that would give good control for leafy spurge. However, given the wooded areas, this may not be the best choice. Tank mixes of clopyralid, triclopyr, and one of the sulfonylurea compounds would control most species except leafy spurge.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Spot application of picloram should be made in wooded areas in the fall after first frost to minimize non target effects. All spot applications in the wooded areas should be made in a manner as to reduce any off target movement of herbicide.

Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
		Priority 5	Russian olive, other invasive plants	Russian olive is being managed as a species specific project and will be treated when resources are made available for that purpose and/or when time and resources allow after other priority species are managed. Management for exotic species is not currently a priority	Cut Stump, basal bark, or injection will be used on larger trees. Foliar applications of appropriate herbicides can be used for regrowth and smaller plants.	Herbicides available for Russian olive treatments contain one of these active ingredients: triclopyr, imazapyr, or glyphosate	Treatment can occur on larger trees year around but should not be made during spring at peak sap flow. Smaller plants are best treated in the spring or fall like many of the other invasive species in the area.	Caution should be used in treating cut stump to minimize runoff or off target drift.
Rowe Island	13	Priority 1	None					
		Priority 2	None					
		Priority 3	None					
		Priority 4	Canada thistle, leafy spurge, Russian knapweed, Spotted knapweed, houndstongue, common burdock	The area around the designated recreation site will be the first priority to help reduce site to site movement via camping. Russian knapweed is very prevalent in the open areas. Spotted knapweed is currently confined to a small area at the mouth of the coulee. Other Species are intermingled with snowberry and/or under the tree canopy.	Herbicides would be applied by backpack sprayer or other handheld equipment as access is limited to motorboat or canoe.	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	annual bromes, other invasive plants	management for these species will occur on project specific basis				
Senuirs Reach	16.2	Priority 1	None					
		Priority 2	None					
		Priority 3	perennial pepperweed, whitetop, poison hemlock, absinth wormwood	The perennial pepperweed and whitetop should be treated w/ herbicide in late spring/early summer. The hemlock is treated each year by an established population of the defoliating moth. Absinth wormwood can be treated along	Spot applications of herbicide would be made with backpack and hand sprayers. Additional releases of the defoliating moth may be acquired to enhance populations.	sulfonylurea compounds such as chlorsulfuron and metsulfuron methyl are effective on this species. If aminopyralid is approved for use on public lands, mixtures of sulfonylureas + aminopyralid are affective as well.	Late Spring/Early Summer to allow for protein synthesis disruption prior to seed set.	Some of the infestation are under the drip line of desired tree species and or mixed with snowberry or other desired shrubs. Spot applications should be precise and care taken to not apply excessive amounts to target species.
		Priority 4	Canada thistle, leafy spurge, Russian knapweed, Houndstongue, Common burdock	The area around the designated recreation site will be the first priority to help reduce site to site movement via camping.	Spot applications of herbicide would be made with backpack and hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	Herbicide applications will coincide in the late spring/early summer w/ priority 3 species. Late summer/fall applications may be made if time and resources allow.	Some of the infestation are under the drip line of desired tree species and or mixed with snowberry or other desired shrubs. Spot applications should be precise and care taken to not apply excessive amounts to target species.
		Priority 5	annual bromes, other invasive plants	management for these species will occur on project specific basis				

Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
Black Bluff Rapids	19.4	Priority 1	None					
		Priority 2	None					
		Priority 3	perennial pepperweed, poison hemlock	Herbicides should be applied in the late spring/early summer. The hemlock is treated each year by an established population of the defoliating moth.	Spot applications of herbicide would be made with backpack and hand sprayers. Additional releases of the defoliating moth may be acquired to enhance populations.	sulfonylurea compounds such as chlorsulfuron and metsulfuron methyl are effective on this species. If aminopyralid is approved for use on public lands, mixtures of sulfonylureas + aminopyralid are affective as well.	Late Spring/Early Summer to allow for protein synthesis disruption prior to seed set.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 4	leafy spurge, Russian knapweed, spotted knapweed, hoary alyssum	established populations of biological control insects treat the leafy spurge and spotted knapweed each year. This site is a collection area for redistributing leafy spurge biological control to other infestations. Russian knapweed can only be treated with herbicide at this time.	Established populations of biological control may be augmented with additional releases. Spot applications of herbicide would be made with backpack and hand sprayers.	Most post emergent, broadleaf herbicides available have some activity on Russian knapweed. Site conditions and herbicide efficacy will help determine the specific herbicide to be used.	Herbicide applications will coincide in the late spring/early summer w/ priority 3 species. Late summer/fall applications may be made if time and resources allow.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	annual bromes, other invasive plants					
Wood Bottom	20.3	Priority 1	none					
		Priority 2	scentless chamomile	When observed, plants will be hand pulled and/or sprayed while other priority species are treated.	Hand removal. Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	The herbicide used will be that which is on site while other priority species are being treated.	plants should be treated whenever they are observed	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 3	perennial pepperweed, poison hemlock, absinth wormwood	Herbicides should be applied in the late spring/early summer. The hemlock is treated each year by an established population of the defoliating moth. Absinth wormwood can be treated along w/ the Priority 4 species.	Established populations of biological control may be augmented with additional releases. Spot applications of herbicide would be made with backpack and hand sprayers.	sulfonylurea compounds such as chlorsulfuron and metsulfuron methyl are effective on this species. If aminopyralid is approved for use on public lands, mixtures of sulfonylureas + aminopyralid are affective as well.	Late Spring/Early Summer to allow for protein synthesis disruption prior to seed set.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD

Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
		Priority 4	Canada thistle, leafy spurge, Russian knapweed, spotted knapweed, houndstongue, hoary alyssum	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using
		Priority 5	annual bromes, other invasive plants	management for these species will occur on project specific basis				
Decision Point	22	Priority 1	none					
		Priority 2	none					
		Priority 3	none					
		Priority 4	leafy spurge	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species.	The site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	other invasive plants	management for these species will occur on project specific basis				
Coal Banks Landing	41.5	Priority 1	none					
		Priority 2	Dalmatian toadflax*	annual monitoring for prevention of this species which occurs upstream near Virgelle. Cooperation w/ the County Weed District and landowners to assist in containment efforts	Hand pull or physical removal if only a few plants are found. Spot applications of herbicide may be required.	A broadleaf post emergent herbicide will be used. Adjuvant selection is critical for herbicide efficacy. A silicone and/or oil based adjuvant will be used when applying herbicides	Timing of potential herbicide application will be determined at the time of discovery w/ consideration of potential herbicides to be used.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. Extreme care should be taken to apply herbicides selectively to the target species.
		Priority 3	none					
		Priority 4	Canada thistle, leafy spurge, Russian knapweed, spotted knapweed, field bindweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species	The site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.

Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
		Priority 5	Russian olive, other invasive plants	Russian olive is being managed as a species specific project and will be treated when resources are made available for that purpose and/or when time and resources allow after other priority species are managed. Management for other exotic species is not currently a priority	Cut Stump, basal bark, or injection will be used on larger trees. Foliar applications of appropriate herbicides can be used for regrowth and smaller plants.	Herbicides available for Russian olive treatments contain one of these active ingredients: triclopyr, imazapyr, or glyphosate	Treatment can occur on larger trees year around but should not be made during spring at peak sap flow. Smaller plants are best treated in the spring or fall like many of the other invasive species in the area.	Caution should be used in treating cut stump to minimize runoff or off target drift.
Little Sandy	46.7	Priority 1	none					
		Priority 2	none					
		Priority 3	perennial pepperweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	sulfonylurea compounds such as chlorsulfuron and metsulfuron methyl are effective on this species. If aminopyralid is approved for use on public lands, mixtures of sulfonylureas + aminopyralid are affective as well.	Late Spring/Early Summer to allow for protein synthesis disruption prior to seed set.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 4	Canada thistle, leafy spurge, Russian knapweed, spotted knapweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	Russian olive, other invasive plants	Russian olive is being managed as a species specific project and will be treated when resources are made available for that purpose and/or when time and resources allow after other priority species are managed. Management for exotic species is not currently a priority	Cut Stump, basal bark, or injection will be used on larger trees. Foliar applications of appropriate herbicides can be used for regrowth and smaller plants.	Herbicides available for Russian olive treatments contain one of these active ingredients: triclopyr, imazapyr, or glyphosate	Treatment can occur on larger trees year around but should not be made during spring at peak sap flow. Smaller plants are best treated in the spring or fall like many of the other invasive species in the area.	Caution should be used in treating cut stump to minimize runoff or off target drift.
Monroe Island	53.7	Priority 1	none					
		Priority 2	none					

Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
		Priority 3	perennial pepperweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	sulfonylurea compounds such as chlorsulfuron and metsulfuron methyl are effective on this species. If aminopyralid is approved for use on public lands, mixtures of sulfonylureas + aminopyralid are affective as well.	Late Spring/Early Summer to allow for protein synthesis disruption prior to seed set.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD
		Priority 4	Canada thistle, leafy spurge, Russian knapweed, spotted knapweed Houndstongue, Common burdock	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations
		Priority 5	Russian olive, annual bromes, other invasive plants	Russian olive is being managed as a species specific project and will be treated when resources are made available for that purpose and/or when time and resources allow after other priority species are managed. Management for other exotic species is not currently a priority	Cut Stump, basal bark, or injection will be used on larger trees. Foliar applications of appropriate herbicides can be used for regrowth and smaller plants.	Herbicides available for Russian olive treatments contain one of these active ingredients: triclopyr, imazapyr, or glyphosate	Treatment can occur on larger trees year around but should not be made during spring at peak sap flow. Smaller plants are best treated in the spring or fall like many of the other invasive species in the area.	Caution should be used in treating cut stump to minimize runoff or off target drift.
Eagle Creek	56	Priority 1	none					
		Priority 2	purple loosestrife*	annual monitoring for prevention of this species which was reported by MT Natural Heritage Staff. No infestations have been observed by BLM.	Hand pull or physical removal if only a few plants are found. Spot applications of herbicide may be required.	If needed, an aquatic labeled herbicide can be selectively applied.	Timing of potential herbicide application will be determined at the time of discovery w/ consideration of potential herbicides to be used.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. Extreme care should be taken to apply herbicides selectively to the target species.
		Priority 3	none					
		Priority 4	leafy spurge	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species.	The site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	annual bromes, other invasive plants	management for these species will occur on project specific basis				
Hole in the Wall	63	Priority 1	none					

Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
		Priority 2	Dalmatian toadflax*, salt cedar*	Both species occur as small spot infestations. Salt cedar is believed to be eradicated at this time but annual monitoring and treatment if found is prescribed.	Salt cedar can be removed manual by hand pulling if it reoccurs and is still below 2' in height. Spot application of herbicide with backpack or hand sprayers	A broadleaf post emergent herbicide will be used. Adjuvant selection is critical for herbicide efficacy on Dalmatian toadflax. A silicone and/or oil based adjuvant will be used when applying herbicides	Timing of potential herbicide application will be determined at the time of discovery w/ consideration of potential herbicides to be used.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. Extreme care should be taken to apply herbicides selectively to the target species.
		Priority 3	perennial pepperweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	sulfonylurea compounds such as chlorsulfuron and metsulfuron methyl are effective on this species. If aminopyralid is approved for use on public lands, mixtures of sulfonylureas + aminopyralid are affective as well.	Late Spring/Early Summer to allow for protein synthesis disruption prior to seed set.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 4	Canada thistle, leafy spurge, spotted knapweed, Russian knapweed	established populations of biological control insects treat the leafy spurge and spotted knapweed each year. This site is a historical release site and will be monitored for impacts of leafy spurge biocontrol. Russian knapweed can only be treated with herbicide at this time.	Established populations of biological control may be augmented with additional releases. Spot applications of herbicide would be made with backpack and hand sprayers.	Most post emergent, broadleaf herbicides available have some activity on Russian knapweed. Site conditions and herbicide efficacy will help determine the specific herbicide to be used.	Herbicide applications will coincide in the late spring/early summer w/ priority 3 species. Late summer/fall applications may be made if time and resources allow.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	other invasive plants	management for these species will occur on project specific basis				
Dark Butte	68.8	Priority 1	none					
		Priority 2	none					
		Priority 3	perennial pepperweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	sulfonylurea compounds such as chlorsulfuron and metsulfuron methyl are effective on this species. If aminopyralid is approved for use on public lands, mixtures of sulfonylureas + aminopyralid are affective as well.	Late Spring/Early Summer to allow for protein synthesis disruption prior to seed set.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.

Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
		Priority 4	Canada thistle, leafy spurge, spotted knapweed, Russian knapweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	other invasive plants	management for these species will occur on project specific basis				
Pablo	72.8	Priority 1	none					
		Priority 2	black henbane	annual monitoring for prevention of this species as it has occurred as a small spot infestation in the near past.	Hand pull or physical removal if only a few plants are found. Spot applications of herbicide may be required.	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	Timing of potential herbicide application will be determined at the time of discovery w/ consideration of potential herbicides to be used.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. Extreme care should be taken to apply herbicides selectively to the target species.
		Priority 3	perennial pepperweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	sulfonylurea compounds such as chlorsulfuron and metsulfuron methyl are effective on this species. If aminopyralid is approved for use on public lands, mixtures of sulfonylureas + aminopyralid are affective as well.	Late Spring/Early Summer to allow for protein synthesis disruption prior to seed set.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 4	Canada thistle, leafy spurge, spotted knapweed, Russian knapweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	annual bromes, other invasive plants	management for these species will occur on project specific basis				
Slaughter River	76.8	Priority 1	none					
		Priority 2	none					

Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
		Priority 3	none					
		Priority 4	Canada thistle, leafy spurge, spotted knapweed, Russian knapweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	Russian olive, annual bromes, other invasive plants	Russian olive is being managed as a species specific project and will be treated when resources are made available for that purpose and/or when time and resources allow after other priority species are managed. Management for other exotic species is not currently a priority	Cut Stump, basal bark, or injection will be used on larger trees. Foliar applications of appropriate herbicides can be used for regrowth and smaller plants.	Herbicides available for Russian olive treatments contain one of these active ingredients: triclopyr, imazapyr, or glyphosate	Treatment can occur on larger trees year around but should not be made during spring at peak sap flow. Smaller plants are best treated in the spring or fall like many of the other invasive species in the area.	Caution should be used in treating cut stump to minimize runoff or off target drift.
The Wall	81.3	Priority 1	none					
		Priority 2	none					
		Priority 3	none					
		Priority 4	Canada thistle, leafy spurge, Russian knapweed	Spot application of herbicide	Spot application of herbicide using backpack and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	annual bromes, other invasive plants	management for these species will occur on project specific basis				
Judith Landing	88.5	Priority 1	none					
		Priority 2	curlyleaf pondweed	annual monitoring and manual removal if needed	hand pull or physical removal with a rake	NA	Timing of potential herbicide application will be determined at the time of discovery w/ consideration of potential herbicides to be used.	If large infestations are required, permits from the MT Dept. of Environmental Quality may need to be obtained prior to treatment.
		Priority 3	none					

Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
		Priority 4	Canada thistle, leafy spurge, spotted knapweed, Russian knapweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD
		Priority 5	Russian olive, annual bromes, other invasive plants	Russian olive is being managed as a species specific project and will be treated when resources are made available for that purpose and/or when time and resources allow after other priority species are managed. Management for other exotic species is not currently a priority	Cut Stump, basal bark, or injection will be used on larger trees. Foliar applications of appropriate herbicides can be used for regrowth and smaller plants.	Herbicides available for Russian olive treatments contain one of these active ingredients: triclopyr, imazapyr, or glyphosate	Treatment can occur on larger trees year around but should not be made during spring at peak sap flow. Smaller plants are best treated in the spring or fall like many of the other invasive species in the area.	Caution should be used in treating cut stump to minimize runoff or off target drift.
Stafford Ferry	101.8	Priority 1	none					
		Priority 2	salt cedar	annual monitoring for prevention of this species which occurs as seedlings on both sides of the river	Hand pull or physical removal if only a few plants are found. Spot applications of herbicide may be required.	If needed, an aquatic labeled herbicide can be selectively applied.	Timing of potential herbicide application will be determined at the time of discovery w/ consideration of potential herbicides to be used.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. Extreme care should be taken to apply herbicides selectively to the target species.
		Priority 3	perennial pepperweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	sulfonylurea compounds such as chlorsulfuron and metsulfuron methyl are effective on this species. If aminopyralid is approved for use on public lands, mixtures of sulfonylureas + aminopyralid are affective as well.	Late Spring/Early Summer to allow for protein synthesis disruption prior to seed set.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 4	Canada thistle, leafy spurge, spotted knapweed, Russian knapweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	annual bromes, other invasive plants	management for these species will occur on project specific basis				

Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
McGary Bar	103.3	Priority 1	none					
		Priority 2	none					
		Priority 3	perennial pepperweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	sulfonylurea compounds such as chlorsulfuron and metsulfuron methyl are effective on this species. If aminopyralid is approved for use on public lands, mixtures of sulfonylureas + aminopyralid are affective as well.	Late Spring/Early Summer to allow for protein synthesis disruption prior to seed set.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 4	Canada thistle, leafy spurge, spotted knapweed, Russian knapweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	annual bromes, other invasive plants	management for these species will occur on project specific basis				
Gist Bottom	122.6	Priority 1	none					
		Priority 2	salt cedar	Occurs as seedlings and will be manual removed when observed. The area will be monitored annually to ensure that seedling do not mature.	Hand removal. Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	The herbicide used will be that which is on site while other priority species are being treated.	plants should be treated whenever they are observed	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 3	perennial pepperweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	sulfonylurea compounds such as chlorsulfuron and metsulfuron methyl are effective on this species. If aminopyralid is approved for use on public lands, mixtures of sulfonylureas + aminopyralid are affective as well.	Late Spring/Early Summer to allow for protein synthesis disruption prior to seed set.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.

Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
		Priority 4	Canada thistle, leafy spurge, Russian knapweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	Russian olive, annual bromes, other invasive plants	Russian olive is being managed as a species specific project and will be treated when resources are made available for that purpose and/or when time and resources allow after other priority species are managed. Management for exotic species is not currently a priority	Cut Stump, basal bark, or injection will be used on larger trees. Foliar applications of appropriate herbicides can be used for regrowth and smaller plants.	Herbicides available for Russian olive treatments contain one of these active ingredients: triclopyr, imazapyr, or glyphosate	Treatment can occur on larger trees year around but should not be made during spring at peak sap flow. Smaller plants are best treated in the spring or fall like many of the other invasive species in the area.	Caution should be used in treating cut stump to minimize runoff or off target drift.
Upper Woodhawk	129.4	Priority 1	none					
		Priority 2	none					
		Priority 3	absinth wormwood	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 4	Canada thistle, leafy spurge, Russian knapweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	annual bromes, other invasive plants	management for these species will occur on project specific basis				
Lower Woodhawk	131.2	Priority 1	none					
		Priority 2	none					

Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
		Priority 3	absinth wormwood	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 4	Canada thistle, leafy spurge, Russian knapweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	annual bromes, other invasive plants	management for these species will occur on project specific basis				
Hideaway	136.7	Priority 1	none					
		Priority 2	none					
		Priority 3	absinth wormwood	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 4	Canada thistle, field bindweed, leafy spurge, Russian knapweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	other invasive plants	management for these species will occur on project specific basis				

Site Location	River Mile	Target Species		Strategy	Application Method	Herbicide	Timing	Cautions
James Kipp Recreation Area	149	Priority 1	none					
		Priority 2	none					
		Priority 3	whitetop	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	sulfonylurea compounds such as chlorsulfuron and metsulfuron methyl are effective on this species. If aminopyralid is approved for use on public lands, mixtures of sulfonylureas + aminopyralid are affective as well.	Late Spring/Early Summer to allow for protein synthesis disruption prior to seed set. Coordination is needed to ensure infestations are not mowed prior to and shortly after application to ensure translocation.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 4	Canada thistle, field bindweed, leafy spurge, Russian knapweed	Spot application of herbicide	Spot application of herbicide using UTV mounted, backpack, and/or hand sprayers	A broadleaf post emergent herbicide will be used to control these species. If aminopyralid or other more selective chemistries become available to BLM, then they may be used to address infestations in the snowberry and under the tree canopy.	The recreation site should be treated in the spring/early summer to stress plants and reduce seed production. As time an resources allow, the other areas can be treated in the fall.	Non-target vegetation may be injured if herbicides are allowed to move from area of application. All SOPs and mitigations established in the Vegetation Treatments on BLM Lands in 17 Western States Using Herbicides EIS/ROD (2007) will be followed.
		Priority 5	annual bromes, other invasive plants	management for these species will occur on project specific basis				

Appendix E – Implementation of Integrated Weed Management in the Upper Missouri River Breaks National Monument EA (2008)

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Appendix F –
Biological Control Monitoring Protocol

http://www.agri.state.id.us/Categories/PlantsInsects/NoxiousWeeds/Bio_Control.php

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A step-by-step guide for completing the SIMP biological control monitoring form:

General Information:

- Observer(s) – Who are you?
- Date – Today's date.
- Landowner – Who is the landowner/land manager?
- Permanent? – Is this a permanent monitoring site?
- Site name – Which site are you monitoring? This could have a specific name if it is a permanent site.
- Weed – Which target weed are you are monitoring?
- Biological control agent – Which biological control agent you are monitoring?
- Insect Stage – What is the developmental stage of the agent are you monitoring (egg, larva, nymph, pupa adult)?
- Lat/Long OR UTM – What are the GPS coordinates of the site you are monitoring? If UTM (preferred), what datum and year is your coordinate system?

