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Programmatic Noxious Weed and Invasive Plant Management
Grand Staircase-Escalante National Monument

Location: The Grand Staircase-Escalante National Monument (GSENM) is located in south-central Utah. GSENM includes approximately 1.9 million acres of public land in Kane and Garfield Counties.

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Table of Contents

Page

Table of Contents

1.0 Purpose and Need 1
1.1 Introduction 1
1.2 Background 2
1.3 Purpose(s) of the Proposed Action 9
1.4 Need for the Proposed Action 10
1.5 Conformance with GSENM Management Plan 10
1.6 Relationship to Statutes, Regulations, or other Plans 12
1.7 Identification of Issues 15
2.0 Description of Alternatives 17
2.1 Introduction 17
2.2 Design Features Common to all Action Alternatives 17
2.3 Alternative A (Proposed Action) 20
2.4 Alternative B (No Action) 28
2.5 Alternative C (No Herbicide) 32
2.6 Alternatives Considered but Eliminated from Detailed Study 36
3.0 AFFECTED ENVIRONMENT 36
3.1 Introduction 36
3.2 General Setting 36
3.3 Resources 37
3.3.1 Water Resources 37
3.3.2 Hydrologic Condition 46
3.3.3 Fish and Wildlife Excluding USFW Designated Species 47
3.3.4 Threatened, Endangered or Candidate Animal Species 48
3.3.5 Threatened, Endangered or Candidate Plant Species 51

3.3.6 Vegetation 55
3.3.7 Soils 58
3.3.8 Air Quality 60
3.3.9 Flood Plains 60
3.3.10 Wild and Scenic Rivers 61
3.3.11 Fuels and Fire Management 62
3.3.12 Recreation 63
3.3.13 Livestock Grazing 65
3.3.14 Paleontology 66
3.3.15 Visual Resources 67
3.3.16 Lands with Wilderness Characteristics 69
3.3.17 Wilderness Study Areas 69
4.0 ENVIRONMENTAL IMPACTS 70
4.1 Introduction 70
4.2 General Analysis Assumptions and Guidelines 71
4.3 Direct and Indirect Impacts 71
4.3.1 Proposed Action – Herbicide use 71
4.3.1.1 Water Resources 71
4.3.1.2 Hydrologic Condition 74
4.3.1.3 Fish and Wildlife Excluding USFW Designated Species 74
4.3.1.4 Threatened, Endangered or Candidate Animal Species 76
4.3.1.5 Threatened, Endangered or Candidate Plant Species 76
4.3.1.6 Vegetation (includes Invasive, Noxious Weeds and Wetlands and Riparian) 80
4.3.1.7 Soils 88
4.3.1.8 Air Quality 89
4.3.1.9 Floodplains 90
4.3.1.10 Wild and Scenic Rivers 91
4.3.1.11 Fuels and Fire Management 91
4.3.1.12 Recreation 91
4.3.1.13 Livestock Grazing 92
4.3.1.14 Paleontology 93
4.3.1.15 Visuals 93

4.3.1.16 Lands with Wilderness Characteristics 95
4.3.1.17 Wilderness Study Areas 96
4.3.2. Alternative B – No Action.....97
4.3.2.1 Water Resources 97
4.3.2.2 Hydrologic Condition 98
4.3.2.3 Fish and Wildlife Excluding USFW Designated Species..... 98
4.3.2.4 Threatened, Endangered or Candidate Animal Species 98
4.3.2.5 Threatened, Endangered or Candidate Plant Species 99
4.3.2.6 Vegetation..... 99
4.3.2.7 Soils 100
4.3.2.8 Air Quality 100
4.3.2.9 Flood Plains 101
4.3.2.10 Wild and Scenic Rivers 101
4.3.2.11 Fuels and Fire Management 101
4.3.2.12 Recreation..... 101
4.3.2.13 Livestock Grazing 102
4.3.2.14 Paleontology 102
4.3.2.15 Visual Resources 103
4.3.2.16 Lands with Wilderness Characteristics 103
4.3.2.17 Wilderness Study Areas 103
4.3.3 Alternative C –No Herbicide Use 103
4.3.3.1 Water Resources..... 103
4.3.3.2 Hydrologic Condition 103
4.3.3.3 Fish and Wildlife Excluding USFW Designated Species..... 104
4.3.3.4 Threatened, Endangered or Candidate Animal Species 104
4.3.3.5 Threatened, Endangered or Candidate Plant Species 104
4.3.3.6 Vegetation..... 105
4.3.3.7 Soils 106
4.3.3.8 Air Quality 106
4.3.3.9 Flood Plains 106
4.3.3.10 Wild and Scenic Rivers 106
4.3.3.11 Fuels and Fire Management 106

4.3.3.12 Recreation 107
4.3.3.13 Livestock Grazing 107
4.3.3.14 Paleontology 107
4.3.3.15 Visual Resources 108
4.3.3.16 Lands with Wilderness Characteristics 108
4.3.3.17 Wilderness Study Areas 108
4.4 Cumulative Impacts Analysis 109
4.4.1 Water Resources 109
4.4.2 Hydrologic Condition 114
4.4.3 Fish and Wildlife Excluding USFW Designated Species 114
4.4.4 Threatened, Endangered or Candidate Animal Species 117
4.4.5 Threatened, Endangered or Candidate Plant Species 118
4.4.6 Vegetation 119
4.4.7 Soils 121
4.4.8 Air Quality 125
4.4.9 Flood Plains 129
4.4.10 Wild and Scenic Rivers 129
4.4.11 Fuels and Fire Management 130
4.4.12 Recreation 131
4.4.13 Livestock Grazing 131
4.4.14 Paleontology 132
4.4.15 Visual Resources 132
4.4.16 Lands with Wilderness Characteristics 132
4.4.17 Wilderness Study Areas 133
5.0 CONSULTATION AND COORDINATION 134
5.1 Introduction 134
5.2 Summary of Public Participation ..... **Error! Bookmark not defined.**
5.2.1, 2, 3 Comment Analysis, Commenters, Response to Public Comment .... **Error! Bookmark not defined.**
5.3 List of Preparers 156
6.0 REFERENCES, GLOSSARY AND ACRONYMS 157
6.1 References Cited 157
APPENDICES 166

APPENDIX A: Interdisciplinary Team Checklist 166
APPENDIX B 171
Appendix B-1: Prevention Measures 171
Appendix B-2: Standard Operating Procedures 174
Appendix B-3: Vegetation Treatment Standard Operating Procedures and Guidelines 183
Appendix B-4: Mitigation Measures 197
Conservation Measures for Plants (BLM 2007d) 201
Conservation Measures for Aquatic Animals (BLM 2007d) 209
Conservation Measures for Terrestrial Animals (BLM 2007d) 215
APPENDIX C Non-native plant species for GSENM 225
APPENDIX D Escalante River Watershed monitoring methods 228

Programmatic Noxious Weed and Invasive Plant Management

Grand Staircase Escalante National Monument

DOI-BLM-0300-2011-0009-EA

1.0 PURPOSE AND NEED

1.1 Introduction

This Environmental Assessment (EA) has been prepared to disclose and analyze the environmental consequences of noxious weed and invasive plant management as proposed by GSENM. The discussion and analysis focusses on Utah State listed noxious weeds and invasive plants, as well as invasive plants of particular concern in riparian areas such as tamarisk and Russian olive. This EA considers the use of all BLM approved pesticides (2,4-D, bromacil, chlorsulfuron, clopyralid, dicamba, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, sulfometuron, methyl, tebuthiuron, and triclopyr), including new approved chemicals (imazapic, diquat, diflufenzopyr [in formulation with dicamba], and fluridone) and will incorporate those that may be approved by the BLM in the future such as diflufenzopyr as a stand-alone active ingredient if it becomes registered by the USEPA under FIFRA. This EA documents the analysis and discloses impacts that are predicted to occur as a result of implementing the proposed action or an alternative to the proposed action. This EA assists the BLM in project planning and ensuring compliance with the National Environmental Policy Act (NEPA). The project area includes all public lands within GSENM; these lands are within Garfield and Kane Counties.

Grand Staircase-Escalante National Monument (GSENM) covers about 1,870,800 acres on the Colorado Plateau in Garfield and Kane Counties of Utah (see attached map). Approximately 68 percent of the Monument is in Kane County, while the remaining 32 percent is in Garfield County. The Monument is primarily surrounded by other federal lands. Dixie National Forest borders the Monument to the north, Capitol Reef National Park to the east, Glen Canyon National Recreation Area to the east and southeast, Bryce Canyon National Park to the northwest, and other Bureau of Land Management administered lands to the south and west. Elevation ranges from 3840 feet in Little Valley Canyon to 8612 feet near Canaan Peak.

The climate in the Monument is classified as semiarid. Annual precipitation ranges from 13 inches in the Grand Staircase physiographic region to about 8 inches in the lower Escalante Desert. The area experiences a bimodal precipitation pattern with peaks in the summer and winter. The highest moisture received during one year was 24.75 inches recorded at the Nephi Pasture rain gauge in 1980 and the lowest recording of 1.56 inches was at the Croton rain gauge in 2000.

The Monument encompasses portions of four broad hydrologic subbasins, all of which are part of the Colorado River system. The Escalante River system flows from the Aquarius Plateau and Boulder Mountain into the central portions of Lake Powell. Last Chance Creek and Wahweap Creek are the principal tributaries off the Kaiparowits Plateau, flowing into the lower portion of Lake Powell. The Paria River Subbasin (including Hackberry Creek and Cottonwood Creek) extends from the Bryce Canyon-Bryce Valley area, terminating below Glen Canyon Dam near Lee's Ferry. The Escalante and Paria River drainages cover much of GSENM and are the major perennial flowing waters.

1.2 Background

Noxious weeds and invasive plants are compromising the ability to manage BLM lands for a healthy native ecosystem. Noxious weeds and invasive plants are defined as a plant whose existence does or is likely to cause economic or environmental harm or harm to human health (see definition in Executive Order 13112). Invasive plants are specifically defined as "non-native plants whose introduction does or is likely to cause economic or environmental harm or harm to human health." EXECUTIVE ORDER 1311 INVASIVE SPECIES (1999) - 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. Noxious weeds and invasive plants can cause environmental and other effects which are harmful to native ecosystem processes, including: displacement of native plants; reduction in functionality of habitat and forage for wildlife and livestock; increased potential for soil erosion and reduced water quality; alteration of physical and biological properties of soil; loss of long-term riparian area function; loss of habitat for culturally significant plants; high economic cost of control; and increased cost of keeping systems and recreational sites free of these undesirable species.

Integrated Weed Management

The BLM treats vegetation using an integrated vegetation management program, each management option is considered, recognizing that no one management option is a stand-alone option and that each has its own strengths and weakness. Utilizing the strengths of each allows for a more effective and environmentally sound program. When the BLM plans vegetation control management projects, all control methods should be available for use, allowing the BLM to select the one method, or the combination of methods, that optimizes vegetation control with respect to environmental concerns, effectiveness, and cost of control. No individual method will control undesirable vegetation in a single treatment; diligence and persistence will be required over a number of years to subdue vegetation such as weeds. The success of different treatment methods depends on the type of vegetation being controlled.

Integrated weed management methods for noxious weed and invasive plant control that will be analyzed in this EA include the following:

Chemical - Herbicides are chemicals that kill or injure plants. Herbicides can be categorized as selective or non-selective. Selective herbicides kill only a specific type of plant, such as broad-leaved plants, while non-selective herbicides kill all types of plants.

Manual (or Physical) - Manual treatment involves the use of hand tools and hand-operated power tools to cut, clear, or prune herbaceous and woody species. Treatments include cutting undesired plants above the ground level; pulling, grubbing, or digging out root systems of undesired plants to prevent sprouting and re-growth; cutting at the ground level or removing competing plants around desired species; or placing mulch around desired vegetation to limit competitive growth.

Biological - Biological control involves the intentional use of domestic animals, insects, nematodes, mites, or pathogens (agents such as bacteria or fungus that can cause diseases in plants) that weaken or destroy vegetation. Biological control is used to reduce the targeted weed population to an acceptable level by stressing target plants and reducing competition with the desired plant species.

Mechanical - Mechanical treatment involves the use of vehicles such as wheeled tractors, crawler-type tractors, or specially designed vehicles with attached implements designed to cut, uproot, or chop existing vegetation. The selection of a particular mechanical method is based upon characteristics of the vegetation, seedbed preparation and re-vegetation needs, topography and terrain, soil characteristics, climatic conditions, and an analysis of the improvement cost compared to the expected productivity (USDI, BLM, 1991a).

Mechanical methods that may be used by BLM include chaining, root plowing, tilling and drill seeding, mowing, roller chopping and cutting, blading, grubbing, and feller-bunching. As new technologies or techniques are developed, they could be used if their impacts are similar or less than existing methods.