Annual grass – note stems which are typically solitary or in a few stemmed tufts.

Vegetation Cover (all in %, rows add up to 100%) – All percentages are to be estimated to the nearest 5%. If there is a trace of any of the vegetation you monitoring in the frame, round up to 5%.

- Frame – Which frame number are you working on (1= 2m, 2= 4m, …,10 = 20m)?
- Target weed % – What is % cover of the target weed to the nearest 5%?
- Other weeds % – What is the % cover of any other weeds in the frame to the nearest 5%? <u>Count undesirable annual grasses as weeds</u>.
- Forb/Shrub % – What is the % cover of native forbs/shrubs in the frame to the nearest 5%?
- Grass % – What is the % cover of perennial grass to the nearest 5%?
- Bare Ground/Litter % – What is the % cover of bare ground/litter to the nearest 5%?

Perennial grass – note the multiple stem base with multiple year's growth.

Target Weed Size/Density

- Frame – Which frame number are you working on (1=2m, 2=4m,…,10=20m)?
- Number of stems – How many stems of the target weed are in the frame?
- Height of tallest stems (cm) – How tall is the tallest stem of the target weed in the frame (in cm)?

Biological Control Agent

- Count location – Identify 6 sites at least 5 paces away from the vegetation transect but within the same weed infestation.
- # of insects per 10 sweeps – How many insects are in your net after 10 sweeps of the surrounding vegetation? Take one step between each sweep. Repeat 5 more times (for a total of 6 sweep sites, 60 sweeps) moving at least 2 steps away from the last sweep location **<u>(for AP, CYAC, GA, LA, & OBER)</u>**.
- # of biological control insects or galls per 3 min. count – How many biological control agents or galls do you see in a 3 minute period? Carefully approach the plants and be sure to count insects one time only. Please repeat 5 times (for a total of 6) moving at least 4 paces away from the first count location **<u>(for, MEJA, ACMA galls & URCA galls)</u>**.

Monitoring biological control agents is an essential component of a successful biological control program. Monitoring data can be used to accurately document the impact of this weed management practice. This monitoring form has been endorsed by the Nez Perce Biocontrol Center, University of Idaho, Forest Health Protection, Bureau of Land Management, and Idaho State Department of Agriculture. The monitoring information from this form will be used to document vegetation cover, target weed density, and biological control agent abundance. When conducted annually, this monitoring data will document changes that occur over time.

Standardized Impact Monitoring Protocol (SIMP) Biological Control Monitoring Form

General Information:

Observer(s):		Date:	Landowner:
Permanent site? Y N	Site name:		Weed:
Biological control agent:		Insect Stage:	
Lat/Long: N ° '	W ° '	UTM Datum:	UTM E:
		UTM Year :	UTM N:

Weed Infestation:

Size in acres:	Picture taken?	Yes No	If Y, picture direction:

Vegetation cover (all in %, rows add to 100%):

Frame	Target weed%	Other weed%	Forb/shrub%	Perennial Grass%	Bare ground%	Litter%	Moss%	Total%
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Target weed size/density:

Frame	Number of Stems	Height of tallest stem (cm)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Biological control agent:

10 sweeps repeated 6 times (for AP, GA, LA, CYAC & OBER) **OR** a 3 minute timed count repeated 6 times (for MEJA, ACMA galls & URCA galls)

Count site	Insect (or gall) count
1	
2	
3	
4	
5	
6	

Notes:

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Appendix G – Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement – Record of Decision (Sept 2007)

http://www.blm.gov/wo/st/en/prog/more/veg_eis.html

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Appendix H –
List of Approved Herbicides and Adjuvants for Use on Public Lands

The most recent list can be found by searching the BLM's website: http://www.blm.gov/

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United States
Department of
Agriculture

Marketing and
Regulatory
Programs

Animal and
Plant Health
Inspection
Service

APHIS

Field Release of *Jaapiella ivannikovi* (Diptera: Cecidomyiidae), an Insect for Biological Control of Russian Knapweed (*Acroptilon repens*), in the Continental United States

Environmental Assessment, December 2008

Field Release of *Jaapiella ivannikovi* (Diptera: Cecidomyiidae), an Insect for Biological Control of Russian Knapweed (*Acroptilon repens*), in the Continental United States

Environmental Assessment, December 2008

Agency Contact:
Robert S. Johnson, Branch Chief
Permits, Registrations, Imports and Manuals
Plant Protection and Quarantine
Animal and Plant Health Inspection Service
U.S. Department of Agriculture
4700 River Road, Unit 133
Riverdale, MD 20737–1236

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This publication reports research involving pesticides. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

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CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife–if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

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I. Purpose and Need for the Proposed Action

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) is proposing to issue permits for release of a gall midge, *Jaapiella ivannikova* Fedotova (Diptera: Cecidomyiidae). The agent would be used by the applicant for the biological control of Russian knapweed, *Acroptilon repens* (L.) DC (=*Centaurea repens* L.), in the continental United States. Before permits are issued for release of *J. ivannikova*, APHIS must analyze the potential impacts of the release of this agent into the continental United States.

This environmental assessment[1] (EA) has been prepared, consistent with USDA, APHIS' National Environmental Policy Act (NEPA) implementing procedures (Title 7 of the Code of Federal Regulations (CFR), part 372). It examines the potential effects on the quality of the human environment that may be associated with the release of *J. ivannikova* to control infestations of Russian knapweed within the continental United States. This EA considers the potential effects of the proposed action and a no action alternative.

The applicant's purpose for releasing *J. ivannikova* is to reduce the severity of infestations of Russian knapweed in the United States. Russian knapweed, *Acroptilon repens*, is native to Eurasia and is common in Armenia, Turkestan, Mongolia, Asia Minor, and Iran (Watson, 1980). The weed was first introduced into North America in 1898 and by 1998 had spread to 313 counties in 45 of the 48 contiguous states in the United States (Zimmerman and Kazmer, 1999). It did not become a serious weed in Canada until 1928, and its spread is linked to the distribution of knapweed-infested hay (Maddox et al., 1985). The introduction of Russian knapweed into the United States is thought to be the result of impure Turkestan alfalfa seed, and possibly sugarbeet seed (Maddox et al., 1985).

Estimated Russian knapweed acreage for the western United States and Canada in the year 2000 totaled over 1,561 million acres with 80 percent of the acreage located in the states of Washington, Idaho, Colorado, and Wyoming (Zouhar, 2001).

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[1] Regulations implementing the National Environmental Policy Act of 1969 (42 United States Code 4321 *et seq.*) provide that an environmental assessment "[shall include brief discussions of the need for the proposal, of alternatives as required by section 102(2)(E), of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted." 40 CFR § 1508.9.

Russian knapweed is a long lived perennial in the plant family Asteraceae or sunflower family. The weed thrives in a variety of habitats and is found in both irrigated and arid environments, and in cropland, pastures, rangeland, and wasteland. Russian knapweed is a strong competitor and produces allelopathic[2] compounds that exclude other plant species, and as a result, dense (100–300 plants/square meter) infestations may develop (Ivanova, 1966). This species reproduces primarily vegetatively from a primary vertical root having numerous horizontal lateral roots with deep, vertical extensions. Reproduction by seed is apparently not extensive, although a single plant may produce over 1,200 seeds that may remain viable for up to 5 years (Anderson, 1968). Seeds may aid in the long range spread of the weed through infested hay and other means.

Russian knapweed has many negative qualities. It is generally not utilized for forage because of its bitter taste, and may cause neurological disorders in horses if consumed (Young et al., 1970). It reduces wildlife habitat, suppresses other plants, and has no known beneficial qualities.

Existing Russian knapweed management options are ineffective, expensive, temporary, and have nontarget impacts. For these reasons, there is a need to identify an effective, host-specific biological control organism and release it into the environment for the control of Russian knapweed.

II. Alternatives

This section will explain the two alternatives available to APHIS; no action and to issue permits for environmental release of *J. ivannikova*. Although APHIS's alternatives are limited to a decision on whether to issue permits for release of *J. ivannikova*, other methods available for control of Russian knapweed are also described. These control methods are not decisions to be made by APHIS and are likely to continue whether or not permits are issued for environmental release of *J. ivannikova*. These are methods presently being used to control Russian knapweed by public and private concerns.

A third alternative was considered, but will not be analyzed further. Under this third alternative, APHIS would have issued permits for the field release of *J. ivannikova* but the permits would contain special provisions or requirements concerning release procedures or mitigating measures. No issues have been raised that would indicate that special provisions or requirements are necessary.

[2] Allelopathy is the inhibition of growth of one plant species by another due to the release of chemical substances.

A. No action

Under the no action alternative, APHIS would not issue permits for the field release of *J. ivannikova* for the control of Russian knapweed. The release of this biological control agent would not take place. The following methods are presently being used to control Russian knapweed and these methods will continue under the "No Action" alternative and will likely continue even if permits are issued for release of *J. ivannikova*.

1. Chemical control

Russian knapweed may be controlled using the herbicides 2,4-D (although Russian knapweed has some tolerance of 2,4-D), picloram, dicamba, clopyralid, clopyralid plus 2,4-D, and most recently, aminopyralid.

2. Cultural control

Cultural controls include mowing and deep plowing. Systematic cutting of the roots to a depth of 30 centimeters (cm) over a three year period may destroy the root system in the top meter of soil (Mordovets et al., 1972) and root fragments up to 40 cm long may be killed by burial below 30 cm (Agadzhanyan and Agadzhanyan, 1967).

3. Biological control

Two biological control agents have been released on Russian knapweed in North America. One is the nematode *Mesoanguina picridis*, which was introduced from central Asia. The nematodes attack the shoots as they grow up through the soil and cause galls[3] to form on the stems and leaves. The galls look like tiny tennis balls, causing stunting and some mortality of Russian knapweed plants. A second agent, a stem-galling wasp, *Aulacidea acroptilonica*, was approved for release in 2008.

Research and surveys by Ivanova (1966), Tyurebaev (1972), Kovalev et al. (1975), Ivannikov et al. (1976), Ivannikov and Tyurebaev (1977), Rosenthal et al. (1994), Krivokhatsky and Ovtshinnikova (1995), Sobhian (1994, 1996a,b,c), Fornasari (1996), and Schaffner et al. (2000) have identified at least 13 organisms attacking the plant, although several of these are not being considered for release in the United States. The insects closely associated with Russian knapweed are as follows: a flower gall mite (*Aceria acroptiloni*), a vagrant mite (*Aceria sobhiani*), three flower/bud-gall flies (*Jaapiella ivannikovi, Urophora xanthippe, and U. kasachstanica*), a leaf-gall weevil and midge (*Pseudorchestes*

[3] A gall is an abnormal growth of plant tissues caused by the stimulus of an animal or another plant.

(*Rhynchaenus*) *distans* and *Loewiola acroptilonica*), a stem galling cynipid wasp released in the United States in 2008 (*Aulacidea acroptilonica*), stem boring beetle and a moth (*Agapanthia leucaspis* and *Depressaria squamosa*), a defoliating beetle (*Galeruca interrupta armenica*), and a leaf and stem rust (*Puccinia picridis*). Root feeders associated with Russian knapweed are not well known. Three species have been reported to infest roots, but only *Cochylimorpha nomadana* has potential as a biological control agent.

B. Issue permits for environmental release of *J. ivannikova*

Under this alternative, APHIS would issue permits for the field release of *J. ivannikovi* for the control of Russian knapweed. These permits would contain no special provisions or requirements concerning release procedures or mitigating measures.

1. Biological control agent information

a. Description

Male *J. ivannikovi* are 1.6 millimeters (mm)–1.8 mm long with large eyes. Wings are relatively large and the legs are long. Female *J. ivannikovi* are 2.2–2.5 mm long and similar to the male. The ovipositor (egg-laying organ) is long and capable of being extended from the tip of the abdomen.

J. ivannikovi has three larval instars (immature stages). The larvae are milky whitish/rosy with a curved, legless body and a small whitish head capsule. Pupae (non-feeding, immature insect stage) are approximately 2 mm long and pale.

b. Life history

Females mate soon after adult emergence. Eggs are deposited on the surface of the buds situated on the tips of the main and side shoots of Russian knapweed. Larval feeding causes stunted growth of the shoot and a growing together and fusion of leaves, resulting in a so-called 'rosette gall' (Ananthakrishnan, 1984).

Larvae develop in silky webs between the growing leaves of the rosette gall. Dissection of field-collected galls revealed up to 14 larvae feeding inside galls induced by *J. ivannikovi.*

In Uzbekistan, fully developed larvae of the first generation were first found in late April. Pupation occurs inside the rosette gall. Four to five partially overlapping generations, each about one month long, have been

observed. The gall midge hibernates in the pupal stage inside galls.

c. Native range

J. ivannikovi has been recorded from southern Russia, Kazakhstan, Uzbekistan, Iran, Pakistan, and China. It can be found on Russian knapweed growing in a wide range of habitats: along roadsides, and in fields, orchards, vineyards, wastelands, and undisturbed semi-deserts. Surveys in Uzbekistan indicate that *J. ivannikovi* can build up large populations in habitats that experience disturbance by animal grazing or soil cultivation, or that are irrigated. Disturbance and irrigation during the summer months causes Russian knapweed to produce new shoots throughout the season; young shoots are the preferred stage for egg-laying by *J. ivannikovi.*

d. Impact on Russian knapweed

In field tests conducted by Collier et al. (2007) from 2003 to 2005, attack of Russian knapweed shoots by *J. ivannikovi* caused a significant reduction in Russian knapweed shoot length (10–20 percent) and shoot biomass (20–25 percent). In 2004 and 2005, *J. ivannikovi* galls also significantly reduced seed number. Plants infested by *J. ivannikovi* did not produce any viable seeds in 2004 and 2005. The goal of the release of *J. ivannikovi* is to slow the rate of spread of Russian knapweed by reducing seed production and to reduce Russian knapweed biomass in existing infestations. It is not expected that *J. ivannikovi* alone will control Russian knapweed but will work along with other control methods to reduce Russian knapweed infestations.

III. Affected Environment

Russian knapweed is a long-lived perennial. This species reproduces primarily vegetatively from a primary vertical root having numerous horizontal lateral roots with vertical extensions. The extensive root system that gives rise to new shoots allows for rapid colonization and survival value. Root depth may reach 5–7 meters, although this is uncommon. Shoots emerge early in the spring shortly after soil temperatures remain above freezing. After emergence, the plants form rosettes and bolt[4] in late May to mid-June. Flowering occurs from early July and will continue through the first hard freeze of the fall, given adequate moisture (Watson, 1980; Littlefield, unpub. data).

[4] The rapid growth of a stem prior to flowering.

Russian knapweed does not appear to reproduce extensively by seed within a clone, but a single plant may produce over 1,200 seeds. Seeds may be viable for up to 5 years (Anderson, 1968). In addition, seeds may be spread through the feces of cattle that have ingested mature flower heads. Seeds of Russian knapweed germinate over a wide temperature range of 0.5°–35° C, with optimum germination occurring from 20° to 30° C (Brown and Porter, 1942; Ivanova, 1966; Muminov, 1967). Lateral spread of Russian knapweed clones is somewhat limited, approximately 35 cm per year for clones observed in Montana (Littlefield, unpubl. data) and up to 1 meter in Wyoming.

A. Areas affected by Russian knapweed

1. Native range

Russian knapweed is native to central Asia. The weed extends more or less in a band between 40° and 45° longitude from central Turkey and Crimea into western Mongolia and Siberia in the east, and is common in Armenia, Turkmenistan, Uzbekistan, Kazakhstan, and parts of Turkey and Iran. Russian knapweed has spread within and to adjacent areas via trade routes.

2. Present distribution in North America

Based on a 1998 survey (Zimmerman and Kazmer, 1999), Russian knapweed currently infests 313 counties in 45 of the 48 contiguous states in the United States. The most severe infestations of Russian knapweed occur in the more arid areas of the western United States. Estimated Russian knapweed acreage for the western United States and Canada in the year 2000 totaled over 1,561 million acres, with 80 percent of the acreage located in the states of Washington, Idaho, Colorado, and Wyoming (Zouhar, 2001). The northern distribution of Russian knapweed appears to be southern Canada, approximately 54° N latitude.

3. Potential distribution

Based on a 1982 and a 1998 survey, there was a 28.3 percent increase in number of infested counties in just 16 years (Maddox et al., 1985; Zimmerman and Kazmer, 1999). The potential distribution in North America is not known, but it appears that the more arid regions of the West are more susceptible to infestations.

The mode of spread has not been investigated, although long range spread of the weed is thought to occur by the transport of seeds in infested hay or crop seeds (Rogers, 1928; Renney, 1959). In addition, the ingestion of flower heads by cattle and the ability of the seeds to survive through the

digestive system may also serve to disperse this weed with the movement of cattle.

4. Habitat

Russian knapweed thrives in a variety of habitats and is found in both irrigated and arid environments, and in cropland, pastures, rangeland, shrublands, and wasteland (Rogers, 1928; Zouhar, 2001). Habitat associations for the western United States may be found in Zouhar (2001). Russian knapweed is found in a variety of soil types and is not associated with a particular soil. Russian knapweed is an adaptable plant and is capable of establishing itself in sandy deserts, compacted soils, and roadsides. Resistant to drought, salt, and compacted soils (Ivannikov et al., 1976), Russian knapweed can become established in areas of disturbed land or where the upper layer of soil is removed.

B. Plants related to Russian knapweed and their distribution

1. Taxonomically related plants

The tribe Cardueae (Russian knapweed belongs to this tribe) is comprised of approximately 83 genera and 2,500 species (Bremer, 1994). This tribe is the more primitive of Asteraceae (sunflower, aster, or daisy family) tribes. Species are primarily Palearctic (European, the northwest coast of Africa, and Asia north of the Himalaya Mountains) and north African, although a few species are found in North and South America, Australia, and tropical Africa. The tribe Cardueae is comprised of two large subtribes - the Centaureinae and Carduinae, and two smaller subtribes – the Carlininae and Echinopsidinae. Although there are native North American species contained within the Cardueae, this tribe is comprised primarily of exotic species of economic importance either as weeds or as ornamentals and commercial crops.

In the subtribe Centaureinae, the genus *Acroptilon* consists of a single species, *A. repens* (Russian knapweed). The closely related genus *Centaurea* is comprised of approximately 32 species in the United States, mostly exotic species that are weedy or some that are used as ornamentals. There are two native knapweed species, *C. americana* and *C. rothrockii,* (some botanists have classified these under a different genus - *Plectocephalus*) of concern. Both species are annuals and are native to the southwest, although the range of *C. americana* extends up through the central United States. Both species are commercially available and may be grown as ornamentals. Safflower, *Carthamus tinctorius,* is also placed in this subtribe and is of concern due to its economic importance. The

other subtribe Carduinae contains native species within the genera *Cirsium* and *Saussurea*. Six federally listed threatened or endangered *Cirsium* species are present in the United States. Artichoke, *Cynara scolymus,* is also placed in this subtribe and is of economic concern. Milk thistle, *Silybum marianum,* although considered a noxious weed in many areas is also used as an economic plant species in some locations. The subtribes Carlininae and Echinopsidinae have few representative species in North America, of which all are introduced weeds or ornamentals (i.e., globe thistle).