Treatment Focus - The focus for treatment is on Utah State listed noxious weeds and invasive plants, as well as invasive plants of particular concern in riparian areas such as tamarisk and Russian olive.

Utah currently has 27 different species of weeds that are designated noxious by the Utah Department of Agriculture (see Table 1). These plants are designated into three classes of noxious weeds: Class A (EDRR), Class B (Control), and Class C (Containment):

Class A - Early Detection Rapid Response (EDRR) declared noxious weeds are not native to the State of Utah and pose a serious threat to the state. They should be considered as a very high priority for treatment.

Class B - Control declared noxious weeds are not native to the State of Utah. They pose a threat to the state and should be considered a high priority for control.

Class C - Containment) declared noxious weeds are not native to the State of Utah. These weeds are widely spread and pose a threat to the agricultural industry and agricultural products. These weeds should be treated with a focus on stopping expansion.

The intent of the designation of certain weeds into the EDRR category is that reaction to their discovery within the State will be swift and aggressive. The Utah Department of Agriculture has also identified several invasive plant species; however, these species are not included on the State Noxious Weed list (see Table 2). These invasive plant species have all been classified as EDRR.

Table 1: Utah State Noxious Weed List

Class A - Early Detection Rapid Response	**Class B - Control**	**Class C -Contain**
Black henbane (*Hyoseyamus niger)*	Bermudagrass (*Cynodon dactylon*)	Field Bindweed (*Convolvulus arvensis*)
Diffuse Knapweed (*Centaurea diffuse)*	Perennial Pepperweed (*Lepidium latifolium*)	Hound's Tongue (*Cynoglossum officinale*)
Leafy Spurge (*Euphorbia esula*)	Dalmatian Toadflax (*Linaria dalmatica*)	Canada Thistle
Medusahead (*Taeniatherum caput-medusae*)	Dyer's Woad (*Isatis tinctoria*)	Saltcedar (*Tamarix* spp.)
Oxeye daisy (*Chrysanthemum leucanthemum*)	Hoary cress (*Cardaria draba*)	Quackgrass (*Elytrigia repens*)
Perennial Sorghum spp. Not Limited to: Johnson Grass (*Sorghum halepense*, *Sorghum Almum*)	Musk Thistle (*Carduus nutans*)	
Purple Loosestrife (*Lythrum salicaria*)	Poison Hemlock (*Conium maculatum*)	
Spotted Knapweed (*(Centaurea maculosa*	Russian Knapweed (*Acroptilon repens*)	
St. Johnswort (*Hypericum perforatum*)	Scotch Thistle (*Onopordium acanthium*)	

Class A - Early Detection Rapid Response	**Class B - Control**	**Class C -Contain**
Sulfur cinquefoil (*Potentilla recta*)	Squarrose knapweed (*Centaurea squarrosa*)	
Yellow Starthistle (*Centaurea solstitialis*)		
Yellow Toadflax (*Linaria vulgaris*)		

Table 2: Invasive Species identified by the Utah Department of Agriculture and Food

Class A - Early Detection Rapid Response		
Common crupina (*Crupina vulgaris*)	African rue (P*eganum harmala*)	African mustard (*Brassica tournefortii*)
Small bugloss (*Anchusa arvensis*)	Mediterraniean sage (*Salvia aethiopis*)	Spring millet (*Milium vernale*)
Syrian beancaper (*Zygophyllum fabago*)	Scotch broom (*Cytisus scoparius*)	Plumeless thistle (*Carduus acanthoides*)
Malta Starthistle (*Centaurea melitensis*)	Camelthorn (*Alhagi maurorum*)	Garlic Mustard (*Alliaria petiolata*)
Purple Starthistle (*Centaurea calcitrapa*)	Goatsrue (*Galega officinalis*)	Giant red (*Arundo donax*)
Japanese knotweed (*Polygonum cuspidatum*)	Oxeye daisy (*Leucanthemum vulgare*)	Vipers bugloss, blueweed (*Echium vulgare*)
Elongated mustard (*Brassica elongate*)	Common St. Johnswort (*Hypericum perforatum*)	Sulfur cinquefoil (*Potentilla rect*a)

Figure 1. Overview of project area

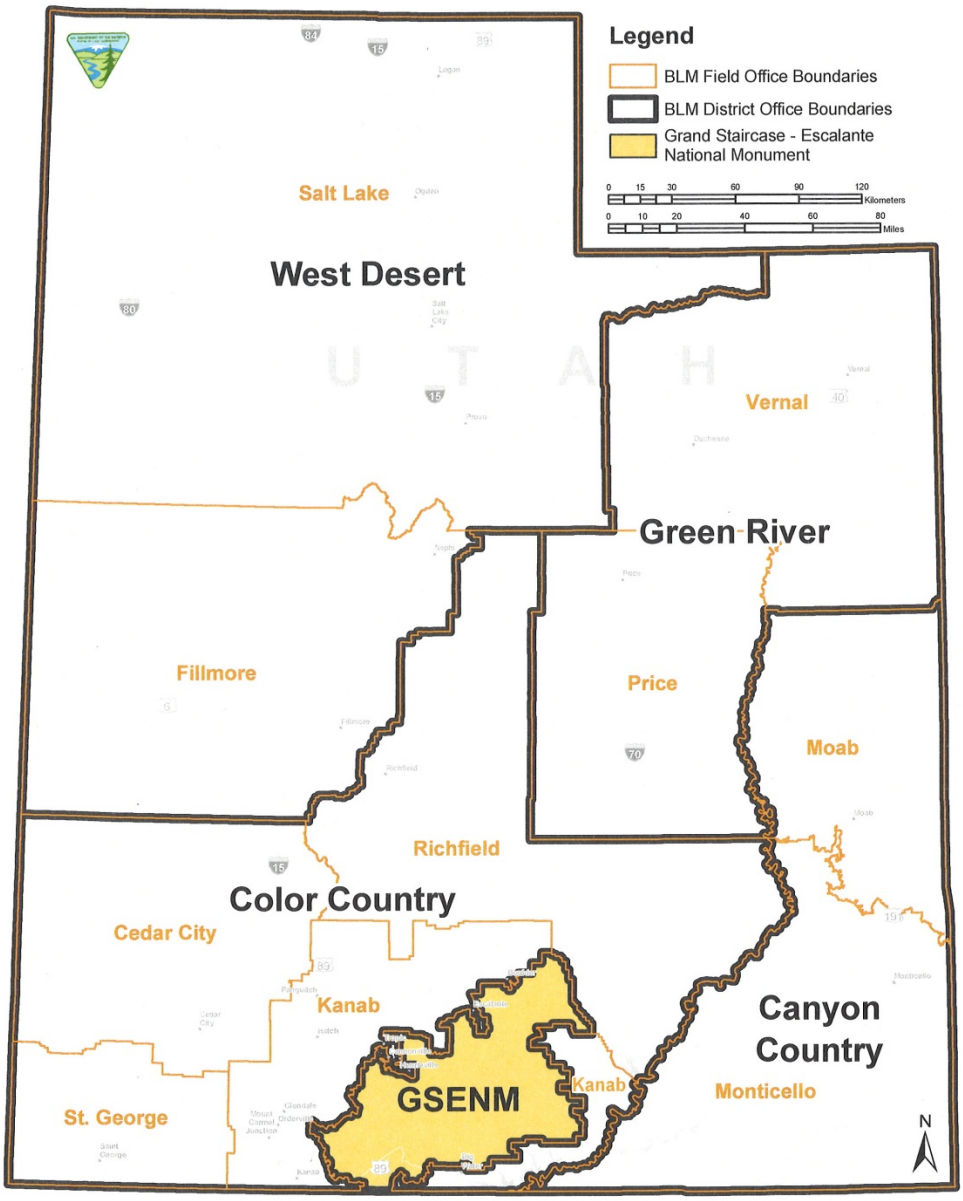


Figure 2 Grand Staircase Escalante National Monument

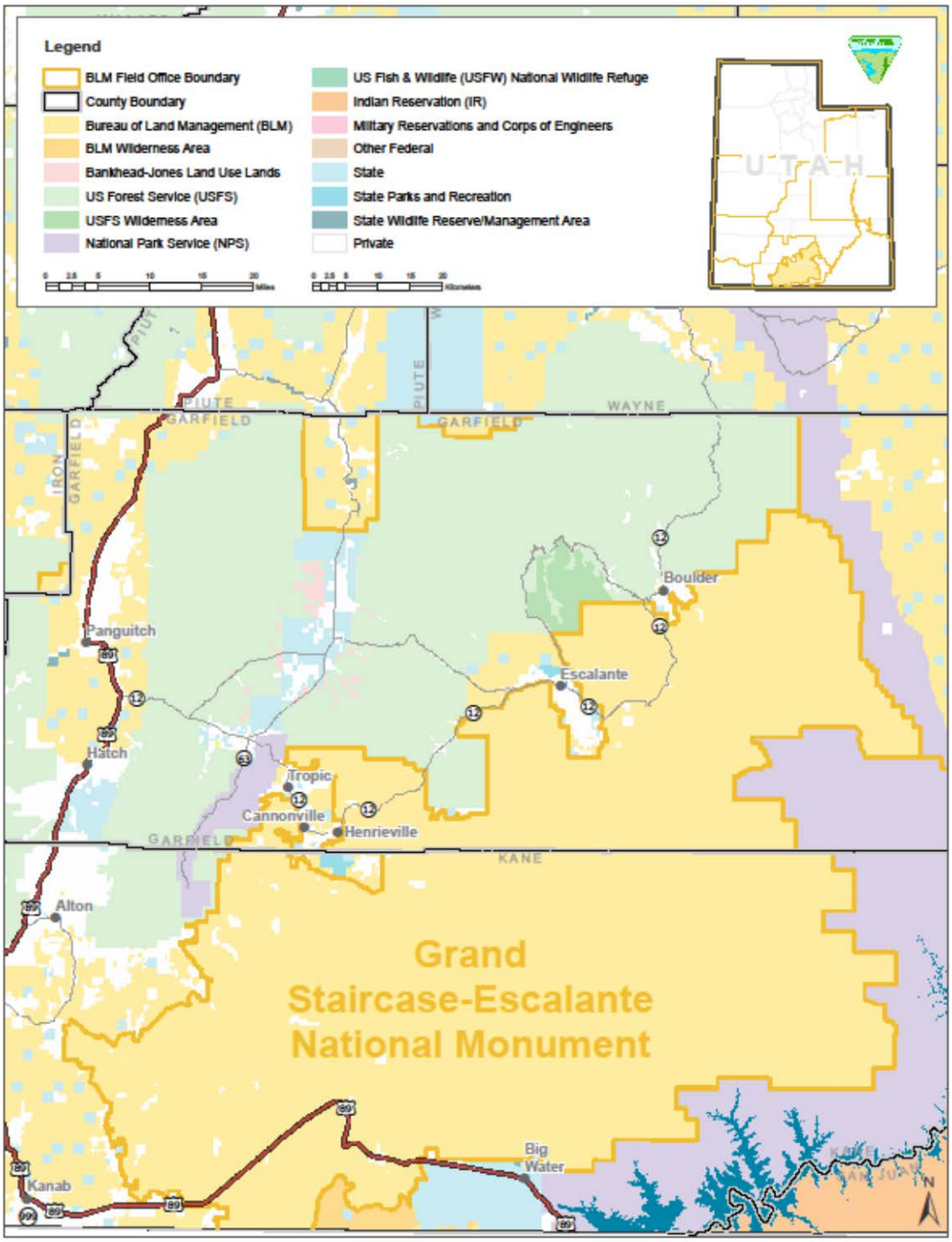
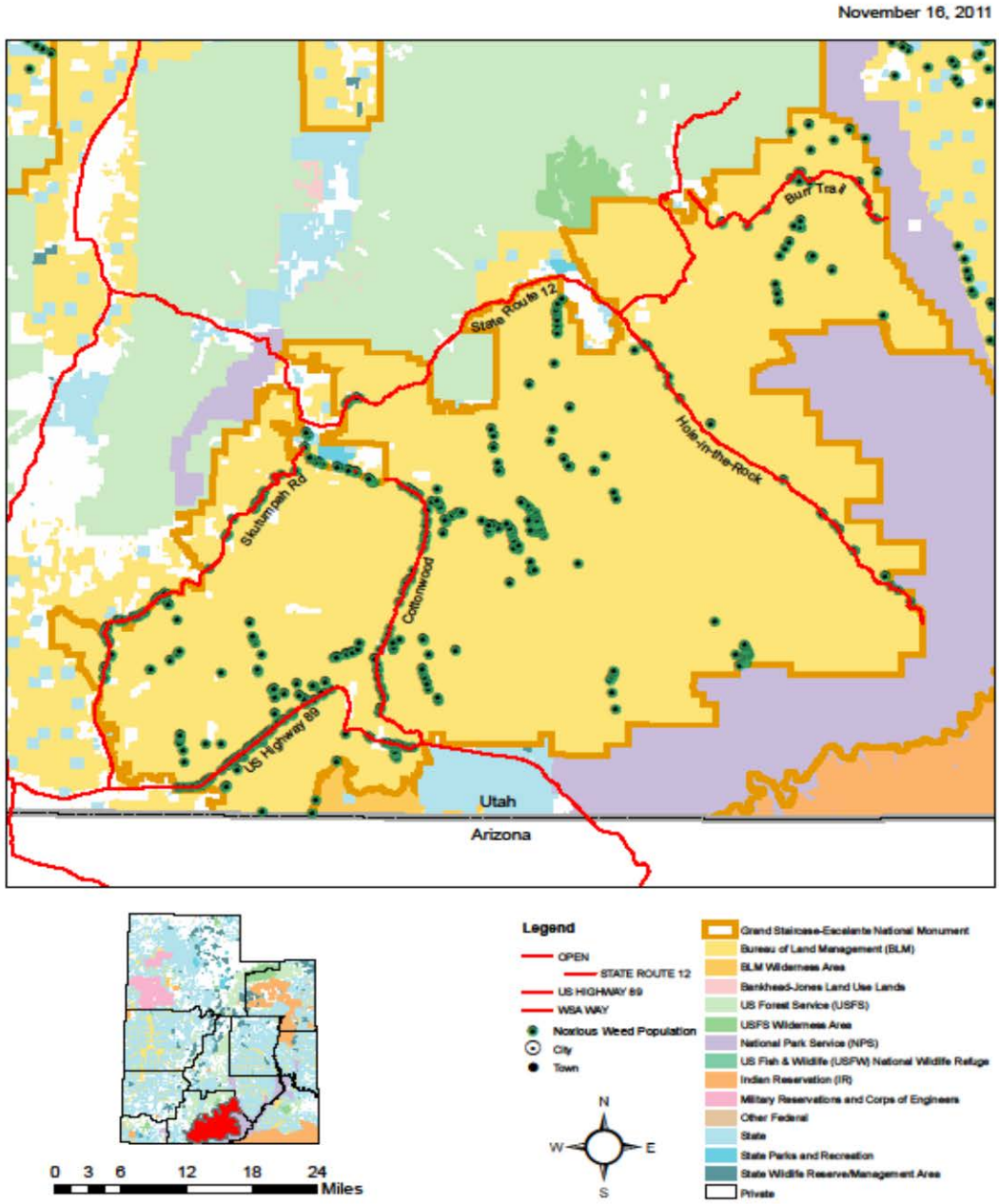