Besides *Cirsium,* a number of genera within the family Asteraceae have federally threatened and endangered species in the continental United States. These genera are: *Ambrosia, Baccharis, Blennosperma, Boltonia, Chrysopsis, Deinandra, Echinacea, Enceliopsis, Erigeron, Eriophyllum, Grindelia, Helenium, Helianthus, Holocarpha, Hymenoxys, Lasthenia, Layia, Lessingia, Liatris, Malacothrix, Marshallia, Monolopia, Pentachaeta, Pityopsis, Pseudobahia, Senecio, Solidago, Stephanomeria, Taraxacum, Thymophylla, Townsendia, Verbesina,* and *Yermo*. These genera are more distantly related to *Acroptilon* and therefore would be at lower risk of being utilized by Russian knapweed biological control agents.

IV. Environmental Consequences

A. No action

1. Impact of spread of Russian knapweed

a. Beneficial uses:

Russian knapweed has no known beneficial qualities. At one time, it was recommended for soil erosion control in Nevada and that allowed the weed to become more widespread (University of Nevada Cooperative Extension, 2004).

b. Social and recreational use:

Russian knapweed does not have any known social or recreational use. The monocultural stands of this weed are considered aesthetically unpleasant in comparison to healthy ecosystems. Russian knapweed can form relatively dense stands along river beds which can inhibit recreational activities.

c. Economic losses:

Economic losses due to Russian knapweed infestations have not been studied in detail. Hirsch and Leitch (1996) addressed direct and secondary economic impacts associated with several knapweed species in Montana. Although this study was limited by various assumptions, it does indicate that potential and severe economic impacts could result should these weeds continue to spread.

Russian knapweed imparts a bitter taste to bread when its seeds are threshed together with wheat (Ivannikov et al., 1976). The quality of flour or other grain products that have been contaminated by Russian knapweed seed at a rate of only 0.01 percent by weight is reduced due to the bitter taste. At a density of 25–50 Russian knapweed plants per square meter, wheat yields were decreased by 50-90 percent (Streibig et al., 1989). Shoot densities of 19, 32, and 65 per square meter have reduced the fresh weight yield of corn by 64, 73, and 88 percent, respectively (Berezovskii and Raskin, 1971). Russian knapweed is aggressive and difficult to control in alfalfa, clover, other forage crops, and pastures. It is generally avoided by grazing animals as it imparts a bitter quinine-like taste. The presence of Russian knapweed in hay decreases the feeding value and market value.

d. Health issues:

Russian knapweed has been known to cause the neurological disorder nigropallidal encephalomalacia in horses (Young et al., 1970). No known human ailments have been associated with Russian knapweed, although the plant produces repin and acroptilin, allergenic sesquiterpene lactones which may cause dermal allergies with prolonged or repeated contact.

e. Effects on wildlife populations:

Kurz et al. (1996) reported on the ecological implications of Russian knapweed infestations on small mammals and habitat associations. Field sites in Wyoming and Colorado were chosen for the study of diversity comparisons at infested and non-infested sites. Vegetation measurements indicated distinct differences in composition and structure between knapweed infested and non-infested plots. Diversity comparisons showed a large shift in species composition in Russian knapweed infested areas for both small mammal and plant communities, indicating a displacement of native species.

Certain species of wildlife may, in certain cases, utilize Russian knapweed infested habitats more. A recent study in Colorado and Wyoming indicates that three times as many small mammals frequented Russian

knapweed infested rangeland compared to adjacent non-infested sites. Adaptation to Russian knapweed infested sites sometimes occurs, as evidenced by one small mammal - a harvester mouse, which utilizes seeds, and may serve to spread the weed as they cache seeds. In contrast, Russian knapweed infested areas had severely reduced populations of kangaroo rats and ground squirrels in Wyoming (Johnson et al., 1994).

Hirsch and Leitch (1996) estimate that knapweed monoculture could reduce wildlife habitat values as much as 80 percent. Russian knapweed infestations have also been reported to impact big horn sheep forage in British Columbia (Zouhar, 2001).

2. Impact from use of other control methods

The continued use of chemical herbicides, mechanical controls, and previously released biological control agents at current levels would be a result if the "no action" alternative is chosen.

a. Chemical control

Although herbicide treatments are temporarily effective, they are short term solutions that must be repeated (Jones and Evans, 1973; Gruzdev and Popov, 1974; Krumzdorov, 1976; Alley and Humberg, 1979, Benz et al., 1996). In addition, a one-time application of herbicide is usually insufficient in managing Russian knapweed.

Large scale chemical control is potentially ecologically harmful and often not economical on western rangeland, which is of relatively low productive value (DiTomaso, 2000). In Fremont County, Wyoming alone, very conservative estimates to apply one herbicide treatment on Russian knapweed (approximately $15/acre), would exceed $950,000 (Baker et al., 1999). This estimate is considered conservative because it does not factor in the additional cost of treating remote infestations. The majority of infested acres in Fremont County are considered remote grazing land (Baker et al., 1999).

b. Mechanical control

The control of this perennial weed by deep plowing or by mowing may have a limited affect on its extensive root system while disturbing or destroying nontarget plants. Mowing appears to stimulate regrowth in the aerial portion of the plant and may induce dormancy in the roots (Tarshish, 1967). Russian knapweed clones are able to compensate for artificial destruction of individual members of the clone by regrowth from root buds (Schaffner et al., 2001). Cultural control of Russian knapweed is typically not economical on low-productive value rangeland.

c. Biological control

The first biological control agent released on Russian knapweed in North America has been the nematode species *Mesoanguina picridis,* which was introduced from central Asia and released in the United States in 1984. Laboratory experiments suggested extensive damage on the seed development and plant growth from this agent. Due to the low mobility of the nematode and varying moisture conditions, the results of field releases were less than expected. *Mesoanguina picridis* would need to be propagated and redistributed on a large scale, which would not be cost effective. In addition, a second agent, a stem-galling wasp, *Aulacidea acroptilonica*, was approved for release in 2008, although it is not expected to control Russian knapweed alone. For these reasons other organisms are being considered for biological control.

These environmental consequences may occur even with the implementation of the biological control alternative, depending on the efficacy of *J. ivannikova* to reduce Russian knapweed in the continental United States. It is not expected that *J. ivannikova* alone will completely control Russian knapweed. The release of *J. ivannikovi* is expected to slow the rate of spread of Russian knapweed by reducing seed production and to reduce Russian knapweed biomass in existing infestations.

B. Issue permits for environmental release of *J. ivannikova*

1. Impact of *J. ivannikovi* on nontarget plants

Host specificity to Russian knapweed has been demonstrated through scientific literature, field observations, and host specificity testing.

a. Scientific literature

In the literature, *J. ivannikovi* is reported only from Russian knapweed (Fedotova, 1985).

b. Field observations

During field surveys in Turkey, several hundred *Centaurea cyanus* plants were inspected for galls in habitats where *J. ivannikovi* occurs naturally. None of these plants were attacked by the gall midge (Collier et al., 2007).

c. Host specificity testing

<u>Site of quarantine and field studies</u>
All laboratory tests were conducted at the CABI Bioscience Centre in

Delémont, Switzerland (Collier et al., 2007). The open-field experiments were carried out in Uzbekistan in collaboration with local scientists.

Test plant list

The list of plants tested consisted of the target plant collected in the native range (Uzbekistan), a population of the target collected in North America (Wyoming), and 50 non-target test plant species or varieties. The test plant list was constructed with the aim of including at least one representative of the major tribes of the family Asteraceae, and the genera within the same tribe as Russian knapweed. The test plant list also included the two native North American species in the genus *Centaurea* (*C. americana* and *C. rothrockii*) and Eurasian species from the genus *Centaurea* that are grown as ornamentals in North America (*C. cyanus*, *C. montana*). Members of the genus *Centaurea* are considered to be the closest North American relatives of *Acroptilon*.

In developing the test list, emphasis was also placed on including as many native North American representatives of the various taxa as possible. Of the three subfamilies of the Asteraceae, the Cichorioideae and the Asteroideae contain species native to North America but the Barnedesioideae do not (Bremer, 1994). Because Russian knapweed resides within the Cichorioideae, this subfamily was more extensively tested than the Asteroideae. In addition, a greater number of genera and species within the tribe Cardueae and subtribe Carduinae were tested than those in other tribes and subtribes (except the Centaurinae). This is because plants in the subfamily Cichorideae, tribe Cardueae and subtribe Carduinae are more closely related to the genus *Acroptilon*, and would be more likely to be potential host plants for *J. ivannikovi*. The Cardueae and Carduinae also contain a number of plants that are either native to North America, federally-listed threatened or endangered species, or important crop plants (e.g. artichoke and safflower).

During the host specificity testing, seed material of some rare and endangered test plant species could not be obtained or proved to have very low germination rates (e.g. *Cirsium pitcheri*, *Cirsium turneri*, *Cirsium wrightii*, *Taraxacum californicum*). Therefore, these species were replaced with other North American *Cirsium* and *Taraxacum* species that were more easily grown.

Laboratory tests

Laboratory host specificity tests followed a no-choice design. Potted non-target test plants and Russian knapweed plants were covered with plastic cylinders and topped with a gauze lid. A moistened filter paper was placed around the base of the plant on the soil surface. Several male and females *J. ivannikovi* gall midges were placed into each of the plastic cylinders. Cylinders remained in place until all female midges had died (maximum of 7 days exposure). After exposure, the test and control plants

were inspected for gall formation.

Table 1 shows the results from the no-choice laboratory tests. In these tests, galls occurred only on the target weed Russian knapweed (*Acroptilon repens*) and on the Eurasian knapweed (*Centaurea cyanus*). No galls were produced on any other test plant species.

Table 1. Results of the no-choice oviposition and gall formation test with *Jaapiella ivannikovi* from eastern Uzbekistan (data from 2002-06) (Collier et al., 2007).

Plant Species	Reps	No. of Galls
SUBFAMILY CICHORIOIDEAE		
Tribe Cardueae		
Subtribe Centaureinae		
Acroptilon repens	**41**	**70**
Centaurea americana	22	0
C. cyanus	**11**	**15**
C. montana	24	0
C. rothrockii	22	0
Carduncellus mitissimus	14	0
Carthamus tinctorius		
Cal-West 4440	11	0
Cal-West 1221	13	0
Cal-West 88-OL	11	0
Montola 2001	6	0
Montola 2000	16	0
Serratula tinctoria	14	0
Subtribe Carduinae		
Cirsium arvense	20	0
C. discolor	10	0
C. tuberosum	3	0
C. undulatum	3	0
C. vulgare	4	0
Cynara scolymus		
Cardon	8	0
Viletto	6	0
Silybum marianum	9	0

Table 1, cont.

Plant Species	Reps	No. of Galls
Subtribe Echinopsinae		
Echinops ritro	17	0
Tribe Lactuceae		
Subtribe Crepidinae		
Taraxacum officinale	10	0
Subtribe Lactucinae		
Lactuca sativa	24	0
Cichorium intybus	10	0
Tribe Vernonieae		
Subtribe Stephanomeriinae		
Stephanomeria virgata	9	0
Subtribe Vernoninae		
Vernonia fasciculata	15	0
V. missourica	17	0
SUBFAMILY ASTEROIDEAE		
Tribe Astereae		
Aster laevis	18	0
A. umbellata	10	0
Solidago nemoralis	16	0
Erigeron compositus	5	0
E. pinnatisectus	3	0
Tribe Anthemidae		
Artemisia ludoviciana	13	0
Tribe Calenduleae		
Calendula officinalis	15	0
Tribe Eupatorieae		
Eupatorium maculatum	15	0
E. perfoliatum	18	0
Tribe Gnaphalieae		
Gnaphalium obtusifolium	16	0

Field tests - multiple-choice oviposition and gall formation

In addition to the laboratory no-choice tests, multiple-choice oviposition and gall formation tests were conducted under open-field conditions in Uzbekistan. Test plant species were either grown from seed or collected in the local area and transplanted to the experimental sites. Test plant species were arranged with Russian knapweed in a randomized design in an experimental garden at the Institute of Zoology, Tashkent, Uzbekistan. *J.*

ivannikovi galls were collected locally. Field experiments were carried out each year from 2002–2004.

Results of the open-field experiments are reported in Table 2. Gall formation was recorded in large numbers on Russian knapweed (*Acroptilon repens*) but from no other test plant species. In contrast to the no-choice laboratory experiment, no gall formation was observed on *Centaurea cyanus*.

Table 2. Results of the open-field oviposition and gall formation tests carried out in Uzbekistan (2002-2004). - = missing data (not determined). (Collier et al., 2007).

Plant species	No. of plants	No. of shoots	% shoots attacked	Total No of galls
2002				
Acroptilon repens	10	124	80.6	501
Centaurea americana	10	16	0	0
C. rothrockii	10	3	0	0
Onopordum illyricum	10	11	0	0
Carthamus tinctorius	10	10	0	0
Cirsium arvense	10	28	0	0
C. discolor	6	33	0	0
C. oleraceum	10	12	0	0
C. palustre	10	3	0	0
Taraxacum officinale	10	4	0	0
2003				
Acroptilon repens	10	-	-	105
Centaurea americana	10	10	0	0
C. rothrockii	8	8	0	0
C. cyanus	8	≈ 10	0	0
C. montana	10	10	0	0
Onopordum illyricum	10	10	0	0
Cirsium arvense	10	≈ 30	0	0
C. oleraceum	10	-	0	0
C. palustre	10	-	0	0
2004				
Acroptilon repens	15	-	-	80
Centaurea americana	10	10	0	0

Table 2, cont.

Plant species	No. of plants	No. of shoots	% shoots attacked	Total No of galls
2004 (cont.)				
C. rothrockii	10	10	0	0
C. cyanus	10	≈ 20	0	0
C. montana	10	8	0	0

Discussion

The results from the laboratory and open-field tests indicate that *J. ivannikovi* has a very narrow host range. Under no-choice conditions, none of the non-target test plant species except *Centaurea cyanus* showed signs of gall formation. In North America, *C. cyanus* is not native and is grown as an ornamental, but is considered an invasive weed by the Southeast Exotic Pest Plant Council, the Southern Weed Science Society, and the Western Society for Weed Science. In the open-field choice tests, no gall formation was observed on *C. cyanus* nor on any of the other test plant species.

2. Uncertainties regarding the environmental release of *J. ivannikovi*

Once a biological control agent such as *J. ivannikovi* is released into the environment and becomes established, there is a slight possibility that it could move from the target plant (Russian knapweed) to attack nontarget plants, such as the native plant *Centaurea americana.* Host shifts by introduced weed biological control agents to unrelated plants are rare (Pemberton, 2000). Native species that are closely related to the target species are the most likely to be attacked (Louda et al., 2003). If other plant species were to be attacked by *J. ivannikovi*, the resulting effects could be environmental impacts that may not be easily reversed. Biological control agents such as *J. ivannikovi* generally spread without intervention by man. In principle, therefore, release of this biological control agent at even one site must be considered equivalent to release over the entire area in which potential hosts occur and in which the climate is suitable for reproduction and survival.

In addition, these agents may not be successful in reducing Russian knapweed populations in the continental United States. Worldwide, biological weed control programs have had an overall success rate of 33 percent; success rates have been considerably higher for programs in individual countries (Culliney, 2005). Actual impacts on Russian knapweed by *J. ivannikovi* will not be known until after release occurs and

post-release monitoring has been conducted. It is not expected that *J. ivannikovi* alone will control populations of Russian knapweed, but will act in combination with other control methods or biological control agents.

3. Cumulative impacts

"Cumulative impacts are defined as the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agencies or person undertakes such other actions" (40 CFR 1508.7).

Many states and counties, particularly in the western United States, conduct weed control programs to manage Russian knapweed as well as other invasive weeds. Chemical, mechanical, and biological controls, as described previously in this document are used in a wide range of habitats.

Release of *J. ivannikovi* is not expected to have any negative cumulative impacts in the continental United States because of its host specificity to Russian knapweed. Effective biological control of Russian knapweed will have beneficial effects for weed management programs, and may result in a long-term, non-damaging method to assist in the control of Russian knapweed, and prevent its spread into other areas potentially at risk from invasion.

4. Endangered Species Act

Section 7 of the Endangered Species Act (ESA) and ESA's implementing regulations require Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened endangered species or result in the destruction or adverse modification of critical habitat.

Sixty-six species of Asteraceae are federally-listed as threatened or endangered in the continental United States. These represent species found within both subfamilies of Asteraceae and the majority of the Asteraceae tribes, including Cardueae.

APHIS has determined that based on the host specificity of *J. ivannikovi,* there will be no effect on any listed plant or designated critical habitat in the continental United States based on literature, field observations, and host specificity testing. In host specificity testing, the biological control agents caused gall formation only in Russian knapweed. The only exception was some galls formed on the closely related *Centaurea cyanus* in no-choice tests but not in choice tests. No listed species occur in the genus *Centaurea.*

V. Other Issues

Consistent with Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations," APHIS considered the potential for disproportionately high and adverse human health or environmental effects on any minority populations and low-income populations. There are no adverse environmental or human health effects from the field release of *J. ivannikovi* and will not have disproportionate adverse effects to any minority or low-income populations.

Consistent with EO 13045, "Protection of Children From Environmental Health Risks and Safety Risks," APHIS considered the potential for disproportionately high and adverse environmental health and safety risks to children. No circumstances that would trigger the need for special environmental reviews is involved in implementing the preferred alternative. Therefore, it is expected that no disproportionate effects on children are anticipated as a consequence of the field release of *J. ivannikovi*.

EO 13175, "Consultation and Coordination with Indian Tribal Governments," was issued to ensure that there would be "meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications...." In November 2008, APHIS sent out letters to potentially affected tribal leaders and organizations to give notification of the proposed environmental release of *J. ivannikovi* and to request input from tribes. APHIS will continue to consult and collaborate with Indian tribal officials to ensure that they are well-informed and represented in policy and program decisions that may impact their agricultural interests, in accordance with EO 13175.

VI. Agencies, Organizations, and Individuals Consulted

The Technical Advisory Group for the Biological Control Agents of Weeds (TAG) recommended the release of *J. ivannikovi* on September 19, 2008. TAG members that reviewed the release petition (Collier et al. 2007) included representatives from the U.S. Fish and Wildlife Service, Bureau of Indian Affairs, Weed Science Society of America, Cooperative State Research, Education, and Extension Service, U.S. Geological Survey, Environmental Protection Agency, U.S. Army Corps of Engineers, Bureau of Reclamation, and Agriculture and Agri-Food Canada, Health Canada.

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Field Release of *Aulacidea acroptilonica* (Hymenoptera: Cynipidae), an Insect for Biological Control of Russian Knapweed (*Acroptilon repens*), in the Continental United States

Environmental Assessment, January 22, 2008

Field Release of *Aulacidea acroptilonica* (Hymenoptera: Cynipidae), an Insect for Biological Control of Russian Knapweed (*Acroptilon repens*), in the Continental United States

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I. Purpose and Need for the Proposed Action

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), is proposing to issue a permit to a University of Wyoming researcher for release of a gall wasp, *Aulacidea acroptilonica* V. Bel. (Hymenoptera: Cynipidae). The agent would be used by the applicant for the biological control of Russian knapweed, *Acroptilon* (*Centaurea*) *repens* (L.) DC, in the continental United States. Before a permit is issued for release of *A. acroptilonica*, APHIS must analyze the potential impacts of the release of this agent into the continental United States.

This environmental assessment[1] (EA) has been prepared, consistent with USDA, APHIS' National Environmental Policy Act (NEPA) implementing procedures (Title 7 of the Code of Federal Regulations (CFR), part 372). It examines the potential effects on the quality of the human environment that may be associated with the release of *A. acroptilonica* to control infestations of Russian knapweed within the continental United States. This EA considers the potential effects of the proposed action and its alternatives, including no action.

The applicant's purpose for releasing *A. acroptilonica* is to reduce the severity of infestations of Russian knapweed in the United States. Russian knapweed, *Acroptilon repens*, is native to Eurasia and is common in Armenia, Turkestan, Mongolia, Asia Minor, and Iran (Watson, 1980). The weed was first introduced into North America in 1898 and by 1998 had spread to 313 counties in 45 of the 48 contiguous states in the United States (Zimmerman and Kazmer, 1999). It did not become a serious weed in Canada until 1928, and its spread is linked to the distribution of knapweed-infested hay (Maddox et al., 1985). The introduction of Russian knapweed into the United States is thought to be the result of impure Turkestan alfalfa seed, and possibly sugarbeet seed (Maddox et al., 1985).

Estimated Russian knapweed acreage for the western United States and Canada in the year 2000 totaled over 1,561 million acres with 80% of the acreage located in the states of Washington, Idaho, Colorado, and Wyoming (Zouhar, 2001).

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[1] Regulations implementing the National Environmental Policy Act of 1969 (42 United States Code 4321 *et seq.*) provide that an environmental assessment "[shall include brief discussions of the need for the proposal, of alternatives as required by section 102(2)(E), of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted." 40 CFR § 1508.9.

Russian knapweed is a long lived perennial in the plant family Asteraceae or sunflower family. The weed thrives in a variety of habitats and is found in both irrigated and arid environments, and in cropland, pastures, rangeland, and wasteland. Russian knapweed is a strong competitor and produces allelopathic[2] compounds that exclude other plant species, and as a result, dense (100-300 plants/square meter) infestations may develop (Ivanova, 1966). This species reproduces primarily vegetatively from a primary vertical root having numerous horizontal lateral roots with deep, vertical extensions. Reproduction by seed is apparently not extensive, although a single plant may produce over 1,200 seeds that may remain viable for 2-3 years. Seeds may aid in the long range spread of the weed through infested hay and other means.

Russian knapweed has many negative qualities. It is generally not utilized for forage because of its bitter taste, and may cause neurological disorders in horses if consumed (Young et al., 1970). It reduces wildlife habitat, suppresses other plants, and has no known beneficial qualities.

There is a need to release a host-specific biological control agent to reduce infestations of *A. repens* because current biological controls are not effective, and chemical and mechanical controls are expensive, are temporary solutions, and are damaging to non-target plants.

II. Alternatives

This section will explain the two alternatives available to APHIS; no action and to issue a permit for release of *A. acroptilonica*. Although APHIS' alternatives are limited to a decision on whether to issue a permit for release of *A. acroptilonica*, other methods available for control of Russian knapweed are also described. These control methods are not decisions to be made by APHIS and are likely to continue whether or not a permit is issued for environmental release of *A. acroptilonica*. These are methods presently being used to control Russian knapweed by public and private concerns.

A third alternative was considered, but will not be analyzed further. Under this third alternative, APHIS would have issued a permit for the field release of *A. acroptilonica* but the permit would contain special provisions or requirements concerning release procedures or mitigating measures. No issues have been raised that would indicate that special provisions or requirements are necessary.

[2] Allelopathy is the inhibition of growth of one plant species by another due to the release of chemical substances.

A. No Action

Under the no action alternative, APHIS would not issue a permit for the field release of *A. acroptilonica* for the control of Russian knapweed. The release of this biological control agent would not take place. The following methods are presently being used to control Russian knapweed and these methods will continue under the "No Action" alternative and will likely continue even if a permit is issued for release of *A. acroptilonica*.

1. Chemical control

Russian knapweed may be controlled using the herbicides 2,4-D (although Russian knapweed has some tolerance of 2,4-D), picloram, dicamba, clopyralid, chlorsulfuron, metsulfuron, and clopyralid plus 2,4-D. In farmland, application of simazine at 10 kilograms/hectare in a layer 28-30 centimeters (cm) deep followed by cropping with corn for three successive years resulted in almost complete control of Russian knapweed (Tarshish and Mordovets, 1974).

2. Cultural control

Cultural controls include mowing and deep plowing. Systematic cutting of the roots to a depth of 30 cm over a three year period may destroy the root system in the top meter of soil (Mordovets et al., 1972) and root fragments up to 40 cm long may be killed by burial below 30 cm (Agadzhanyan and Agadzhanyan, 1967). Sowing desirable plant species such as smooth brome, streambank wheatgrass, thickspike wheatgrass, crested wheatgrass, or Russian wildrye is necessary after the weed is controlled with herbicides (Beck, 2007). Planting sod-forming perennial grasses, like streambank or thickspike wheatgrasses, help prevent reinvasion of Russian knapweed (Beck, 2007).

3. Biological control

The only biocontrol agent released on Russian knapweed in North America is the nematode *Mesoanguina picridis*, which was introduced from central Asia. The nematodes attack the shoots as they grow up through the soil and cause galls[3] to form on the stems and leaves. The galls look like tiny tennis balls, causing stunting and some mortality of Russian knapweed plants.

Research and surveys by Ivanova (1966), Tyurebaev (1972), Kovalev et

[3] A gall is an abnormal growth of plant tissues caused by the stimulus of an animal or another plant.

al. (1975), Ivannikov et al. (1976), Ivannikov and Tyurebaev (1977), Rosenthal et al. (1994), Krivokhatsky and Ovtshinnikova (1995), Sobhian (1994, 1996a,b,c), Fornasari (1996), and Schaffner et al. (2000) have identified at least 14 potential biocontrol organisms attacking the plant. The insects closely associated with Russian knapweed are as follows: a flower gall mite (*Aceria acroptiloni*), a vagrant mite (*Aceria sobhiani*), three flower/bud-gall flies (*Dasineura sp, Urophora xanthippe, and U. kasachstanica*), a leaf-gall weevil and midge (*Pseudorchestes* (*Rhynchaenus*) *distans* and *Loewiola acroptilonica*), a stem galling cynipid wasp (*Aulacidea acroptilonica*), stem boring beetles and a moth (*Agapanthia leucaspis, Phytoecia virgula*, and *Depressaria squamosa*), a defoliating beetle (*Galeruca interrupta armenica*), and a leaf and stem rust (*Puccinia picridis*). Root feeders associated with Russian knapweed are not well known. Three species have been reported to infest roots, but only *Cochylimorpha* (*Stenodes*) *nomadana* and *Napomyza* sp. near *lateralis* have potential as biocontrol agents.

B. Issue the Permit for Environmental Release of *A. acroptilonica*

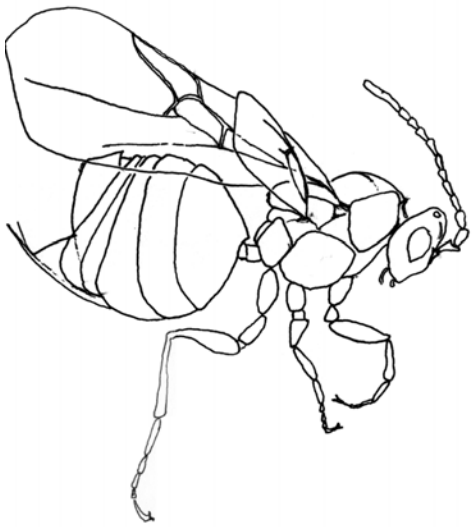
Under this alternative, APHIS would issue a permit for the field release of *A. acroptilonica* for the control of Russian knapweed. This permit would contain no special provisions or requirements concerning release procedures or mitigating measures.

1. Biological control agent information

A. acroptilonica is a small (1.7-2.3 millimeter (mm)) gall-forming wasp belonging in the insect family Cynipidae (Figure 1). Generally gall formers are very host specific. In the literature, *A. acroptilonica* has only been reported on Russian knapweed (Kovalev and D'yakonchuk, 1986). Gall induction diverts nutrients from flower formation, seed production, and/or normal growth of plant tissues. Under certain conditions, galls may stress the plant, reducing the plant's competitive ability and seed production, reducing long-distance spread of the weed.

A. acroptilonica has been recorded from Turkey, Georgia, southern Russia, Iran, Kazakhstan, and Uzbekistan. *A. acroptilonica* can be found in a wide range of habitats, such as along roadsides and crop fields, in orchards, vineyards, and wastelands as well as in undisturbed semi-deserts of Central Asia. Surveys in Turkey and Uzbekistan indicate that *A. acroptilonica* is most common in habitats that experience limited disturbance by animal grazing or soil cultivation. In habitats where old shoots are removed or ploughed under the soil, the gall wasp is absent or occurs in low densities.

Figure 1. Female *Aulacidea acroptilonica*



A. acroptilonica has three larval instars (immature stages). Fully developed third instar larvae are first found in late-July. The third instar larvae aestivate (a state of dormancy, similar to hibernation) over the summer, overwinter, and then pupate inside the galls in early spring. A small number of larvae remain in hibernation after the first winter, pupating after the second winter.

A. acroptilonica has one generation per year. The first adults emerge in early-April in Uzbekistan and during the second half of April in Turkey. In 2003, galls collected in Uzbekistan were kept under ambient outdoor temperature conditions at CABI Biosciences, Switzerland and then brought into the laboratory. Wasps from these galls emerged between mid-April and late-May. The sex ratio of wasps emerging from field-collected galls was strongly female biased with females making up 90-100% of the adults. The mean longevity of females kept at ambient room temperature and fed with sugar water was 4.9 ± 1.7 days. Newly emerged females had a mean of 160 ± 45 fully developed eggs in their abdomens. Mean egg size was 0.21 x 0.09 mm.

Based on observations in the laboratory, mating and oviposition (egg-laying) occur within hours of adult emergence. Nevertheless, unmated females successfully lay eggs, probably male. The female biased sex-ratio suggests that *A. acroptilonica*, like other Hymenoptera, are haplo-diploid, producing male adults from unfertilized eggs and females from fertilized eggs.

Eggs are laid into the meristematic tissue (tissue that is capable of cell division, resulting in growth) of the main and lateral shoots. Alighting on a plant, females walk around antennating the surface of the leaves and shoots. Once the female has reached a potential site for oviposition, she probes the

plant with her ovipositor repeatedly for up to three minutes. Oviposition lasts between 10 and 70 minutes, during which the female sits motionless on the shoot tip with her head downwards and ovipositor inserted into meristematic tissue.

III. Affected Environment

Russian knapweed is a long-lived perennial. This species reproduces primarily vegetatively from a primary vertical root having numerous horizontal lateral roots with vertical extensions. The extensive root system that gives rise to new shoots allows for rapid colonization and survival value. Root depth may reach 5-7 meters, although this is uncommon. Shoots emerge early in the spring shortly after soil temperatures remain above freezing. After emergence, the plants form rosettes and bolt[4] in late May to mid-June. Flowering occurs from early July and will continue through the first hard freeze of the fall, given adequate moisture (Watson, 1980; Littlefield, unpub. data).

Russian knapweed does not appear to reproduce extensively by seed within a clone, but a single plant may produce over 1,200 seeds. Although it has been reported that seeds may remain viable for 2-3 years (Ivanova, 1966), it is speculated that the thick seed coat may allow the seed to remain dormant for a number of years. In addition, seeds may be spread through the feces of cattle that have ingested mature flower heads. Seeds of Russian knapweed germinate over a wide temperature range of 0.5 ^{o}-35 ^{o} C, with optimum germination occurring from 20 ^{o} to 30 ^{o}C (Brown and Porter, 1942; Ivanova, 1966; Muminov, 1967). Lateral spread of Russian knapweed clones is somewhat limited, approximately 35 cm per year for clones observed in Montana (Littlefield, unpubl. data) and up to 1 meter in Wyoming.

A. Areas affected by Russian knapweed

1. Native range

Russian knapweed is native to central Asia. The weed extends more or less in a band between 40 ^{o} and 45° longitude from central Turkey and Crimea into western Mongolia and Siberia in the east, and is common in Armenia, Turkmenistan, Uzbekistan, Kazakhstan, and parts of Turkey and Iran. Russian knapweed has spread within and to adjacent areas via trade routes.

[4] The rapid growth of a stem prior to flowering.

2. Present distribution in North America

Based on a 1998 survey (Zimmerman and Kazmer, 1999), Russian knapweed currently infests 313 counties in 45 of the 48 contiguous states in the United States. The most severe infestations of Russian knapweed occur in the more arid areas of the western United States. Estimated Russian knapweed acreage for the western United States and Canada in the year 2000 totaled over 1,561 million acres, with 80% of the acreage located in the states of Washington, Idaho, Colorado, and Wyoming (Zouhar, 2001). The northern distribution of Russian knapweed appears to be southern Canada, approximately 54° N latitude.

3. Potential distribution

Based on a 1982 and a 1998 survey, there has been a 28.3% increase in number of infested counties in just 16 years (Maddox et al., 1985; Zimmerman and Kazmer, 1999)

In addition, the severity of infestations also appears to be increasing (Zimmerman and Kazmer, 1999). The potential distribution in North America is not known, but it appears that the more arid regions of the West are more susceptible to infestations.

The mode of spread has not been investigated, although long range spread of the weed is thought to occur by the transport of seeds in infested hay or crop seeds (Rogers, 1928; Renney, 1959). In addition, the ingestion of flower heads by cattle and the ability of the seeds to survive through the digestive system may also serve to disperse this weed with the movement of cattle.

4. Habitat

Russian knapweed thrives in a variety of habitats and is found in both irrigated and arid environments, and in cropland, pastures, rangeland, shrublands, and wasteland (Rogers, 1928; Zouhar, 2001). Habitat associations for the western United States may be found in Zouhar (2001). Rogers (1928) suggested that a damp clay soil would provide abundant moisture and would permit easy penetration of roots of Russian knapweed. However, Russian knapweed is found in a variety of soil types and is not associated with a particular soil. Russian knapweed is an adaptable plant and is capable of establishing itself in sandy deserts, compacted soils, and roadsides. Resistant to drought, salt, and compacted soils (Ivannikov et al, 1976), Russian knapweed can become established in areas of disturbed land or where the upper layer of soil is removed.

Examples of some perennial grass species that are commonly driven out

by Russian knapweed include rough fescue (*Festuca scabrella*), Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Agropyron spicatum*), western needlegrass (*Stipa occidentalis*), and Richardson's needlegrass (*Stipa richardsonii*) (Rice et al., 1992). An example of a riparian community in which Russian knapweed can commonly be found is the Freemont cottonwood (*Populus freemontii*)/skunkbrush (*Rhus trilobata*) community (TNC, 2000).

B. Plants related to Russian knapweed and their distribution

1. Taxonomically related plants

The tribe Cardueae (Russian knapweed belongs to this tribe) is comprised of approximately 83 genera and 2,500 species (Bremer, 1994). This tribe is the more primitive of Asteraceae tribes. Species are primarily Palearctic (European, the northwest coast of Africa, and Asia north of the Himalaya Mountains) and north African, although a few species are found in North and South America, Australia, and tropical Africa. The tribe Cardueae is comprised of two large subtribes - the Centaureinae and Carduinae, and two smaller subtribes – the Carlininae and Echinopsidinae. Although there are native North American species contained within the Cardueae, this tribe is comprised primarily of exotic species of economic importance either as weeds or as ornamentals and commercial crops.

In the subtribe Centaureinae, the genus *Acroptilon* consists of a single species, *Acroptilon repens* (Russian knapweed). The closely related genus *Centaurea* is comprised of approximately 32 species in the United States, mostly exotic species that are weedy or some that are used as ornamentals. There are two native knapweed species, *C. americana* and *C. rothrockii,* (some botanists have classified these under a different genus - *Plectocephalus*) of concern. Both species are annuals and are native to the southwest, although the range of *C. americana* extends up through the central United States. Both species are commercially available and may be grown as ornamentals. Safflower, *Carthamus tinctorius,* is also placed in this subtribe and is of concern due to its economic importance. The other subtribe Carduinae contains native species within the genera *Cirsium* and *Saussurea*. Six federally listed threatened or endangered *Cirsium* species are present in the United States. Artichoke, *Cynara scolymus,* is also placed in this subtribe and is of economic concern. Milk thistle, *Silybum marianum,* although considered a noxious weed in many areas is also used as an economic plant species in some locations. The subtribes Carlininae and Echinopsidinae have few representative species in North America, of which all are introduced weeds or ornamentals (i.e., globe

thistle).

Besides *Cirsium*, a number of genera within the family Asteraceae have federally threatened and endangered species in the continental United States. These genera are: *Ambrosia, Artemisia, Baccharis, Blennosperma, Boltonia, Brickellia, Chromolaena, Chrysopsis, Deinandra, Echinacea, Enceliopsis, Erigeron, Eriophyllum, Grindelia, Hazardia, Helenium, Helianthus, Holocarpha, Hymenoxys, Lasthenia, Layia, Lessingia, Liatris, Malacothrix, Marshallia, Monolopia, Pentachaeta, Pityopsis, Pseudobahia, Senecio, Solidago, Stephanomeria, Symphotrichum, Taraxacum, Thymophylla, Townsendia, Verbesina,* and *Yermo*. These genera are more distantly related to *Acroptilon* and therefore would be at lower risk of being utilized by Russian knapweed biocontrol agents.

IV. Environmental Consequences

A. No Action

1. Impact of spread of Russian knapweed

a. Beneficial uses:

Russian knapweed has no known beneficial qualities. At one time, it was recommended for soil erosion control in Nevada, that allowed the weed to become more widespread (University of Nevada Cooperative Extension, 2004).

b. Social and recreational use:

Russian knapweed does not have any known social or recreational use. The monocultural stands of this weed are considered aesthetically unpleasant in comparison to healthy ecosystems. Russian knapweed can form relatively dense stands along river beds which can inhibit recreational activities.

c. Economic losses:

Economic losses due to Russian knapweed infestations have not been studied in detail. Hirsch and Leitch (1996) addressed direct and secondary economic impacts associated with several knapweed species in Montana. Although this study was limited by various assumptions, it does indicate that potential and significant economic impacts would result should these weeds continue to spread.

Russian knapweed imparts a bitter taste to bread when its seeds are

threshed together with wheat (Ivannikov et al., 1976). The quality of flour or other grain products that have been contaminated by Russian knapweed seed at a rate of only 0.01% by weight is reduced due to the bitter taste. At a density of 25-50 Russian knapweed plants per square meter, wheat yields were decreased by 50-90% (Streibig et al., 1989). Shoot densities of 19, 32, and 65 per square meter have reduced the fresh weight yield of corn by 64, 73, and 88%, respectively (Berezovskii and Raskin, 1971). Russian knapweed is aggressive and difficult to control in alfalfa, clover, other forage crops, and pastures. It is generally avoided by grazing animals as it imparts a bitter quinine-like taste. The presence of Russian knapweed in hay decreases the feeding value and market value.

d. Health issues:

Russian knapweed has been known to cause the neurological disorder nigropallidal encephalomalacia in horses (Young et al., 1970). No known human ailments have been associated with Russian knapweed, although the plant produces repin and acroptilin, allergenic sesquiterpene lactones which may cause dermal allergies with prolonged or repeated contact.

e. Effects on wildlife populations:

Kurz et al. (1996) reported on the ecological implications of Russian knapweed infestations on small mammals and habitat associations. Field sites in Wyoming and Colorado were chosen for the study of diversity comparisons at infested and non-infested sites. Vegetation measurements indicated distinct differences in composition and structure between knapweed infested and non-infested plots. Diversity comparisons showed a large shift in species composition in Russian knapweed infested areas for both small mammal and plant communities, indicating a displacement of native species.

Certain species of wildlife may, in certain cases, utilize Russian knapweed infested habitats more. A recent study in Colorado and Wyoming indicates that three times as many small mammals frequented Russian knapweed infested rangeland compared to adjacent non-infested sites. Adaptation to Russian knapweed infested sites sometimes occurs, as evidenced by one small mammal - a harvester mouse, which utilizes seeds, and may serve to spread the weed as they cache seeds. In contrast, Russian knapweed infested areas had severely reduced populations of kangaroo rats and ground squirrels in Wyoming (Johnson et al., 1994).

Hirsch and Leitch (1996) estimate that knapweed monoculture could reduce wildlife habitat values as much as 80%. Russian knapweed infestations have also been reported to impact big horn sheep forage in British Columbia (Zouhar, 2001).

2. Impact from use of other control methods

a. Chemical control

The continued use of chemical herbicides and mechanical controls at current levels would be a result if the “no action” alternative is chosen.

Although herbicide treatments are temporarily effective, they are short term solutions that must be repeated (Jones and Evans, 1973; Gruzdev and Popov, 1974; Krumzdorov, 1976; Alley and Humberg, 1979, Benz et al., 1996). In addition, a one-time application of herbicide is usually insufficient in managing Russian knapweed.