Figure 3 Noxious weed infestation map



1.3 Purpose of the Proposed Action

The purpose of this proposal is to update and implement a Noxious Weed and Invasive Plant Management Plan (IPM Plan) based on integrated weed and pest management principles to address the introduction and spread of invasive plants and noxious weeds. The current treatment focus is on Utah State listed noxious weeds and invasives (see Tables 1 and 2) as well as two invasives that pose a particular threat to riparian areas on the Monument, Russian olive and Tamarisk. The purpose of integrated weed and pest management is to improve ecosystem health by manipulating vegetation to enhance native plant communities, improve riparian and wetland areas, and improve water quality. Increased use of public land has contributed to introduction and spread of noxious weeds and invasive plants that are replacing native vegetation. Left unchecked, noxious weeds and invasive plants can create monocultures that degrade or reduce soil productivity, water quality and quantity, native plant communities, wildlife habitat, wilderness values, recreational opportunities, and livestock forage (BLM 2007a). The updated IPM Plan will incorporate guidance from the 2007 Programmatic Environmental Impact Statement (PEIS) for Vegetation Treatments Using Herbicides and the 2007 Programmatic Environmental Report.

The primary focus is on state listed noxious weeds (see Table 1) and potential new invaders identified as part of the Early Detection Rapid Response Program. Controlling other invasive species that cause management problems related to livestock, wildlife, fuels/fire hazard, and human activities is an important secondary focus. The primary objective is to provide methods for noxious weed and invasive plant treatment on public lands within GSENM and to describe the conditions and limitations that apply to their use. The purpose of this proposal is to achieve the following:

1. Update the GSENM management strategy for controlling noxious weeds and invasive plant species by formalizing the use of an Integrated Pest Management approach to weed control efforts in the Monument. This approach will incorporate appropriate standard operating procedures, conservation measures, mitigation measures, and prevention measures.

2. Allow the BLM to work more efficiently using integrated pest management techniques to prevent, control, and eradicate weed species. The following actions comprise the proposed Invasive Plant Management Plan:

    a. Prevention of weed establishment and weed expansion
    b. Education and Public Awareness of weed related issues and prevention measures
    c. Early Detection Rapid Response for new invaders and new infestations
    d. Control and/or containment of existing populations

e. Reclamation of disturbed or degraded sites
f. Inventory and monitoring of weed populations and treatment effectiveness

3. Update the list of herbicides and adjuvants to be used within the GSENM.

1.4 Need for the Proposed Action

The need for the proposed action is to enable GSENM to implement an integrated weed management program that utilizes methodologies and materials available to control, contain, and/or eradicate noxious weeds and invasive plants (i.e., mechanical, manual, biological, chemical, and fire). An integrated weed management program would be tiered to the Final Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement (PEIS; BLM 2007a) and the Final Vegetation Treatments on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Report (PER; BLM 2007b). This would allow managers to address new conditions that have arisen since the prior analysis documented in the Final EIS for Vegetation Treatments on BLM Lands in Thirteen Western States (BLM 1991).

Currently 18,955 acres of the ~1,900,000 acre project area have been inventoried for weed infestation. Of that acreage approximately 3,443 acres were found to contain noxious weed or invasive plant populations (~2% of the Monument; 18% of the inventoried area); this acreage does not include areas infested with cheatgrass, tamarisk, Russian olive. However, most of GSENM has not been inventoried for noxious weeds and invasive plant species; thus, the actual number of acres infested and likely needing treatment has not yet been established.

1.5 Conformance with GSENM Management Plan

The proposed action is in conformance with the Grand Staircase-Escalante National Monument Management Plan (MMP) (BLM 2000). The MMP includes a goal for vegetation that indicates "... the Monument will be managed to achieve a natural range of native plant associations." To help achieve this goal, the MMP notes that "A variety of vegetation restoration methods may be used to restore and promote a natural range of native plant associations in the Monument." The MMP includes the following plan decisions related specifically to noxious weed control:

NW-1 - The BLM will control noxious weeds in accordance with National and State policies and directives. Control of noxious weeds is also a priority to achieve the overall vegetation objectives stated.

NW-2 -Projects will be designed in conjunction with Kane and Garfield Counties and adjacent U.S. Forest Service and National Park Service Staffs. With this strategy the

BLM hopes to control noxious weed species and prevent introduction of new invasive species into the Monument and surrounding ecosystems.

NW-3 - An array of methods will be used as appropriate for the control of specific noxious weed species. These methods include: the use of chemicals (aerial spraying, hand spraying, and painting), hand cutting, biological control agents, and manual pulling. Each of these methods has a place in the control of these invasive species and will be evaluated for their effectiveness as eradication projects are designed.

NW-4 - BLM employees or contractors with appropriate certification will be responsible for the use of these chemicals and will take precautions to prevent possible effects to non-target plant species.

NW-5 - Aerial chemical applications may only be used in limited circumstances where:

- accessibility is so restricted that no other alternative means is available,
- it can be demonstrated that non-target sensitive species or other Monument resources will not be detrimentally affected, and
- noxious weeds are presenting a significant threat to monument resources.

NW-6 - The noxious weed control program will target species in a prioritized manner. Priorities for weed control may include: invasiveness of the species, extent of invasion, sensitivity of the area being invaded, and accessibility. Areas with special status species habitat will have a priority for weed removal. Project level environmental assessments or other NEPA analysis will be completed prior to noxious weed removal project initiation.

NW-7 - In addition to strategies for control of established noxious weeds, it is also imperative to reduce the introduction of noxious weed species as stated in Presidential Executive Order (EO 11312) on invasive species. Cooperative programs established for control of these species will also help identify potential new invasions before area-wide establishment has occurred. There are two policies which will help to reduce potential noxious weed introduction.

- First, the BLM requires all hay used on BLM lands be certified weed free. This is a statewide policy which applies to the Monument, as well as all other BLM lands in the State of Utah.
- Second is the requirement that all machinery that has been outside the Monument be cleaned prior to use on the Monument. This provision generally applies to contract equipment used for projects such as construction of facilities and firefighting equipment. Both of these provisions will help reduce the introduction and spread of noxious weed species in the Monument.

NW-8 - For major removal projects, monitoring plots will be established in key areas to determine effectiveness of methods and presence of noxious weed species. All projects will contain restoration and /or revegetation protocols to minimize re-

colonization of treated areas by noxious weed species. Monitoring in these areas will be part of the adaptive management framework described in Chapter 3.

In addition to the specific decisions listed above, the MMP also includes numerous other decisions that encourage or target control of noxious weeds and invasive species and the type of actions that may be taken. Some of these other decisions include:

VEG-1 - The BLM will place a priority on the control of noxious weed species and prevent the introduction of new invasive species in conjunction with Kane and Garfield Counties and the adjacent U.S. Forest Service and National Park Service units.

RIPA-6 - The noxious weed control program will target invasive species such as tamarisk and Russian olive, which will improve riparian functioning condition.

1.6 Relationship to Statutes, Regulations, or other Plans

Several Federal laws direct the BLM to manage noxious weeds, invasive plants, and other vegetation to improve ecosystem health. Section 302(b) of the Federal Land Policy and Management Act of 1976 directs BLM to "take any action necessary to prevent unnecessary or undue degradation of the lands" (43 U.S.C. § 1732(b)(2)). The Carlson-Foley Act of 1968 (43 U.S.C. §§ 1241-1243) and the Plant Protection Act of 2000 (7 U.S.C. § 7702), authorize 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 (7 U.S.C. § 2814(a)) established a program to manage undesirable plants, implemented cooperative agreements with State agencies, and established integrated management systems to control undesirable plant species.

Other statutes, regulations, policies, and plans also provide direction or guidance for managing noxious weeds and invasive plants. The following laws, plans, manuals, and policies provide a foundation for noxious weed management; this list is not intended to be all-inclusive.

The *Proclamation for the Grand Staircase-Escalante National Monument (1996)* established the Grand Staircase-Escalante National Monument for the purpose of protecting the objects identified.

The *Federal Land Policy and Management Act (1976)* (FLPMA) directs the BLM to manage public lands "in a manner that will protect the quality of scientific, scenic, historic, ecological, environmental, air and atmospheric, water resources and archeological values" and to "take any action necessary to prevent unnecessary and undue degradation of public land."

The *Carson-Foley Act of 1968* (Public Law 90-583), and the *Plant Protection Act of 2000* (Public Law 106-224.) authorize and direct the BLM to manage noxious weeds (including management of undesirable plants on federal lands) 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* (Public Law 93-629), *as amended by Section 15, Management of Undesirable Plants on Federal Lands, 1990*, authorizes the Secretary "...to cooperate with other federal and state agencies and others in carrying out operations or measures to eradicate, suppress, control, prevent, or retard the spread of any noxious weed." This Act 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 *Public Rangelands Improvement Act of 1978* (Public Law 95-514) requires that BLM manage, maintain, and improve the condition of the public rangelands so that they become as productive as feasible.

The *Noxious Weed Control and Eradication Act of 2004* (Public Law 108–412) 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 *Clean Water Act (1987)* regulates discharges into waters of the United States, including wetlands. As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Based on a recent ruling by the USEPA (2006), an NPDES permit is not required for applications of herbicides directly to water in order to control aquatic vegetation, or for application of herbicides that are present over or near water, where a portion of the herbicide will unavoidably be deposited to the water in order to target the pest vegetation. The ruling does not apply to terrestrial herbicide applications that drift over and into waters of the U.S.; issues related to these applications are under review by the United States Environmental Protection Agency (USEPA).

The *Clean Air Act*, as revised in 1990, primarily governs prescribed fire smoke emissions, and requires the USEPA and states to carry out programs to assure attainment of the National Ambient Air Quality Standards (NAAQS).

The *Endangered Species Act (1973)* provides for conserving endangered and threatened species of plants and animals. The Endangered Species Act requires that federal agencies consult with the U.S. Fish and Wildlife Service to ensure that any actions that they authorize, fund, or carry out are not likely to jeopardize the continued survival of a listed species or result in the adverse modification or destruction of its critical habitat.

In February 1999, the President issued *Executive Order 13112* on invasive species. This Executive Order requires 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."

BLM Manual 6220- National Monuments, National Conservation Areas, and Similar Designations (2012) provide guidance for managing BLM public lands that are components of the BLM's National Landscape Conservation System such as GSENM. Site-specific activities in Monuments will be managed in a manner that is compatible with the protection of the objects for which the area was designated.