Large scale chemical control is potentially ecologically harmful and often not economical on western rangeland, which is of relatively low productive value (DiTomaso, 2000). In Fremont County, Wyoming alone, very conservative estimates to apply one herbicide treatment on Russian knapweed (approximately $15/acre), would exceed $950,000 (Baker et al., 1999). This estimate is considered conservative because it does not factor in the additional cost of treating remote infestations. The majority of infested acres in Fremont County are considered remote grazing land (Baker et al., 1999).

b. Mechanical control

The control of this perennial weed by deep plowing or by mowing may have a limited affect on its extensive root system while disturbing or destroying non-target plants. Mowing appears to stimulate regrowth in the aerial portion of the plant and may induce dormancy in the roots (Tarshish, 1967). Russian knapweed clones are able to compensate for artificial destruction of individual members of the clone by regrowth from root buds (Schaffner et al., 2001). Cultural control of Russian knapweed is typically not economical on low-productive value rangeland.

c. Biological control

The only biocontrol agent released on Russian knapweed in North America has been the nematode species *Mesoanguina* (*Subanguina*) *picridis,* which was introduced from central Asia and released in the United States in 1984. Laboratory experiments suggested extensive damage on the seed development and plant growth from this agent. Due to the low mobility of the nematode and varying moisture conditions, the results of field releases were less than expected. *Mesoanguina picridis* would need to be propagated and redistributed on a large scale, which would not be cost effective. For these reasons other organisms are being considered for biological control.

These environmental consequences may occur even with the implementation of the biological control alternative, depending on the efficacy of *A. acroptilonica* to reduce Russian knapweed in the continental United States. It is not expected that *A. acroptilonica* alone will completely control Russian knapweed. However, reductions in the above-ground growth rate and seed output caused by *A. acroptilonica* are expected to lead to reduced competitive ability of the weed and reduced long-distance dispersal of Russian knapweed seeds.

B. Issue the permit for environmental release

1. Impact of *A. acroptilonica* on non-target plants

Host specificity to Russian knapweed has been demonstrated through scientific literature, field observations, and host specificity testing.

a. Scientific literature

According to Kovalev and D'yakonchuk (1986), *A. acroptilonica* only attacks Russian knapweed.

b. Field observations

During field surveys in Turkey (Collier et al. 2006), several hundred individual *Centaurea cyanus*, *Carduus pycnocephalus*, and *Cirsium* species (plant species that are closely related to Russian knapweed) were inspected for galls in habitats where *A. acroptilonica* occurs naturally. None of the inspected plant species were attacked by this gall wasp. These data suggest that *A. acroptilonica* is likely to attack only Russian knapweed in its native range.

c. Host specificity testing

<u>Site of quarantine and field studies</u>

All laboratory tests were conducted at the CABI Bioscience Centre in Delémont, Switzerland. The open-field experiments were carried out in Uzbekistan and Turkey.

<u>Test plant list</u>

The test plant list used to determine the host specificity of *A. acroptilonica* consisted of the target population of Russian knapweed collected from various localities in Wyoming and 48 non-target test plant species or varieties. The test plant list was constructed with the aim of including at least one representative of the major tribes of the family Asteraceae and one representative of genera within the same tribe as Russian knapweed. The test plant list included the two native North American species in the genus *Centaurea* (*C. americana* and *C. rothrockii*) and Eurasian species of

the genus *Centaurea* that are used as ornamentals in North America (*C. cyanus*, *C. montana*). By all accounts, members of the genus *Centaurea* are considered to be the closest relatives of *Acroptilon* in North America.

In developing the test list, emphasis was also placed on including as many native North American representatives of the various taxa as possible. Of the three subfamilies of the Asteraceae, only the Cichorioideae and the Asteroideaea contain indigenous species in North America (Bremer, 1994). Because Russian knapweed resides within the Cichorioideae, this subfamily was more extensively tested than the Asteroideae. Additionally, a greater number of genera and species within the tribe Cardueae and subtribe Carduinae were tested than those in other tribes and subtribes. The assumption here is that the former taxa are more closely related to *Acroptilon* and so would be more likely to be potential host plants for *A. acroptilonica*. Furthermore, the Cardueae and Carduinae contain a number of plants that are native to North America, are federally-listed threatened or endangered species, or are important crop plants (e.g. artichoke, lettuce, safflower).

Laboratory tests

In the laboratory, host specificity tests followed a sequential no-choice design. Potted non-target test plants and Russian knapweed plants were covered with plastic cylinders (10 cm diameter; 15-100 cm high), each topped with a gauze lid. Two females each were introduced into the plastic cylinders for two days. Female wasps were removed and then transferred onto the next test or control plant. Dead females were replaced with newly emerged females. Care was taken that a pair of gall wasps was never exposed to the same test plant species more than once. After exposure, test and control plants were put back into the garden, where they were regularly inspected for gall formation.

Table 1 shows the results from the sequential no-choice laboratory tests with the *A. acroptilonica* populations from Turkey and Uzbekistan. No galls were produced on any of the non-target test plants (Table 1) with the exception of a single gall on *Centaurea americana*. Galls were readily induced on the target plant Russian knapweed.

Table 1. Results of the no-choice oviposition/gall formation tests (1998-2004) (Collier et al., 2006).

	Turkey		Uzbekistan	
Plant Species	Reps	Galls	Reps	Galls
SUBFAMILY CICHORIOIDEAE				
Tribe Cardueae				
Subtribe Centaureinae				
Acroptilon repens	**122**	**42**	**154**	**99**
Centaurea americana	**67**	**1**	**24**	**0**
C. rothrockii	23	0	9	0
C. jacea	10	0	7	0
C. solstitialis	5	0	7	0
C. cyanus	14	0	10	0
C. arenaria	5	0	6	0
C. napifolia	7	0	1	0
C. montana	12	0	9	0
Carduncellus mitissimus	13	0	8	0
Carthamus tinctorius				
Cal-West 4440	-	-	9	0
Cal-West 1221	16	0	6	0
Cal-West 88-OL	19	0	5	0
SeedTec 518	8	0	7	0
SeedTec 555	5	0	5	0
SeedTec 317	7	0	3	0
Montola 2000	15	0	5	0
Montola 2001	11	0	4	0
Serratula tinctoria	13	0	8	0
Subtribe Carduinae				
Carduus pycnocephalus	3	0	5	0
Cirsium muticum	3	0	-	-
C. hillii	2	0	-	-
C. vinaceum	5	0	-	-
C. fontinale	2	0	-	-
C. arvense	13	0	14	0
C. pannonicum	6	0	-	-
C. undulatum	7	0	-	-
C. vulgare	3	0	3	0
C. discolor	18	0	7	0

(**Table 1**, continued)

Plant Species	Turkey Reps	Turkey Galls	Uzbekistan Reps	Uzbekistan Galls
Subtribe Carduinae (cont.)				
C. canescens	-	-	1	0
C. hydrophilum	1	0	2	0
Cynara scolymus				
Green Globe	10	0	3	0
Viletto			2	0
Silybum marianum	12	0	9	0
Subtribe Carlininae				
Carlina vulgaris	-	-	9	0
Subtribe Echinopsidinae				
Echinops rito	13	0	10	0
Tribe Lactuceae				
Subtribe Crepidinae				
Taraxacum officinale	10	0	9	0
T. laevigatum	9	0	-	-
Subtribe Hieraciinae				
Hieracium canadense	8	0	10	0
Subtribe Lactucinae				
Cichorium intybus	8	0	9	0
Lactuca sativa	23	0	8	0
Subtribe Sonchinae				
Sonchus arvensis	4	0	1	0
Subtribe Stephanomeriinae				
Stephanomeria virgata	10	0	-	-
Tribe Vernonieae				
Subtribe Vernoniinae				
Vernonia missourica	13	0	8	0
V. fasciculata			5	0

(**Table 1**, continued)

Plant Species	Turkey Reps	Turkey Galls	Uzbekistan Reps	Uzbekistan Galls
SUBFAMILY ASTEROIDEAE				
Tribe Astereae				
Aster laevis	12	0	11	0
A. umbellata	13	0	2	0
Solidago nemoralis	12	0	8	0
Erigeron pinnatisectus	10	0	3	0
Tribe Anthemideae				
Artemisia ludoviciana	10	0	15	0
Tribe Senecioneae				
Senecio fremontii	-	-	2	0
S. triangularis	7	0	-	-
S. pauperculus	12	0	-	-
Cacalia atriplicifolia	16	0	5	0
Tribe Helenieae				
Helenium autumnale	13	0	10	0
H. flexuosum	12	0	5	0
Hemizonia conjungens	3	0	-	-
H. pungens	12	0	9	0
Gaillardia pinnatifida	10	0	13	0
Tribe Helinatheae				
Helianthus annuus				
Cargill SF 187	12	0	8	0
Cargill SF 270	16	0	4	0
Echinacaea pallida	8	0	4	0
E. purpurea	12	0	4	0
Liatris pycnostachya	9	0	-	-
Tribe Eupatorieae				
Eupatorium maculatum	10	0	11	0
E. perfoliatum	15	0	10	0
Tribe Calenduleae				
Calendula officinalis	12	0	12	0
Tribe Gnaphalieae				
Gnaphalium audax	7	0	1	0
G. obtusifolium	12	0	7	0

Field tests - multiple-choice oviposition and gall formation

In addition to the laboratory no-choice tests, multiple-choice oviposition and gall formation tests were conducted under open-field conditions in Turkey and Uzbekistan. Test plant species were either grown from seed or collected and transplanted from the local area. Plants were arranged with Russian knapweed in a randomized design at one of three localities, one in Turkey and two in Uzbekistan. Galls of *A. acroptilonica* were collected locally and brought out in the field plots in a way to minimize losses due to wind dispersal and predation.

In the open-field experiments, gall formation was recorded from Russian knapweed and *Centaurea americana* but from no other test plant species (Table 2). The three galls produced on *C. americana* occurred on a single plant in a single replicate during 2000. No galls were produced on any of the non-target test plants, including *C. americana*, in any replicates in the 2001 tests in Uzbekistan nor in the 2002 tests in Turkey. Galls produced on *C. americana* were preserved in alcohol; therefore it was not possible to determine if these gall wasps would have successfully emerged from *C. americana* as viable adults. Also it was not possible to determine if the galls were produced by *A. acroptilonica* rather than some other naturally occuring cynipid.

Table 2. Results of the multiple-choice, open-field oviposition and gall formation tests carried out in Uzbekistan (2001) and Turkey (2000 and 2002) (Collier et al., 2006).

Plant species	Replicates	Number of galls
A) Turkey (2000)		
Acroptilon repens	20	7
Centaurea americana	10	3
C. rothrockii	12	0
C. solstitialis	22	0
C. nigra	10	0
Carduus pycnocephalus	10	0
Silybum marianum	10	0
Carthamus lanatus	10	0
C. tinctorius	29	0
Echinops sp.	17	0
Cirsium acarna	13	0

Table 2 **(continued)**

Plant species	Replicates	Number of galls
B) Uzbekistan (2001)		
Acroptilon repens	9	30
Centaurea americana	9	0
Onopordum illyricum	10	0
Carthamus tinctorius	10	0
Carthamus lanatus	9	0
Cirsium vulgaris	8	0
C. arvense	10	0
C. discolor	1	0
C. acharna	9	0
C) Turkey (2002)		
Acroptilon repens	19	9
Centaurea americana	10	0
C. rothrockii	10	0
C. solstitialis	12	0
C. nigra	10	0
Carduus pycnocephalus	14	0
Cynara scolymus	10	0
Silybum marianum	10	0
Carthamus lanatus	10	0
C. tinctorius	20	0
Cirsium discolor	10	0
C. acarna	15	0
C. arvense	17	0
C. vulgare	10	0
Echinops rito	18	0
Matricaria perforata	10	0
Helianthus annuus	18	0

An impact experiment was set up with the non-target species *Centaurea americana* at CABI Bioscience Switzerland Centre because *C. americana* is the only non-target test plant on which gall formation was observed. A total of 58 bolting *C. americana* plants were randomly assigned to either a group exposed to the gall wasp or a group untreated as control. In parallel, nine Russian knapweed plants of similar growth stage were exposed to gall wasps. As soon as adult gall wasps started to emerge from galls

stored in the laboratory, all plants were covered with plastic cylinders (10 cm diameter and 15-50 cm height). Plants from the "galled" group were exposed to two *A. acroptilonica* females for two days. After the exposure period, the wasps were aspirated, the cylinders removed and the plants transferred to the Centre's garden. None of the 29 potted *C. americana* plants exposed to the gall wasp produced galls, while gall formation was observed in six of the nine Russian knapweed plants that were exposed to the gall wasp. Hence, the potential impact of gall wasp attack on individual *C. americana* plants could not be assessed. Nevertheless, the experiment provides further evidence that attack of this non-target species by *A. acroptilonica* is likely to be rare under no-choice conditions, as well as under sequential-choice conditions.

Discussion

The results from the laboratory and open-field tests indicate that *A. acroptilonica* has a very narrow host range. None of the non-target test plant species except *Centaurea americana* showed any signs of gall formation. The level of attack on *C. americana* was so low that non-target impact could not be assessed. In sequential no-choice tests, only a single gall was produced on *C. americana* test plants in 66 replicates with the Turkish population of *A. acroptilonica* and no galls were produced in 21 replicates with the Uzbek population. In the open-field choice tests, no galls were produced in 9 replicate tests in Uzbekistan and 3 galls were produced in 20 replicate tests in Turkey. All three of the galls in the Turkish tests were found on a single plant in a single replicate.

One potential explanation for the galls in the open-field tests is that they were produced by a gall wasp species other than *A. acroptilonica*. Because the three galls were preserved in alcohol, it was impossible to determine whether the galls were produced by *A. acroptilonica*. Other *Aulacidea* spp., (i.e. *A. discolor* and *A. parvula*) have been reported to attack *Centaurea* spp. in Asia but these data need to be verified.

Finally, it is unclear whether gall formation on *C. americana* leads to successful emergence of viable *A. acroptilonica* adults. Galls formed in the 2000 choice trial were preserved in alcohol. No adult gall wasps emerged from the single gall formed in the 2000 no-choice test, so data on performance of the gall wasp on *C. americana* are not available. In subsequent trials attempting to investigate this issue, it has been impossible to produce additional galls on *C. americana*.

2. Uncertainties regarding the environmental release of *A. acroptilonica*

Once a biological control agent such as *A. acroptilonica* is released into the environment and becomes established, there is a slight possibility that it could move from the target plant (Russian knapweed) to attack nontarget plants, such as native *Centaurea america.* Host shifts by introduced weed biological control agents to unrelated plants are rare (Pemberton, 2000). Native species that are closely related to the target species are the most likely to be attacked (Louda et al., 2003). If other plant species were to be attacked by *A. acroptilonica*, the resulting effects could be environmental impacts that may not be easily reversed. Biological control agents such as *A. acroptilonica* generally spread without intervention by man. In principle, therefore, release of this biological control agent at even one site must be considered equivalent to release over the entire area in which potential hosts occur and in which the climate is suitable for reproduction and survival.

In addition, these agents may not be successful in reducing Russian knapweed populations in the continental United States. Worldwide, biological weed control programs have had an overall success rate of 33 percent; success rates have been considerably higher for programs in individual countries (Culliney, 2005). Actual impacts on Russian knapweed by *A. acroptilonica* will not be known until after release occurs and post-release monitoring has been conducted. It is not expected that *A. acroptilonica* alone will control populations of Russian knapweed, but will act in combination with other control methods or biological control agents.

3. Cumulative impacts

"Cumulative impacts are defined as the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agencies or person undertakes such other actions" (40 CFR 1508.7).

Many states and counties, particularly in the western United States, conduct weed control programs to manage Russian knapweed as well as other invasive weeds. Chemical, mechanical, and biological controls, as described previously in this document are used in a wide range of habitats.

Release of *A. acroptilonica* will have no negative cumulative impacts in the continental United States because of its host specificity to Russian knapweed. Effective biological control of Russian knapweed will have beneficial effects for weed management programs, and may result in a long-term, non-damaging method to assist in the control of Russian knapweed, and prevent its spread into other areas potentially at risk from

invasion.

4. Endangered Species Act

Section 7 of the Endangered Species Act (ESA) and ESA's implementing regulations require Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened endangered species or result in the destruction or adverse modification of critical habitat.

Sixty-six species of Asteraceae are federally-listed as threatened or endangered in the continental United States. These represent species found within both subfamilies of Asteraceae and the majority of the Asteraceae tribes, including Cardueae.

APHIS has determined that based on the host specificity of *A. acroptilonica*, there will be no effect on any listed plant or designated critical habitat in the continental United States based on literature, field observations, and host specificity testing. In host specificity testing, the biological control agents caused gall formation only in Russian knapweed. The only exception was a few galls formed on the closely related *Centaurea americana.* No listed species occur in the genus *Centaurea.*

V. Other Issues

Consistent with Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations," APHIS considered the potential for disproportionately high and adverse human health or environmental effects on any minority populations and low-income populations. There are no adverse environmental or human health effects from the field release of *A. acroptilonica* and will not have disproportionate adverse effects to any minority or low-income populations.

Consistent with EO 13045, "Protection of Children From Environmental Health Risks and Safety Risks," APHIS considered the potential for disproportionately high and adverse environmental health and safety risks to children. No circumstances that would trigger the need for special environmental reviews is involved in implementing the preferred alternative. Therefore, it is expected that no disproportionate effects on children are anticipated as a consequence of the field release of *A. acroptilonica*.

VI. Agencies, Organizations, and Individuals Consulted

The Technical Advisory Group for the Biological Control Agents of Weeds (TAG) recommended the release of *A. acroptilonica* on March 5, 2007. TAG members that reviewed the release petition (Collier et al. 2006) included representatives from the U.S. Fish and Wildlife Service, Bureau of Indian Affairs, Weed Science Society of America, Cooperative State Research, Education, and Extension Service, National Park Service, U.S. Geological Survey, Environmental Protection Agency, U.S. Forest Service, U.S. Army Corps of Engineers, Bureau of Reclamation, Animal and Plant Health Inspection Service, Agriculture and Agri-Food Canada, Health Canada, and University of British Columbia.

This EA was prepared and reviewed by APHIS. The addresses of participating APHIS units, cooperators, and consultants (as applicable) follow.

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Policy and Program Development
Environmental Services
4700 River Road, Unit 149
Riverdale, MD 20737

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Permits, Registrations, Imports, and Manuals
4700 River Road, Unit 133
Riverdale, MD 20737

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Department of Renewable Resources
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Laramie, WY 82071

VII. References

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U.S. Department of the Interior
Bureau of Land Management

Environmental Assessment MT- 066-08-08
Feb. 11, 2008

Implementation of Integrated Weed Management (IWM) in the Upper Missouri River Breaks National Monument

Location: The Monument includes about 375,000 acres of BLM land in north central Montana in Blaine, Chouteau, Fergus and Phillips Counties. The Monument generally corresponds with the Upper Missouri National Wild and Scenic River from Fort Benton downstream to approximately Arrow Creek, where the Monument begins to widen from 5 to 16 miles on either side of the Missouri River to the Charles M. Russell National Wildlife Refuge. Approximately 80,000 acres of private land and 39,000 acres of state land are intermingled with the Monument. The BLM has no jurisdiction over private or state land, and these lands are not part of the Monument.

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CHAPTER 1
INTRODUCTION AND NEED FOR THE PROPOSED ACTION

INTRODUCTION

The Bureau of Land Management proposes continuation of Integrated Weed Management (IWM) practices in the Upper Missouri River Breaks National Monument (Monument). The basic principles of integrated pest management are: education and awareness for staff, cooperators, and the public, prevention and early detection and rapid response of all noxious weed species, inventory of public and cooperator lands for noxious weeds, control of noxious weeds by various methods that include cultural, physical, biological, and chemical controls or other land practices, and evaluation of treatment areas.

PURPOSE AND NEED FOR THE PROPOSED ACTION

The Bureau of Land Management (BLM) has prepared this Environmental Assessment (EA) to update and evaluate the implementation of Integrated Weed Management (IWM) in response to the signing of a Record of Decision on the Vegetation Treatments on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement (BLM, 2007). This EA will assist the BLM by ensuring compliance with the National Environmental Policy Act (NEPA) in implementing IWM treatments throughout the Monument. This document will replace current NEPA analysis for the planning area that tiers to one or both of two previous programmatic vegetation treatment environmental impact statements.

The Monument has seen a significant increase in the amount and distribution of noxious weeds and invasive plants along the Missouri River and many of its tributaries in the past 15-20 years. Leafy spurge, Russian and spotted knapweed, and Canada thistle, have become commonplace along the entire length of the river corridor. More recently, new invasions of salt cedar, purple loosestrife, Dalmatian toadflax, and perennial pepperweed, have been documented along river banks, in campgrounds, and in river bottoms. This expansion and invasion of noxious weeds places many of the unique resources found within the Monument at risk. Invasive plants interfere with recreation activities and limit future opportunities, they replace distinct and critical wildlife habitat, reduce forage for livestock, and compete with riparian plant communities critical to wildlife and recreation along this stretch of the Missouri River.