BLM *Integrated Vegetation Management Handbook (H-1740-2) (2008)* provides guidance on the role of Integrated Pest Management (IPM) in achieving vegetation management objectives.

The *Vegetation Treatments Using Herbicides Final Programmatic EIS Record of Decision (BLM, 2007c)* approved the herbicide active ingredients assessed and analyzed under the Preferred Alternative (Alternative B) in the PEIS for use on public lands administered by the BLM in 17 western states, including Alaska. The decision also included standard operating procedures (SOPs) and mitigation measures to ensure that the natural and human environment is protected during implementation of herbicide treatments.

The *Final Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western State Programmatic Environmental Impact Statement (BLM, 2007a)* analyzes the effects of herbicide use on humans, plants, and animals and other environmental and social resources associated with public lands. The PEIS also provides a broad, comprehensive background source of information to which subsequent environmental analyses can be tiered. This analysis tiers to the PEIS; however, it focuses on impacts of methods and options for use in GSENM.

The *Vegetation Treatments on BLM Lands in Western U.S Programmatic Environmental Report (BLM, 2007b)* assesses vegetation treatment activities on public lands and evaluates the effects of non-herbicide vegetation treatments. This Programmatic Report will be referenced in this EA to address the effects of using non-herbicide treatment methods, including mechanical, manual, biological control methods, and debris management through prescribed fire.

Federal Insecticide, Fungicide, and Rodenticide Act (EPA) 1947
The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) provides for federal regulation of pesticide distribution, sale, and use. All pesticides distributed or sold in the United States must be registered (licensed) by EPA. Before EPA may register a pesticide under FIFRA, the applicant must show, among other things, that using the

pesticide according to specifications "will not generally cause unreasonable adverse effects on the environment.''

The *Garfield County General Management Plan (2007)* identifies a desired condition to eradicate tamarisk and Russian olive on federal, state, and local lands.

The *Kane County, Utah Resource Management Plan (2014)* indicates that federal agencies should participate in cooperative weed management in the county. The plan states "Early detection and control of noxious weed and insect infestations are essential to the public health, welfare and economy of the citizens of the county. Neither the county, nor the public land managers can be successful in controlling noxious weeds without joint coordination."

1.7 Identification of Issues

A scoping letter was mailed on March 9, 2012 to the public, soliciting comments for this EA. The scoping period ended on April 9, 2012. The proposed action was posted on the Utah BLM Environmental Notification Bulletin Board (ENBB) website for public review on March 9, 2012. Seven comment letters were received.

On February 26, 2013, GSENM employees met to discuss the development of an EA for the proposed action. Based on internal scoping and public comment letters, staff identified the following issues to be addressed in the EA.

Human Health and Safety are considered in all proposed alternatives. Standard Operating Procedures and Mitigation Measures in Appendix B outline the actions which will be taken to actively reduce or eliminate any risks to human and environmental safety.

The following issues are relevant to the noxious weed and invasive plant program in GSENM:

Water Resources
How will water quality and aquatic resources be protected? What mitigation measures and best management practices will be employed to limit adverse effects on water quality?
How will herbicides affect the use of untreated surface water for drinking? What are the public health risks associated with drinking water that may have been exposed to herbicides? What is the potential for herbicide contamination of groundwater that is or could be used as a domestic or municipal drinking water source?

Hydrologic Conditions

What mitigation measures and best management practices will be employed to limit adverse effects on hydrology?

Fish and Wildlife Excluding Threatened and Endangered Species
How will BLM protect fish and wildlife from possible exposure to herbicides and removal activities?

Threatened, Endangered or Candidate Animal Species
What will be done to protect occupied, potential and critical habitat for T&E and Candidate animal species?

Threatened, Endangered or Candidate Plant Species
How will BLM protect T&E, and Candidate plant species from herbicide exposure?
What will be done to protect these plant species from ground disturbing activities?

Vegetation
How will treatments impact vegetation, target and non-target plant species in upland and riparian areas.

Soil
How will soil resources be protected? What mitigation measures and best management practices will be employed to limit adverse effects on soils?

Air Quality
How will air quality be protected? What mitigation measures and best management practices will be employed to limit adverse effects on air quality?

Floodplains
How will floodplains be protected? What mitigation measures and best management practices will be employed to limit adverse effects on floodplains?

Wild and Scenic River
How will Wild and Scenic Rivers be protected?

Fuels and Fire Management
Will removal of species such as tamarisk and Russian olive increase fuel for fires?

Recreation
How will visitors be notified of projects to reduce conflicts?
What will BLM do to protect visitors from potential exposure to herbicides?

Livestock Grazing
Treatments, whatever the method used, would be temporary actions that have the potential to affect livestock grazing depending on location, timing, and method type.

Paleontology
How will Paleontological resources be protected from ground disturbing activities?

Visual Resources
How will removal of non-native vegetation affect the character of a landscape?

Lands with Wilderness Characteristics
How will lands with wilderness characteristics be protected?

Wilderness Study Areas
How will Wilderness Study Areas be protected?

2.0 DESCRIPTION OF ALTERNATIVES

2.1 Introduction

This chapter describes the alternatives analyzed in detail and alternatives considered but eliminated from detailed study. GSENM is analyzing three alternatives: the Proposed Action, a No Action alternative, and a No Herbicide Use alternative.

2.2 Design Features Common to all Action Alternatives

In 2007, the BLM identified standard operating procedures (SOPs) that must be used with all applications of herbicides; these SOPs were included in Appendix B of the Record of Decision for the Vegetation Treatments Using Herbicides Final Programmatic EIS. These SOPs ensure that risks to human health and the environment from herbicide treatment actions are kept to a minimum. The BLM also identified prevention measures to minimize the amount of non-target vegetation that is disturbed during noxious weed and invasive plant treatments. These SOPs and prevention measures are included in Appendix B of this EA.

Health and Safety

- All herbicide application in Alternatives A and B will follow label direction which takes into account health and safety issues.
- When applying herbicide in proximity to water sources use aquatic active ingredients according to label instructions.
- Sign areas of high use (trail heads, camp grounds, etc.) prior to herbicide application
- Follow SOPs, Mitigation, and design features.

Recreation

- Avoid piling debris (vegetation removed via manual or mechanical methods) along primary routes of travel (trails) used by the public.

- Post temporary signs at trail heads, accessing a project area, to inform the public of the project location, timeline, noise disturbance and identification of herbicides being used in the area on land and in water.