The BLM is required by specific authorities to manage invasive species/noxious weeds. It is also recognized that cooperative efforts to control these species across boundaries are the only “realistic” management means.

CONFORMANCE WITH BLM LAND USE PLANS

Currently, the Judith-Valley-Phillips Resource Management Plan (RMP), approved in September 1994, and West HiLine RMP, approved in September 1998 and January 1992,

address the public lands in the area. The Monument RMP is currently being developed and upon completion will replace the other two documents for the Monument.

Judith-Valley-Phillips RMP/Final EIS (1992)
"BLM will control, eradicate or contain noxious plants to maintain native rangelands. The primary tool will be the use of Integrated Pest Management (IPM). IPM uses chemical, biological, mechanical, and other strategies to most effectively combat noxious plants while minimizing impacts to the environment.

Management efforts will be focused primarily on leafy spurge and knapweeds. The containment/eradication of noxious plants will proceed as analyzed in the Programmatic Environmental Assessment on Containment/Eradication of Selected Noxious Plants in the BLM Lewistown District, May 1986 and the Northwest Area Noxious Weed Control Program EIS, December 1985.

BLM will encourage and pursue educational efforts in cooperation wit the Montana Cooperative Extension Service to increase awareness of the noxious plant problem. BLM will cooperate with state and county governments to detect and prevent the spread of noxious plants. BLM will control, eradicate, and/or contain noxious weed infestations on public land cooperative agreements with county weed boards. If weed problems occur in an intermingled ownership pattern, BLM will initiate control measures in conjunction with the other landowners.

Biological weed control efforts with the use of insects, pathogens, sheep or goats with continue to be emphasized, especially where use of chemicals would be environmentally or economically impractical. Herbicides will be used on small infestation and on the perimeter of large infestations. BLM will continue cooperating with the Agricultural Research Service

The use of sheep and goats will be done in accordance with Instruction Memorandum No. MT-90-195."

West HiLine RIM/Final EIS (1988)
"The containment/eradication of noxious plants will proceed as analyzed in the Northwest Area Noxious Weed Control EIS and Supplement (1985, 1987) and Programmatic Environmental Assessment on Containment/Eradication of Selected Noxious Plants in the BLM Lewistown District, May 1986. All activity plans will address noxious plant management as necessary."

RELATIONSHIPS TO STATUTES, REGULATIONS AND OTHER PLANS
Several state and federal agencies have laws and regulations regarding weed control or the environmental effects thereof. State and county laws commonly place responsibility for noxious weed management on Federal land with the Federal Government. The BLM will comply with the individual States' noxious weed management acts. Various State and federal legal mandates are shown below:

U.S. Environmental Protection Agency (EPA)
Federal Insecticide, Fungicide, and Rodenticide Act.
The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), administered by the EPA, provides for the registration of pesticides, certification of applicators to apply restricted use pesticides, and enforcement of pesticide regulations. FIFRA also provides for individual states to obtain primacy for enforcement of FIFRA regulations as long as the states' requirements are at least equal to federal requirements.

Each Federal Agency
a. Executive Order 13112
On February 3rd of 1999, President Clinton signed Executive Order 13112 dealing with Invasive Species. The order states: a) each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, (1) identify such actions; (2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restorations of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction sand provide for environmentally sound control of invasive species; and (vi) promote public educations on invasive species and the means to address them; and (3)not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has pre-scribed, the agency has determined and made public its determinations that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

b. Federal Noxious Weed Act of 1974 (7 U.S.C. 2801=2813), as amended by Sec. 15, Management of Undesirable Plants on Federal Lands, 1990.
Congress amended the Federal Noxious Weed Act of 1974 and this amendment was signed into law November 28, 1990. This bill requires that each Federal Agency:
1. Designated a lead office and person trained in the management of undesirable plants.
2. Establish and fund an undesirable plant management program.
3. Complete and implement cooperative agreements with State Agencies.
4. Establish integrated management systems to control undesirable plant species.

c. Carlson-Foley Act (P.L. 90-583)
This Act provides for the management of noxious plants on land under the control or jurisdiction of the Federal Government. It permits a State agency to enter upon federal lands to destroy noxious plants. Reimbursement provisions are provided.

d. National Environmental Policy Act (NEPA)

A Record of Decision issued in September, 2007 for the **Vegetation Treatments on Bureau of Land Management Lands in 17 Western States** programmatic environmental impact statement (PEIS) has taken the place of both the **Northwest Area Noxious Weed Control Program (1987)** and **Vegetation Treatment on BLM Lands in Thirteen Western States (1991).** However, much of the analysis for this most recent PEIS was brought forward in addition to new information and risk assessments of treatment types.

A programmatic environmental assessment, "**Containment/Eradications of Selected Noxious Plants in BLM Lewistown District**," was prepared in May 1986. This document sets the guidelines and background needed for the Lewistown District noxious weed management program.

There may be requirements for further environmental analysis under provisions of the NEPA. Interdisciplinary impact analysis will be based on the above programmatic EIS and other related EISs such as resource management plans. The BLM will develop Pesticide Use Proposals and/or Biological Control Agent Release Proposals with narrative justification to evaluate the method and specifications needed on each project area. If this environmental assessment does not adequately address the onsite circumstances, issues, solutions and stipulations, a site-specific environmental assessment will be prepared.

Montana Dept. of Agriculture

a. Montana Weed Control Act gives the Montana Dept. of Agriculture (MDA) the authority to provide technical assistance and services to local governments, agricultural producers and the general public on the management and control of noxious plants. In addition, MDA makes information available on the proper use of herbicides and recommends where certain management tools should be utilized in order to avoid adverse economic or environmental impacts.

b. Montana Pesticide Act – The Montana Department of Agriculture administers the Montana Pesticides Act which requires the registration of all pesticides manufactured, formulated, distributed, sold, or transported in the state. Commercial and government applicators must be licensed to apply pesticides and farm applicators must obtain special use permits for restricted use pesticides. In addition, pilots and aircraft involved with aerial application must be registered by the Montana Dept. of Commerce.

The State of Montana has primacy for enforcement of FIFRA under the Montana Pesticides Act.

c. County Noxious Weed Control Act. – The County Noxious Weed Control Act (CNWCA) is administered at the county level. The Act states that it is unlawful for any person to allow noxious weeds to propagate or go to seed on his or her land and encourages landowners to file weed control plans. State law requires counties to develop weed control districts to plan and implement weed control efforts. County commissioners appoint a district weed board responsible for administration and

enforcement of the district's noxious weed program. The CNWCA provides for the promulgation of rules to list statewide noxious weeds and allows for county-wide listing of additional species.

Montana Department of Health and Environmental Sciences.
a**. Montana Water Quality Act –** The Water Quality Bureau of the Montana Department of Health and Environmental Sciences (MDHES) is responsible for administration of the Montana Water Quality Act (75-5-101 et seq., MCA). This law provides a framework for classification of surface and ground water, establishes surface and ground water quality standards, and provides for a permit program to control discharge of pollutants into state waters. State waters are required to be free of discharges that create toxic concentrations harmful to human, animal, plant, and aquatic life.

MDA & MDHES
a. Montana Agricultural Chemical Ground Water Protection Act – The Montana Agricultural Chemical Ground Water Protection Act (MACGPA) was adopted by the 1989 legislature and implemented on January 1, 1990. Administered jointly by the MDA and the MDHES, the act charges the MDA with the development of agricultural chemical ground water plans and monitoring programs and MDHES with adoption of ground water quality standards and ground water monitoring requirements. Each agency administers enforcement provisions under the Act.

BLM Guidance
a. BLM Manual 9014 – Use of Biological Control Agents of Pests on Public Lands – This Manual Section outlines policy, defines responsibilities, and provides guidance for the release, maintenance, and collections of Biological Control Agents for Integrated Pest Management programs on the lands administered by the BLM.
b. BLM Manual 9220 – Integrated Pest Management – This Manual Section outlines policy, defines responsibilities, and provides guidance for implementing Integrated Pest Management programs on lands administered by the BLM.
c. BLM Manual 9011 and Manual Handbook H-9011-1, Chemical Pest Control – These manual and handbook sections outline policy and provide guidance for conduction pest control programs on public land.
d. BLM Manual 9015 – Integrated Weed Management – This manual sections sets fourth the BLM's policy relating to the management and coordination of noxious weed activities among activities of the BLM, organizations, and individuals.

Montana State Weed Summit Steering Committee
The federal, state, and local weed management agencies and other cooperative entities in Montana have committed to follow the guidelines developed in the **Montana State Weed Management Plan (2001, 2005, 2008)** and subsequent updates. This plan sets forth guidelines to facilitate consistent and coordinated approaches to IWM.

CHAPTER 2
DESCRIPTION OF ALTERNATIVES

INTRODUCTION

This EA will focus on the Proposed and No Action Alternatives that were previously analyzed by the Programmatic EA developed for Containment/Eradication of Select Noxious Weeds in the Lewistown District (BLM 1986). This document will also replace the above mentioned programmatic EA for BLM administered lands in the Monument. The No Action Alternative is considered and analyzed to provide a baseline for comparison of the impacts of the proposed action.

This analysis will be used to further implement the Upper Missouri River Breaks National Monument: Guidelines for Integrated Weed Management Plant (BLM 2001) and its subsequent updates.

Alternative A - NO ACTION

Alternative A allows for no control efforts to stop the growth and further spread of noxious plants (other than good rangeland management practices, and residual biological control from past treatments).

Alternative B - PROPOSED ACTION

The Proposed Action is to implement cooperative Integrated Weed Management (IWM) to the extent practicable. Site specific guidance can be found in the Upper Missouri River Breaks National Monument: Guidelines for Integrated Weed Management Plan (Appendix B). The basic principles of integrated pest management are: Education and awareness for staff, cooperators, and the public, Prevention and early detection and rapid response of all noxious weed species, Inventory of public and cooperator lands for noxious weeds, Control of noxious weeds by various methods that include cultural, physical, biological, and chemical controls or other land practices, and Monitoring of treatment areas. This EA will analyze the treatment types that may be employed to manage invasive and noxious plant species.

Biological Control – This method of treatment employs the use of living antagonists to stress a target invasive plant or group of invasive plants. Biological control is generally broken down into two categories. These being: 1) the use of domestic animals to graze/browse invasive species, and 2) the use of organisms that specifically attack a target species. These organisms consist mainly insects and plant pathogens that have been imported from the general area where the invasive species is believed to be native. In some cases local insects and pathogens can be utilized but tend to be less specific towards the target. Species specificity is determined by rigorous tests in quarantine facilities to ensure that non target plants are not affected. The use of domestic animals will be restricted in areas where populations of big horn sheep occur. The use of domestic sheep and goats puts the big horn sheep at risk from pathogens that can be transmitted to the wild sheep.

Only a handful of the invasive plant species occurring within the Monument have biological control insects available for use. These species are leafy spurge, Russian and spotted knapweed, Canada thistle, and poison hemlock. Most of the available insects have been released at some point in time within the planning area with varying success. The BLM will continue to distribute these species to infestations within the Monument. New insects/pathogens currently being developed will be addressed in the development of a Biological Control Agent Release Proposal and tiered to this and other NEPA documentation developed by the USDA-Animal & Plant Health Inspection Service – Plant Protection and Quarantine (APHIS-PPQ) and the Montana Dept. of Agriculture (MDA).

Chemical Control – This method of treatment employs the use of herbicides to stress target plant biology. Herbicides that will be used have been evaluated and analyzed in the Vegetation Treatment on BLM Lands in 17 Western States. As part of this effort, these chemicals have been re-assessed for potential risk. These chemicals will be applied within the label restrictions, under guidance from BLM handbook 9011, and with consideration to site specific characteristics to minimize non target impacts. This EA incorporates the list of approved herbicides for application on BLM administered lands, Standard Operating Procedures (SOPs), and the mitigation measures set forth in the Record of Decision of the Vegetation Treatments on BLM Lands in 17 Western States Programmatic EIS (*Appendix A).*

The nature of herbicide applications will normally be spot spraying with a backpack or ATV mounted sprayer with a handgun. In some instances, broad jet sprayers mounted on an ATV will be used on larger infestations. Some areas will be treated aerially by fixed wing or helicopter. Other herbicide delivery options include the use of rope wick applicators and cut stump applications.

Physical Control – Physical control is the actual removal of all or part of the target plant species. This is usually broken up into the following three categories: 1) manual, 2) mechanical, and 3) prescribed fire.

Manual removal will occur periodically by hand pulling and cutting of certain invasive species as the need arises.

Mechanical treatments are unlikely to happen on a large scale, and would be most likely used to manipulate vegetation rather than control invasive species. Mechanical treatments, such as chiseling, disking, tilling, and mowing will need a site specific analysis prior to disturbance.

Prescribed fire may be used as a preparation treatment to clear decadent plant material and encourage efficacy of both biological and chemical treatments. The use of prescribed fire will also need to be addressed on a site specific basis. Fire may also be used to dispose of woody plant parts removed by mechanical means in slash piles. If in a

recreation site, this material will be bucked and stacked for recreational use. In other areas, it may be burned.

Reclamation/ Revegetation – Treatments to reclaim and revegetate may be implemented as needed. In most cases, however; there is enough remnant vegetation that will fill in after an invasive species is removed. In many cases any attempt to plant desired plant species will be done by broadcast seeding due to limited access to areas. Where possible, feasible, and environmentally sound, a range drill could be used.

Goals will be different on a species specific basis due to the various degrees of infestation and site characteristics in which infestations normally occur.

CHAPTER 3
AFFECTED ENVIRONMENT/ENVIRONMENTAL IMPACTS

INTRODUCTION AND GENERAL SETTING

This EA is tiered to the Vegetation Treatments on BLM Lands in 17 Western States Programmatic Environmental Impact Statement and Record of Decision signed in October, 2007. This document analyzed the specific treatment types and developed risk assessments for all herbicides approved for use on public lands in the general ecoregion types. This EA narrows the focus of the analysis to the Monument, and will look closer at those resources and resource uses that IWM treatments may impact. This document will incorporate the mitigation measures and Standard Operating Procedures (SOPs) set forth in the Vegetation Treatment PEIS and assessment protocol of new herbicides as needed (*Appendix A)*.

Critical Elements of the Human Environment are those elements that are subject to the requirements specified in statute, regulation, or executive order, and must be considered in all EAs (BLM H-1790-1, Appendix 5). The existing condition and potential impacts are described for resources, including Critical Elements that are potentially affected by the proposal.

CRITICAL ELEMENTS		
Determination*	**Resource**	**Rationale for Determination**
NI	Air Quality	Air Quality will not be affected in that treatments that would temporarily degrade quality would require subsequent NEPA analysis.
PI	Areas of Critical Environmental Concern	There is one ACEC in the planning area that is/could be impacted by invasive species and their treatment
PI	Cultural Resources	There are cultural resources present that may be impacted by invasive species and their treatments

NP	Environmental Justice	Minority and low-income concerns would not be unequally affected by implementation of IWM.
NP	Farmlands (Prime or Unique)	Resource is not present
NP	Floodplains	Resource is not present
PI	Invasive, Non-native Species	Invasive specie would be impacted by either alternative.
PI	Native American Religious Concerns	There should be no impact on specific sites of concern. Potential exposure from related activities such as collection of wild materials are analyzed in the Vegetation Treatment on BLM Lands in 17 Western States.
PI	Threatened, Endangered or Candidate Plant or Animal Species	There are no listed plants within the project area. There would be no impact to listed animals in the planning area.
NI	Wastes (hazardous or solid)	Although herbicides in concentrated form prior to mixing may be considered Hazardous, provisions in the chemical label as well as other guidance minimize and risk of environmental exposure.
PI	Water Quality (drinking/ground)	Herbicides will be applied in strict compliance with all label instructions and other laws. Herbicides will be applied in accordance to the guidelines and mitigation measures outlined in the Vegetation Treatment PEIS
PI	Wetlands/Riparian Zones	These areas would potentially be impacted by invasive species and their management
PI	Wild and Scenic Rivers	The project area includes the Upper Missouri Wild and Scenic River that would potentially be impacted by invasive species and their management
PI	Wilderness	There are six Wilderness Study Areas within the planning area and would potentially be impacted by invasive species and their management

*Possible determinations:
NP = not present in the area impacted by the proposed or alternative actions
NI = present, but not affected to a degree that detailed analysis is required
PI = present and may be impacted to some degree. Will be analyzed in affected environment and environmental impacts. (NOTE: PI does not mean impacts are likely to be significant in any way).

The following critical elements have been determined to be unaffected to the extent analysis is needed for this proposal and will not be discussed further:
Environmental Justice
Farmlands (Prime or Unique)
Floodplains
Wastes (Hazardous or solid)

The following critical elements were sufficiently analyzed in the Vegetation Treatments on BLM Lands in 17 Western States programmatic EIS. Analysis can be located in this document (ref. pages)
Air Quality (pp. 4-4)
Cultural Resources (pp. 4-102)
Native American Religious Concerns (pp. 4-102)

SOIL & WATER

Soils

Soils developed primarily from sedimentary bedrock (approximately 70%) that was deposited during the Upper Cretaceous periods and from lesser amounts of glacial till (approximately 5%) and mixed alluvium (approximately 25%). Soils are generally fine textured, well drained and slowly permeable. Landforms range from broad rolling ridges to steep (20 to 60 percent slope) or very steep (>45 percent slope) dissected valley walls. These sedimentary break landforms were formed during the Pleistocene Epoch when the Missouri River was rerouted by continental glacial activity.

Detailed Soil Surveys have been published by the Natural Resources Conservation Service (NRCS) for Blaine-Soil Survey Area (SSA) 608 (USDA-NRCS, 1986), Choteau-SSA 615 (USDA-NRCS, 2003), Fergus-SSA 027 (USDA-NRCS, 1988) and Phillips-SSA 641 (USDA-NRCS, 2004). These soil surveys were performed by the NRCS according to National Cooperative Soil Survey standards and were done at the second and third order of detail. Pertinent information for review and analysis is from published Soil Surveys and the National Soils Information System (NASIS) database for the area. For each soil map unit, interpretive ratings and soil characteristics are provided that can be used for general land-use planning and management. Soil investigations should be done at the site-specific level to determine the suitability of soils at specific locations.

Sedimentary Soils

These soils developed in calcareous or acid shales, siltstones and sandstones of the Bearpaw, Judith River, Clagget and Eagle Sandstone Formations. Soils are fine textured, high in smectitic 2:1 clays, and very shallow (<10 inches) to moderately deep (20 to 40 inches). Where high sandstone ridges occur, soils are loamy or sandy. These sedimentary soils are usually fragile and highly erosive because of their steep to very steep (20% to 65%) slopes and extreme physical properties such as high clay content, slow permeability, very high surface runoff, relatively shallow depth to bedrock and sparse vegetative ground cover. Soils are generally low in organic matter and high in sodium and soluble salts.

Active geologic erosion is observed throughout the Monument. This process can be accelerated by surface disturbance, especially on steep and very steep slopes when the protective vegetative cover is removed.

Glacial Till Soils

These soils are located on nearly level to rolling (1% to 15%) slopes and are typically very deep (>60 inches). Textures are loamy to clayey. Erosion is slight to moderate due to the relatively gentle rolling topography, short slope lengths and prominence of dense sod-forming vegetation. When disturbed, water and wind erosion hazards increase.

Alluvial Soils

These soils are on nearly level to undulating (0% to 8%) slopes along floodplains, stream terraces, alluvial fans and footslopes. They are important because of their high vegetative production potential. Soil properties are variable and can differ over short distances.

These soils range from sandy to clayey, poorly drained to well-drained, and slightly to severely erosive. Erosion increases when soils are compacted and vegetative cover is disturbed. Hydric soils exist, although they are not extensive. Hydric soils are defined as soils that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part of the soil (Federal Register, 1994).

Groundwater

Ground water occurs in unconsolidated materials (alluvium, glacial outwash, or terrace deposits) and in consolidated rocks such as sandstones, shaley sandstones, coal, limestone, or igneous rocks.

Most of the BLM land along Arrow Creek and the Judith River lies above the floodplains on the Cretaceous age shales. No shallow aquifers are present for ground water development.

The Missouri River in the Monument area is a young river system in geologic terms. Floodplains are poorly developed or absent, reducing potential for ground water development. The adjacent breaks are in the Bearpaw shale. The Bearpaw shale contains thin, widely scattered and isolated sandstone stringers. Yields are seldom large enough for well development (less than 2 gallons per minute (gpm)), but several small springs and seeps do occur in the deeply incised drainages. Water quality is poor, with total dissolved solids (TDS) generally too high for domestic or livestock use.

The breaks region is underlain by the Judith River and Eagle sandstones. Depths from the surface to these aquifers range from 700 to 2,500 feet. Most wells in these formations flow at the surface yielding 2 to 60 gpm. Water quality is suitable for livestock but generally not for domestic use.

Occasionally, aquifers are present at the contact between terrace gravel deposits and the underlying Bearpaw shale. These aquifers usually appear as low yield springs and seeps (less than 2 gpm) on hillsides above drainages. Water quality is generally suitable for livestock but not for domestic use.

No other shallow aquifers (less than 500 feet) exist.

Surface Water

Stream flow volumes differ greatly. Flows in all unregulated streams have large seasonal variations, with the largest flows generally occurring during the spring or early summer as a result of snowmelt and rainstorms. The Missouri and Judith Rivers are the only perennial streams in the Monument. The table below lists the perennial and intermittent streams. Numerous ephemeral streams also exist but flow only in response to snowmelt or intense summer storms.

Peak flows on prairie streams from snowmelt occur in March or April. Larger peak flows on small drainages can occur from intense summer thunderstorms, but generally not on

an annual basis. Summer rainstorms can result in short intervals of increased stream flow during June through August.

During winter, stream flow in prairie streams is greatly reduced or absent as a result of little ground water inflow and ice formation.

Most precipitation is transpired, evaporated, added to soil moisture, or added to the supply of ground water. Average annual runoff is approximately 0.5 inches. Average annual precipitation ranges from 12 inches in the eastern part of the Monument to 14 inches in the western portion of the Monument (SCS 1977).

Surface water quality is variable depending on the geologic formations through which the water has passed and the volume of flow in the stream. Dissolved solids are derived primarily by the leaching of soluble minerals from soils and geologic formations underlying the drainage basin. The dissolved solids are composed largely of the cations calcium, magnesium, and sodium, and the anions bicarbonate, sulfate, and chloride.

Variations in the dissolved-solids concentration and composition in streams result primarily from changes in the amount and source of stream flow. During low flows, water in the streams is derived mostly from ground water sources and will reflect the dissolved-solids concentration and water type of contributing aquifers. During high flows, most of the water entering the streams is from precipitation runoff. The relatively short period of time that the runoff is in contact with the soils of the basin provides little opportunity for the dissolution of minerals. Consequently, the increased volume of water during high flows reduces the dissolved solids concentration by dilution.

In addition to stream flow variability and geology, other factors that affect the dissolved solids concentration of a stream include irrigation return flows, saline seeps, and water losses from evapotranspiration. Dissolved solids concentrations during low flow range from 1,500 to 3,500 milligrams per liter (mg/l). At high flows, concentrations range from 500 to 1,300 mg/l. The predominant ion in these prairie streams is sodium sulfate.

Streams in the Monument area normally exhibit a pH between 6.5 and 8.5, typical of well-buffered natural waters. Most streams have generally large alkalinities, which provide a buffering capacity that prevents large changes in pH from persisting far downstream. Because of the near-neutral pH, concentrations of dissolved trace elements rarely exceed water quality standards.

VEGETATION

Vegetation is a mixture of communities from the northern prairies and plains to the badland breaks. Variability in geology, topography, soils, and effective precipitation lead to a complex mosaic of different vegetation communities and transitions between communities. In addition, influences of fire (or lack of fire), animal populations, and management practices have led to varying successional levels within plant communities.

Forest and Woodlands

The four main forest types are: Douglas-fir, juniper, ponderosa pine and mixed hardwoods.
Douglas-fir is commonly found on the cooler and wetter aspects (northerly and easterly). The juniper forests are found mostly on dry, rocky sites. The ponderosa pine forest exists in scattered pockets throughout the Monument on all aspects and elevations. These forests are considered more savanna types, rather than open forest, with the break point being sites that are not capable of producing at least 25% canopy coverage. The mixed hardwoods, known as riparian forests, are characterized with stands of cottonwoods, aspen, chokecherry and box elder. See the Vegetation - Riparian section of this chapter for a more complete description of riparian communities.

Badlands
Much of the Monument consists of badlands and breaks. The breaks consist of steep, rugged topography interspersed with benches and rolling hills. Badlands support little vegetation because of steep terrain, shale and rock outcroppings, and the abundance of heavy clays.

Grassland Communities
Grassland communities are found on a variety of sites. Common species include western and thickspike wheatgrass, needle-and-thread grass, bluebunch wheatgrass, green needle grass, Sandberg bluegrass, plains reed grass, inland salt grass, blue grama, prairie junegrass, and threadleaf sedge.

Sagebrush/Grassland
Sagebrush/grassland communities occur throughout the Monument on ridges and slopes. The conspicuous species is Wyoming big sagebrush with wheatgrasses, but also include silver sagebrush, rabbit brush, needle grasses, blue grama, fringed sagewort and other mixed prairie species. These communities are in various successional stages from influences of wildlife, livestock, fire (or lack of), and human activities. They account for most of the forage resources that wildlife and livestock use.

Other adapted shrubland communities occur in areas where particular site characteristics are present.

Where soils are of better quality and soil moisture conditions are favorable, woody draw shrubland communities exist. These communities include chokecherry, currant, buffalo berry, and snowberry. These communities are particularly important to wildlife species.

Crops
The farming of crops is authorized in three locations on BLM land. Under a special use permit, some farming occurs on approximately 650 acres of 1300 acres acquired by BLM in the Loma area that is part of an upland bird project. In the benchlands up river from Steamboat Rock and outside of the UMNWSR, some old agricultural trespass has occurred (approximately 100 acres) on BLM land. This area is being prepared for re-establishment of perennial native species. At the James Kipp Recreation Area 45 acres

are farmed as part of a weeds management program. With these exceptions, no farming occurs on BLM land.

Threatened, Endangered, and Sensitive Plant Species

No populations of federally listed plant species are found in the Monument. However the Montana Natural Heritage Program lists *Phacelia thermalis*, *Pediomelum hypogeaum*, and *Rorippa calycina* as plant species of concern in the area of the Monument.

Riparian

Wetlands are transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface or land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season each year (BLM 1986b).

Riparian areas are those areas within wetlands geographically delineated by distinctive resource values and characteristics that are comprised of aquatic and riparian ecosystems. Riparian areas may be associated with lakes, reservoirs, estuaries, potholes, springs, bogs, wet meadows, and ephemeral, intermittent, or perennial streams. Hansen (1989) described approximately 8,000 acres of riparian habitat existing along the Missouri River in the Monument area.

Riparian communities along the perennial drainages and larger intermittent streams are often dominated by cottonwood and willow with occasional stands of green ash and box elder. The understory often consists of woody plants such as chokecherry, buffalo berry, sumac, currant, grasses, and forbs. The higher terraces adjacent to the floodplains are often dominated by silver sage or greasewood with a grass understory.

Noxious and Invasive Plants

Distribution - Upper Missouri Wild and Scenic River Corridor - Major waterways are a common means of invasive plant distribution with the Upper Missouri River being no exception. Currently, 19 invasive and/or noxious plants are being managed within the river corridor. Of these 19 species, 10 are currently designated as noxious by the State of Montana. The other nine species are included on the BLM nationwide list of invasive plants of concern, with several of these species being designated noxious in nearby states.

River bottoms and cut banks contain the majority of infested acres within the Monument. This is attributed to the many natural disturbances common with river systems such as: flooding, ice jams/scouring, and fluctuating surface water levels. These areas are also well used by livestock, wildlife, and people that can potentially create additional disturbance and/or supply noxious/ invasive plant seed from other areas.

Blaine, Fergus, and Phillips Counties outside the Wild and Scenic River - Inventories have not been conducted in areas outside the river corridor on upland sites in Blaine and

Fergus Counties. Although documented infestations occur in a few areas, most of the upland areas are relatively free of noxious/invasive plants.

Upland sites in Phillips County were inventoried in 2001 and a few small infestations of leafy spurge and Russian knapweed were found.

Areas in these off-river sites that would be most at risk for invasion or may currently be infested are: roads, trails, wildlife/livestock gathering areas, riparian areas associated with springs or non-perennial streams, areas that see measurable recreational use and any areas experiencing natural or manmade disturbance.

Judith River and Arrow Creek
Judith River - Inventories have not been conducted for the Judith River and surrounding land within the Monument. Most of the river bottom where noxious/invasive plants would most likely occur is privately owned. Russian olive, leafy spurge, and Russian knapweed do occur in this area. Salt cedar has been documented and treated on public land along the PN Road approximately three miles south of the PN Bridge.

Arrow Creek - The BLM participated in a cooperative project with local landowners in the Arrow Creek drainage in 1996. Russian knapweed, spotted knapweed, and leafy spurge were mapped in this effort. These infestations are mostly on the creek bottom and privately owned. The most common species documented in this inventory were Russian knapweed, spotted knapweed, and leafy spurge. Although the majority of infestation occurred on private land in 1996, more than adequate time has passed for these infestations to spread into outlying areas of public land. Salt cedar has also been identified at the confluence with the Missouri River, which suggests there is a potential seed source somewhere along the drainage. Most salt cedar infestations in Montana can been traced to ornamental plantings.

Areas of Special Concern
Recreational Use Areas - All of the recreational use areas within the Wild and Scenic River corridor are infested with at least three noxious/invasive plants. These areas are at further risk with the potential for movement of seed and plant material from site to site in the clothing, gear, and pet fur of the many visitors to these sites. The potential for the introduction of noxious/invasive species that are not currently present is also greater at these sites due to human activities.

Occurrence at River Corridor
Recreation Sites within the Monument

Recreation Site	River Mile No.	Noxious/Invasive Plant Species																
		Russian Knapweed	Leafy Spurge	Canada Thistle	Spotted Knapweed	Hoary Cress	Perennial Pepperweed	Poison Hemlock	Russian Olive	Salt Cedar	Dalmation Toadflax	Purple Loosestrife	Houndstongue	Black Henbane	Field Bindweed	Musk/Scotch Thistle	Burdock	Scentless Chamomile
Evans Bend	6.5	x	x	x	x										x			x
Rowe Island	13	x	x	x	x				x				x		x			
Senieurs Reach	16.3	x		x			x		x				x					x
Black Bluff Rapids	19.3	x	x	x	x		x	x	x				x		x		x	x
Wood Bottom Boat Ramp	20.6	x	x	x	x		x	x	x				x		x		x	x
Coal Banks Landing	42.5	x	x	x			x		x						x			
Little Sandy	46.7	x	x	x	x		x		x						x		x	
Monroe Island	53.8	x	x	x	x		x		x		x		x					
Eagle Creek	55.7	x	x	x			x					x						
Hole in the Wall	62.8	x	x	x	x		x			x	x				x			
Dark Butte	69	x	x	x	x		x		x									
Pablo Rapids	73.2	x	x	x	x		x		x					x	x			
Slaughter River	76.5	x	x	x					x									
The Wall	81.2	x	x	x			x											
Judith Landing	88.5	x	x	x	x				x									
McGarry Bar	103.3	x	x	x			x											
Stafford Ferry	101.8	x	x	x	x		x									x		
Gist Bottom	122.5	x	x	x			x		x	x					x	x		
Cow Island Landing	125.5	x	x	x	x		x											
Woodhawk Area	131	x	x	x	x													
Hideaway	136.5	x	x	x					x									
James Kipp Recreation Area	149	x	x	x		x									x			

Wilderness Study Areas - All six of the Wilderness Study Areas (WSAs) have been infested with several species of noxious/invasive plants. Most of these infestations are along areas near the Missouri River. Upland portions of these areas are monitored regularly as required by the Interim Management Policy and Guidelines for Lands Under Wilderness Review (BLM Handbook H-8550-1). Salt cedar has been documented in three locations near the Dog Creek South WSA. These infestations are thought to have originated with ornamental plantings. These infestations have also been the most likely

source of the two infestations of salt cedar on the riverbanks of the Stafford WSA just downstream from the mouth of Dog Creek.

		Noxious/Invasive Plant Species						
		Russian Knapweed	Leafy Spurge	Canada Thistle	Spotted knapweed	Perennial Pepperweed	Russian Olive	Salt Cedar
WSA	Antelope Creek	x	x	X				
	Cow Creek	x	x	x				
	Woodhawk	x	x	x	x			
	Ervin Ridge	x	x	X		X		
	Stafford	x	x	x	x	x	x	x
	Dog Creek	x	x	x	x		x	
	South	x	x	x	x		x	

WILDLIFE

The wildlife species within the Monument are diverse, abundant and widespread. Of the species known to occur in the area pre-settlement, only the grizzly bear, grey wolf, and black-footed ferret no longer occur in the Monument. The variety of vegetation along the river and its associated areas provides habitat for the diverse wildlife population. More than 60 mammals, 233 species of birds and 20 species of amphibians and reptiles inhabit these areas. The river itself is home to 48 species of fish ranging from half-ounce minnows to the 140 pound paddlefish. A complete listing of species which occur or could occur within the corridor is listed in the UMRBNM RMP.

Mammals
The area between the river's edge and the mixed forested, sagebrush steppe and agricultural land along the canyon rims provides valuable habitat for several species of mammals. Probably the most significant of these mammals are five big game species: bighorn sheep, elk, mule deer, whitetail deer and pronghorn antelope. The canyon areas also provide habitat for predator species. Mountain lions appear to be doing well in the breaks portions of the corridor.

Birds Of the 233 species of birds that inhabit the corridor, the bald eagle, the peregrine falcon, mountain plover, and several other migratory birds are BLM Designated Sensitive Species. The cliff faces provide perching and nesting habitat for many raptors and other birds. The more significant and abundant of the cliff nesters (golden eagle, prairie falcon, and Canada geese) are using some of the cliffs adjacent to water to nest in. Six species of upland game birds are present in the corridor: turkey, gray partridge, sharp-tailed and sage grouse, mourning dove and ring-necked pheasant. A complete listing of species which occur or could occur within the corridor is listed in the UMRBNM RMP.

Fish
Forty-eight species of fish are found in this area of the Missouri River and its tributaries. Of these, the pallid sturgeon is on the threatened and endangered list and five are BLM Designated Sensitive Species, blue sucker, paddlefish, sauger, sicklefin chub, and sturgeon chub. A complete listing of species which occur or could occur within the corridor is listed in the UMRBNM RMP.

Herptofauna
Reptiles and amphibians (collectively referred to as "herptiles" or "herptofauna") are sensitive to habitat conditions and changes, as well as changes in wildlife community composition and abundance.

Reptiles and amphibians serve as valuable bioindicators of ecosystem health (Lind 1996). Some amphibian populations in Montana have recently undergone, or are currently undergoing declines and extirpations (Carey 1993, Reichel and Flath 1995). Direct and indirect impacts from a variety of human activities may affect the viability of reptile and amphibian populations in Montana (Joslin and Youmans 1999).

The tiger salamander is the only salamander occurring in the Monument. The woodhouse toad, spadefoot toad, western chorus frog, and the northern leopard frog all occur in the area. Of concern are the northern leopard frog populations, which appear to be in a sharp decline. Spiny soft-shell and snapping turtles occur and are listed as sensitive species. There is concern that concentration of livestock in soft-shell turtle nesting areas may impact nesting success. The short-horned lizard is also known to be present.

A complete listing of species which occur or could occur within the corridor is listed in the UMRBNM RMP.

Special Status Species
Special status species include sensitive, State-listed, and federally proposed, listed, and candidate species. A complete listing of Threatened, Endangered, Candidate Species, or BLM Designated Sensitive Species which occur or could occur within the corridor is listed in the UMRBNM RMP..

Greater Sage-Grouse (Sensitive Species)
Sage-grouse, an important game bird in Montana, are considered sensitive and are considered a species of potential concern and have decreased in numbers throughout their range (Montana Sage Grouse Work Group 2004); however, in many areas outside the Monument sage-grouse populations have stabilized or increased in recent years. Faltering sage-grouse populations can be attributed to a number of different factors. Habitat fragmentation and habitat condition are the primary factors which the BLM can manage or manipulate.

Black-tailed Prairie Dog (Sensitive Species)

In February 2004, the USFWS concluded that this species does not warrant listing under the Endangered Species Act. Several small prairie dog towns occur within the Monument.

Bald Eagle (Sensitive Species)
In 1978, the USFWS designated the bald eagle an endangered species. The bald eagle was reclassified as a threatened species in 1995, was recovered and removed from the Threatened Species List in 2007. The species is still included as a BLM Designated Sensitive and is protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Pallid Sturgeon (Endangered Species)
The USFWS listed the pallid sturgeon as an endangered species in 1990. The current distribution of the pallid sturgeon in Montana includes the Missouri River between the mouth of the Marias River and Fort Peck Reservoir. The preferred habitat of the pallid sturgeon is the bottom of large, swift, turbid, relatively warm, free-flowing rivers (USFWS 1993a; Aderhold 1996). The construction of dams on the Missouri River is believed to be the primary cause of the pallid sturgeon's decline.

CULTURAL RESOURCES
This alternative does nothing to control the spread of weeds in the UMRBNM. This would result in the greater loss of biotic heritage resources. There is no impact to archeological and historic sites from application of herbicide, mechanical treatments, or burning. Site disturbance probability is low, based on no areas proposed for treatments. Indirectly this could create a greater concern due to the changing of vegetation from native species that would be available for collecting and use, to invasive species with no historic cultural benefit associated with this geographical area.

This alternative is based on treatment continuing at current levels. The continued spread of existing noxious weed populations and the establishment of new species that we currently experience are not likely to have an effect on non-biotic heritage resources. Mechanical treatments have a greater potential to disturb cultural sites than do biological or chemical control measures. The amount of acres with the potential to be affected is negligible. Mechanical treatment will take place on small sites in riparian areas where herbicides and vehicles are not appropriate. Of the known historic sites on the UMRBNM, none are located in areas of weed infestation proposed for that type of treatment. Mechanical treatment would have no effect on the qualities that make the sites eligible for the National Register of Historic Places

Recovery of communities dominated by invasive and noxious weeds would not be achieved; this alternative could prevent the expansion of existing weed populations, and could hinder new species and population centers from becoming established. This would prevent any further loss of biotic heritage resources to erosion.
Noxious weeds could affect these sites if the invasive weeds affect soil stability at the sites. Erosion has the potential to affect the spatial and temporal relation of artifacts, which can in turn reduce the significance and information potential of sites. Thus far, this

has not been a problem at known cultural sites. If the spread of noxious weeds accelerates, or if noxious weed populations become established at known historic or prehistoric sites and the level of weed treatment remains at the current level, this could adversely affect heritage resources.

This alternative should have no effect on historic or prehistoric cultural resources, with the caveat identified in the previous paragraph.

SPECIAL MANAGEMENT AREAS
Noxious weeds are recognized as serious problems on lands managed for wilderness or wildland values by federal, state, and private entities in Montana. When weeds invade and expand into a wilderness environment, the "naturalness" of the area is degraded and scientific values of once biologically diverse landscapes are impaired. The unchecked spread will degrade and put at risk many of the objects (biological, geological, visual, historic and remote character) for which the area is being managed for.

RECREATION
Recreation sites are often infested due to the disturbance caused by repeated recreational use and the introduction of reproductive plant parts from users moving from infested sites to the recreation area. Invasive species in these areas would increase and in some instances may render the site unfit for recreational use.

ENVIRONMENTAL IMPACTS
NO ACTION
Direct and Indirect Impacts of the No Action Alternative

SOIL AND WATER
It is likely that invasive plants would continue to rapidly spread, resulting in dramatic and potentially irreversible effects on soil quality through changes in organic matter content, diversity and abundance of soil organisms, and nutrient and water availability. Invasive species and other undesirable vegetation can out compete native vegetation and lead to widespread incidence of fire and other conditions that can result in increased rates of soil erosion and loss of soil productivity.

Ground water quality should not see any significant impact, although some invasive species are known to be alleopathic, placing chemicals designed to inhibit competitive plant growth in the soil. These chemicals may be leachable into groundwater, but any risks to human health or the environment are not known. Ground water quantity could be significantly reduced in areas where salt cedar would be allowed to persist. This plant has been documented to lower water tables in areas of high infestation.

Surface water quality and long-term production potential of land can be reduced when tap-rooted species such as spotted and diffuse knapweed invade grasslands. In western Montana, surface runoff was 56% higher and sediment yield was 192% higher on spotted knapweed infested sites compared to those dominated by native bunchgrass (Lacey et al 1989). Exotic species can also alter hydrologic cycles, sediment deposition, erosion, and

other ecosystem processes causing serious ecological damage. Saltcedar, a relatively new invader in Montana, impacts wetland and riparian areas by lowering water tables and changing soil properties. This reduces or eliminates surface water habitats required by native plants and animals. Saltcedar infestations also trap more sediment than stands of native vegetation, thus altering the shape, carrying capacity and flooding cycle of water courses (McDaniel et al. 2005).

VEGETATION

Invasive and noxious plants would continue to persist and expand on public and private lands within the planning area. Current data indicates that the average annual expansion is approximately 23% (BLM 2001). Vegetation would be impacted as this expansion of invasive species spreads across the landscape. Native and desirable vegetation would be replaced by invasive species and lead to altered plant communities composed of monocultures of single species or a mosaic of invasive species. This in turn would impact other resources. Riparian and wetland areas would see the most impact as these areas are usually the site of introduction of invasive species and the soils, water, and disturbances of these areas are conducive for invasion.

WILDLIFE

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. Leafy spurge reduced habitat utilization by bison (*Bos bison*), deer (*Odocoileus* spp.), and elk (*Cervus elaphus*) (Trammell and Butler 1995) in western North Dakota. Grasshopper sparrow (*Ammodramus savanarum*) and savannah sparrow (*Passerculus sandwichensis*) densities were lower on high (>60%) leafy spurge cover than on medium (20 to 60%) or low (0 to 20%) cover (Scheiman et al. 2003). Spotted knapweed was shown to influence elk and deer foraging behavior and population distribution in western Montana. Elk use increased an average of 266% after knapweed was removed from a winter range site (Thompson 1996). Although knapweed is common on most winter ranges in western Montana, studies indicate that the plant is not a major component of mule deer diet

Noxious weeds also impact small birds and mammals. Purple loosestrife, a weed that infests wetlands, was first reported in Montana in 1980 and by 2004 had been reported in 10 counties in the state but has been eradicated in seven of the 10 counties. The weed forms dense infestations that reduce desirable plants, such as cattails, that are preferred habitats for muskrats and long-billed marsh wrens. Waterfowl broods are also more susceptible to predation because dense stands of purple loosestrife reduce access from water to nesting sites (Brown 2005). Changes in bird species have been reported on sites dominated by non-native weed species such as leafy spurge. Russian knapweed has been shown to reduce small mammal populations (mice) by altering species diversity (Kurz 1995).

Special Status Species

Because treatments to prevent and reduce the rate at which noxious weeds supplant the native vegetation, negative indirect effects are expected. Allowing invasive plants to persist on public lands may indirectly affect populations of rare, threatened, or

endangered plants by providing a seed source for potential spread into habitats occupied and required by these species.

CULTURAL RESOURCES

This alternative does nothing to control the spread of weeds in the UMRBNM. This would result in the greater loss of biotic heritage resources. There is no impact to archeological and historic sites from application of herbicide, mechanical treatments, or burning. Site disturbance probability is low, based on no areas proposed for treatments. Indirectly this could create a greater concern due to the changing of vegetation from native species that would be available for collecting and use, to invasive species with no historic cultural benefit associated with this geographical area.

This alternative is based on treatment continuing at current levels. The continued spread of existing noxious weed populations and the establishment of new species that we currently experience are not likely to have an effect on non-biotic heritage resources. Mechanical treatments have a greater potential to disturb cultural sites than do biological or chemical control measures. The amount of acres with the potential to be affected is negligible. Mechanical treatment will take place on small sites in riparian areas where herbicides and vehicles are not appropriate. Of the known historic sites on the UMRBNM, none are located in areas of weed infestation proposed for that type of treatment. Mechanical treatment would have no effect on the qualities that make the sites eligible for the National Register of Historic Places

Recovery of communities dominated by invasive and noxious weeds would not be achieved; this alternative could prevent the expansion of existing weed populations, and could hinder new species and population centers from becoming established. This would prevent any further loss of biotic heritage resources to erosion.
Noxious weeds could affect these sites if the invasive weeds affect soil stability at the sites. Erosion has the potential to affect the spatial and temporal relation of artifacts, which can in turn reduce the significance and information potential of sites. Thus far, this has not been a problem at known cultural sites. If the spread of noxious weeds accelerates, or if noxious weed populations become established at known historic or prehistoric sites and the level of weed treatment remains at the current level, this could adversely affect heritage resources.

This alternative should have no effect on historic or prehistoric cultural resources, with the caveat identified in the previous paragraph.

SPECIAL MANAGEMENT AREAS

Noxious weeds are recognized as serious problems on lands managed for wilderness or wildland values by federal, state, and private entities in Montana. When weeds invade and expand into a wilderness environment, the “naturalness” of the area is degraded and scientific values of once biologically diverse landscapes are impaired. The unchecked spread will degrade and put at risk many of the objects (biological, geological, visual, historic and remote character) for which the area is being managed for.

RECREATION
Recreation sites are often infested due to the disturbance caused by repeated recreational use and the introduction of reproductive plant parts from users moving from infested sites to the recreation area. Invasive species in these areas would increase and in some instances may render the site unfit for recreational use.

PROPOSED ACTION

Direct and Indirect Impacts of the Proposed Action

SOIL AND GROUND WATER

Non-chemical Methods

Manual treatments may increase soil erosion on sites with moderate to steep slopes. Manual, grazing, or biological weed control activities would have no significant impact on ground water quality.

Mechanical tillage and mowing can result in increased sediment loading in water courses. These methods disturb vegetative cover and consequently increase soil movement. In some cases, tillage is used to control weeds in cropland. The BLM may also utilize tillage as a noxious weed management tool on very small areas of non-crop land. These will be reseeded to permanent vegetative cover as soon as feasible, so the risk of increasing sediment yield to streams from these treatments is limited. Riparian habitats may be affected by grazing animals if livestock use is not monitored.

Release of biological control agents would have no direct effect on surface water quality and fisheries. These biological control agents have a very specific food base and would not be competing with aquatic insect species. If the biological control agents effectively reduced the weed densities, the impact of noxious weeds on soil erosion would be reduced.

Treatment with Herbicides

Soils are an important part of the environmental analysis because of the interaction of soil characteristics and herbicides. Soil characteristics that are most important include percent organic matter, permeability, and texture. These three characteristics in combination with flooding hazard, depth to ground water, land use (irrigated vs dryland), and herbicide properties determine the potential for a herbicide to move through the soil profile and contact ground water.

The herbicides picloram, clopyralid, 2,4-D, dicamba, and metsulfuron methyl are considered mobile in the soil environment. Areas with relatively shallow water tables, unconsolidated sand and gravel materials, and rapid to moderately rapid
permeable soils containing little or no organic matter are highly susceptible to ground water degradation by herbicides. In shallow bedrock areas, herbicide laden water could potentially leach to bedrock, migrate along the bedrock surface, and arise downslope in off-target areas. Bedrock fissures could act as conduits to ground water movement.

On most upland range sites, soils retain almost all available moisture within the upper 2 feet of soil. Thus, there is little opportunity for herbicide leaching to occur. Several

studies have been conducted on the movement and persistence of picloram in soil and its potential for surface and ground water contamination. Results of these studies indicate that picloram applied at 1 pint per acre (recommended rate for knapweed control) moved to a maximum depth of 20 inches in 90 days. Thirteen percent of the herbicide remained in the soil 365 days following treatment. An application of picloram at 2 quarts per acre moved to a maximum depth of 40 inches in the soil. The highest concentrations of picloram were located in the upper foot of soil at both locations. Picloram was not found in either surface or groundwater resources at either site (Watson et. al., 1989).

Rice and co-researchers (1992) studied soil mobility of Tordon 22K (picloram), Transline (clopyralid), and Curtail (clopyralid + 2,4-D) on western Montana grassland and forest sites. Study results confirm that clopyralid and 2,4-D are less persistent than Tordon 22K. Clopyralid and 2,4-D were not detected at any time below a 10 inch soil depth. Tordon 22K was detected in the 10 to 20 inch soil strata within 30 days of spraying, but was not detected below 10 inches 1 or 2 years following application.

Results of these studies show that very little leaching occurs under dryland range and pasture conditions, indicating that herbicides proposed for use by the BLM can be safely applied on many sites without posing a risk to ground water resources. Weed management activities within riparian areas will be discussed later in this chapter. In general, aquatic labeled herbicides will be used near surface water and on shallow groundwater areas, and the use of low-persistent herbicides on steeply sloping sites will further mitigate risk of contaminating surface and ground water resources through runoff. Mechanical/manual and biological management methods will be used on sites with a high potential for groundwater contamination.

Herbicides have the potential to affect surface water quality and fisheries. They may enter surface water either through non-point sources such as spray drift, erosion of soil containing herbicides, ground water discharge, irrigation return flows, and surface runoff. Point source problems such as improper cleaning, mixing, loading activities, and accidental spills of herbicides can also enter surface water.

The potential for a herbicide to reach surface water through runoff is a function of herbicide characteristics, application rate, soil texture, slope, vegetation, the length of time between application and rainfall, and distance to the water. Picloram and 2,4-D have been reported to enter surface water through runoff. However, a study conducted by the EPA to measure runoff of picloram concluded that, under field conditions, it does not present a serious threat to water quality a short distance downstream from the application site (Evans and Duseja, 1974). Runoff potential of most other herbicides proposed for use should be similar or less than that of picloram. The strong adsorption characteristics of Roundup to soil particles makes it unlikely to reach ground or surface water through leaching, however, it may be detected in surface water if soil particles are moved into a watercourse during rainfall.

The use of any pesticide in a watershed requires careful consideration. The herbicides (2,4-D amine, dicamba, and picloram) proposed for use are characterized by relatively

low aquatic toxicity. Most weed infestations occur on infiltration-dominated, rather than runoff-dominated sites. Because rainfall (and herbicide) percolates into the soil, it is unlikely that herbicides will contact surface waters when applied to most sites.

Herbicide drift from spray applications may directly enter surface water. The amount of spray drift depends on the herbicide formulation, size of droplets, wind, and height above ground from which the spray is released. Drift is the greatest concern with aerial application. Risk can be mitigated by applying herbicides in wind speeds less than 10 mph.

VEGETATION

Proposed control activities are not expected to have a significant impact on vegetation. The use of selective herbicides such as picloram, dicamba, and 2,4-D may injure non-target broadleaf species on sites where weed control activities occur. However, since proposed control methods would reduce the spread of weeds, plant biodiversity would be enhanced and indirect effects would be positive.

In general, plants in the asteraceae (composite), fabaceae (legume), polygonaceae (buckwheat), and apiaceae (parsley) families will be affected by picloram. Dicamba and 2,4-D will affect these species, in addition to plants in the brassicaceae (mustard) family. Metsulfuron methyl will affect plants in the legume, composite, and mustard family, and clopyralid affect plants in the composite, legume, and buckwheat family. Application of these herbicides may reduce abundance of plants within these families especially within areas where higher herbicide rates are necessary to control persistent weeds such as leafy spurge and Russian knapweed

Direct impacts from proposed treatments to riparian communities should be negligible. Mechanical methods will not be used in riparian areas. Herbicide treatment of small satellite weed infestations may occur within these areas. Applications will be made with wick applicators or directed spray to the target weed to minimize damage to sensitive vegetation. Herbicides with a moderate to long half-life will not be used on these sites. Indirect effects from releasing insects and pathogens to control weeds in riparian areas are expected to be positive. The prevention and reduction of noxious weeds should enhance the functioning of riparian systems.

Grazing animals, such as sheep or goats, eat both weeds and desirable species. Both have been shown to selectively graze leafy spurge reducing seed production. Goats are likely to browse more heavily on shrubs that may provide important wildlife food and habitat within riparian areas. The level of management will determine impact of grazing animals on non-target species. Weed seeds can be spread to non-infested sites by adhering to grazing animals or passing through their digestive tract. Restricting livestock use in weed infested areas during seed ripening and dispersal will help reduce weed spread to uninfested sites.

By implementing IWM, populations of noxious and invasive plants would be contained to the area along the Missouri River where natural processes of flooding and ice jamming

would continue to spread and move these plants along the river. Noxious and invasive plant infestations through out the Monument would be aggressively treated using IWM principles. Cooperative management efforts would also impact infestations by allowing BLM to work with other affected interests in addressing entire infestations without administrative boundaries.

WILDLIFE

Non Chemical Methods

Mechanical treatments with machinery have the potential to destroy habitat, negatively impact ground-nesting birds and small mammals unable to avoid machinery. However, because mechanical methods generally are not used to control noxious plants on rangeland, wildlife should not be impacted.

Biological control involving sheep or goats may displace some wildlife during the treatment period and could reduce forage and cover. Sheep and goats will not be allowed within 15 miles of documented big horn sheep, to avoid spread of disease to wild populations. However this is not expected to be significantly different from other domestic livestock use. Other biological methods of weed control such as insects or pathogens would not significantly affect wildlife.

Weed control could also affect fish and other aquatic organisms if sedimentation were altered. Removal of vegetation may result in short-term increases in surface runoff and sediment transport to waterways. Generally, impacts would be small because targeted areas would represent only a small percentage of most watersheds.

Herbicide Treatments

Wildlife could be impacted from removal or reduction of vegetation that provides food or cover. Big game species such as elk, deer and antelope which eat broadleaf plants and shrubs as a large portion of their diets, could experience a reduction in preferred foods on lands where these species are reduced by herbicide applications. The potential for reduction in desirable forbs and browse is greater with herbicide applications on leafy spurge because of repeated applications of relatively high rates. Elk, which rely on grasses, would benefit from selective weed control measures because grasses are likely to increase after herbicide treatments. Wildlife habitat can also be improved by selective weed control methods by eliminating a weed monoculture and replacing it with a more diverse plant community.

Herbicides generally pose little risk to wildlife. This is expected because many species move away from herbicide operations, herbicides proposed for use do not persist in food chains, small areas of habitat (relative to total habitat available) are treated, and herbicides applied at recommended rates are non-lethal. Herbicide application could have slight impacts on fisheries if herbicides enter water sources either through drift, miss-application, or accidental spills.

Special Status Species

In general, proposed treatments are not expected to have any significant direct effects on wildlife species. Because the treatments are expected to prevent and reduce the rate at which noxious weeds supplant the native vegetation, positive indirect effects are expected.

CULTURAL RESOURCES

Mechanical treatments have a greater potential to disturb cultural sites than do biological or chemical control measures. Ground disturbance from hand pulling, clipping, and mowing is anticipated to be small, localized, and limited to areas already heavily disturbed.

With the increased acres proposed for mechanical treatment, the likelihood of impacting heritage resources is greater than in alternative 1, but still is relatively low. Activities that could have the greatest effect on cultural resources (burning, disking) would require cultural resource inventory prior to treatment implementation. Any potential effects could be mitigated by avoiding the cultural resource concerns.

This alternative should have no effect on historic or prehistoric cultural resources. Additionally, this alternative ensures continued use of native plants for traditional uses by preserving native plant communities and promoting their expansion.
While full recovery of communities dominated by invasive and noxious weeds may not be achieved, this alternative could prevent the expansion of existing weed populations, and could hinder new species and population centers from becoming established. This would prevent any further loss of biotic heritage resources to erosion.

This alternative should have no effect on historic or prehistoric cultural resources. Additionally, this alternative ensures continued use of native plants for traditional uses by preserving native plant communities.

Neither of the alternatives would affect known cultural resource sites within the analysis area. No traditional plant gathering areas have been identified within the boundaries of areas proposed for treatment. Conversely, with no treatment, the continued spread of weeds has the potential to displace any native vegetation traditionally gathered. Additionally, with the change in vegetative cover and reduced soil stability, the spread of noxious weeds has the potential to increase site erosion, affecting the integrity and stability of historic and prehistoric cultural sites.

SPECIAL MANAGEMENT AREAS

Characteristics for which the special management area was designated would be protected in some areas. In areas were invasive species would be present, management would decrease the impacts by decreasing the rate of spread. However, some management practices may impact the special characteristics of the area. BLM would follow the SOP's and mitigation measures developed in the Vegetation Treatment EIS and follow the Interim Management Policy and Guidelines for Lands Under Wilderness Review (BLM, 1995)were applicable.

RECREATION

In an extreme case, the potential for short term closure of a recreation site may be possible to allow for the effective treatment of an infestation. However, for the most part, the largest impact from treatments would be that a site would be closed and posted for 12 to 24 hours to comply with herbicide label re entry periods. The use of domestic livestock should not have any visible impact if managed correctly. Recreational users may notice scat left by animals used for weed control. This is unavoidable if this management technique is used. However, many of the sites are already grazed and experience this condition currently.

CUMULATIVE IMPACTS

Cumulative impacts are those impacts resulting from the incremental impact of an action when added to other past, present, or reasonably foreseeable actions regardless of what agency or person undertakes such other actions.

Integrated Weed Management Practices are implemented by the BLM have been conducted to the extent time and resources allowed since the mid 1980s. Although more emphasis was placed on IWM through the 1990's and into the 2000's, adequate resources have yet been available to meet the challenge of reducing invasive plant populations. Cooperation with county weed districts and private landowners have helped to address invasive species challenges on a broader level. Although management has been inadequate to prevent the spread of invasive species, the management actions have slowed their expansion and in localized areas been able to contain and eradicate certain species and infestations.

The use of herbicides on BLM lands since 2000 has been relatively consistent. This can be said generally about each county weed districts activities. There is no reasonable way to determine the use of herbicides by private individuals. There is little information available to determine the cumulative impact of repeated applications of herbicides across the planning area other than factors that are already monitored for rangeland and riparian health. Mitigations applied from the Vegetation Treatment EIS and the pesticide labels are designed to mitigate and avoid these perceived impacts. Foreseeable future use of herbicides should remain consistent unless resources and priorities change above the scope of this analysis.

Classical biological control has been used across the planning area by the BLM since the late 1980's, however, there may be some instances where local weed districts have made releases prior to that. This form of biological control impacts target plant species over a longer time span as they have to establish a viable population from a small number of individuals. Given time and supplemental population enhancements through continued releases, some areas have shown that biological control is a useful tool for invasive species management. These populations have yet been given adequate time to reach an equilibrium where the interaction between the plant and insect has stabilized. It is not known that when this equilibrium occurs if the plant population will be held under a tolerable threshold.

CHAPTER 4
PERSONS, GROUPS, AND AGENCIES CONSULTED

During preparation of the EA, the public was notified of the proposed action through a posting on the Lewistown Field Office NEPA Register on 12/28/2007.

Table 4.1. List of Persons, Agencies and Organizations Consulted

Name/Agency	Purpose & Authorities for Consultation or Coordination
Chouteau, Fergus, Blaine and Phillips County Weed Districts	Provided the BLM with County IWM plans to coordinate IWM activities
Montana Dept. of Agriculture	Review for adherence to the Montana Weed Management Plan

Table 4.2. List of Preparers

Name (and agency, if other than BLM)	Title	Responsible for the Following Section(s) of this Document
Josh Sorlie	**Soil Scientist**	**Soils**
Chad Krause	**Hydrologist**	**Surface & Ground Water, Riparian Vegetation**
Mitch Forsyth	**Rangeland Management Specialist**	**Vegetation**
Jody Peters	**Wildlife Biologist**	**Wildlife Habitat, T&E and Sensitive Species**
Jerry Majerus	**NEPA Coordinator**	**Overall Compliance w/ NEPA**
Zane Fulbright	**Archeologist**	**Cultural Resources/Native American Religious Concerns**

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Montana Weed Management Plan, 2005. Montana State Weed Summit Steering Committee.

Upper Missouri River Breaks National Monument: Guidelines for Integrated Weed Management, 2001. USDI Bureau of Land Management.

Vegetation Treatements on Bureau of Land Management Lands in 17 Western States Final Programmatic Environmental Impact Statement and Record of Decision, Sept. 2007. USDI – Bureau of Land Management.

APPENDICES

Appendix A – Vegetation Treatments on BLM Lands in 17 Western States Record of Decision

Appendix B – Upper Missouri River Breaks National Monument: Guidelines for Integrated Weed Management