Cultural Resources

- Any project that will have the potential to impact Cultural Resources will undergo all appropriate Section 106 National Historic Preservation Act requirements, including field inventories, site identification, and consultations with the Utah State Historic Preservation Officer (SHPO) and interested Native American tribes.
- Cultural Resource sites deemed eligible to the National Register of Historic Places will be avoided.

Visual Resources

- Visual contrasting ratings (using BLM's VRM Contrast Rating Form 8400 – 4) will be conducted for all projects large enough in scale to create visual contrast on the landscape to ensure they meet VRM Class objectives.
- Individual projects will be designed to mimic the natural form, line, color, and texture of the characteristic landscape in which they are located.
- Revegetation efforts will be designed to mimic the natural vegetative structure of the project area (i.e. if shrubs and trees are or should be present, the revegetation efforts will include similar native species).

Prescribed Fire

- Prescribed fire would be focused during the cooler seasons and would be implemented by trained fire personnel.

Wildlife, including Threatened and Endangered Species

- Follow United States Fish and Wildlife Service (USFWS) survey protocols for projects proposed in habitat for threatened, endangered and sensitive species.
- For large scale projects and vegetation removal projects within suitable habitat for threatened, endangered, or candidate species clearance surveys will be completed prior to project initiation.
- Vegetation removal projects within suitable habitat for threatened, endangered or candidate species will not occur during the species breeding and brood raising period. For Mexican spotted owl March 1 – August 31, southwestern willow flycatcher May 1 – August 31, Yellow billed cuckoo May 1 – August 31.
- Vegetation removal projects will not occur in all habitats from April 1 through July 15 to avoid adverse impacts to nesting migratory birds.

Wilderness Study Areas and Lands with Wilderness Characteristics

- In wilderness study areas and on LWC inventoried lands found to possess wilderness characteristics, treatment and restoration will use least-impairing techniques. Non-motorized tools and equipment would be used for access and

removal of exotic vegetation unless the use or treatment is evaluated and determined to be the "minimum tool" through use of the Minimum Requirement Decision Guide (MRDG). If motorized or mechanized travel is necessary on administrative or other routes that are closed in the transportation plan or on ROW's within WSA's, prior approval from the Monument Manager would be required. Mechanical weed removal projects involving ground disturbance beyond the impact of a wheel or track, such as use of bulldozers, tractors and heavy equipment will not be allowed within WSA's or on LWC without additional site-specific NEPA.

- In WSA's and on LWC, any slash generated by cutting of woody species should not intrude on the natural setting. Slash may be mulched, burned, removed, widely scattered, etc. to avoid unnatural alterations of the setting.
- Treatment methods within WSA's and on LWC should eliminate potential for impacts to non-target native species. Compliance with design features as detailed in Appendix B, to protect native plants and wildlife serve to protect and enhance the wilderness characteristic of naturalness and protect natural successional processes. No aerial or broadcast spraying of herbicides will be conducted within WSA's or on LWC without further site specific NEPA.
- Native species of seeds, seedlings and trees would be used for any vegetation restoration projects as the primary component of a natural setting.

Wild and Scenic Rivers

- Access, removal and restoration activities within segments of the Paria and Escalante River main corridors or tributaries found suitable for designation as Wild and Scenic River corridors, will only occur through use of non-motorized tools and equipment, unless determined a "minimum tool" through use of the Minimum Required Decision Guide (MRDG).
- Access, removal and restoration activities occurring on any suitable WSR river corridors or tributaries can only be implemented if designed to protect; restore and enhance the natural river environment.
- Removal, treatment and recovery actions need to insure protection of the wild and free-flowing nature of the river, as well as identified Outstanding Remarkable Values.
- "Riparian" is identified as an Outstanding Remarkable Value (ORV) for WSR suitable segments of both the Escalante and Paria Rivers. Compliance with design features as detailed in Appendix B, to protect native plants and wildlife will protect ORV's for identified suitable WSR segments. No aerial or broadcast spraying of herbicides will be conducted on WSR eligible segments without further site specific NEPA.
- Chemical treatments will be evaluated to insure no adverse affect on water quality.
- Within all suitable WSR segments, all vehicle/equipment refueling and maintenance activities would be conducted at least 150 feet from any water or drainage.

Climate Change

Climate change has the potential of modifying the affected environment for all natural resources. A recent summary of climate change in the Southwest (Garfin et al 2013) summarizes observed and expected changes to climate variables (temperature and precipitation patterns and variability) and impacts on the water cycle, terrestrial and freshwater ecosystems and human health. Changes observed in the recent past include: 1) increasing temperatures (increased average daily temperatures, fewer cold waves and more heat waves); 2) severity of recent drought (generally greater than observed in the last century, but still less severe than some events in the past 2,000 years); 3) lower stream flows in the Upper Colorado River basin (2001-2010 compared to 20th century averages); and 4) changing timing of snowmelt (earlier in the late 20th century than in the early 20th century. Projected changes during the 21st century include: 1) continued warming (more in the summer and fall than in winter and spring); 2) decreased average precipitation; 3) more frequent and more intense winter precipitation extremes; 4) decreased late-season snowpack; 5) continued declines in streamflow and soil moisture; 6) changes in flood frequency; and 7) hotter, more frequent and more severe drought. Predicted impacts to natural resources include: 1) changing distributions of plant and animal species; 2) changes in ecosystem function and functional roles of resident species; 3) substantial changes in land cover; and 4) decreased water availability. The observed changes have already resulted in impacts to land management and its planning; the projected changes and associated impacts indicate a clear need to continue to consider climate change in land management planning, as required by DOI Secretarial Order 3289 (September 14, 2009).

2.3 Alternative A (Proposed Action)

GSENM is proposing to manage noxious weeds and non-native invasive plants using an integrated weed management approach, utilizing a combination of manual, mechanical, biological, chemical, and debris management methods. The following 19 herbicide active ingredients approved for use in the 2007 Record of Decision would be available for use on GSENM and other chemicals as they come available for use on BLM lands: 2,4-D, bromacil, chlorsulfuron, clopyralid, dicamba, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, tebuthiuron, triclopyr, imazapic, diquat, diflufenzopyr (in formulation with dicamba), and fluridone.

Herbicide treatments would follow BLM procedures outlined in BLM Handbook H-9011-1 (*Chemical Pest Control*), and manuals 1112 (*Safety*), 9011 (*Chemical Pest Control*), and 9015 (*Integrated Weed Management)*, and would meet or exceed states' label standards (BLM 1991). Several herbicide application methods are available. The

application method chosen depends upon the treatment objective (removal or reduction); accessibility, topography, and size of the treatment area; characteristics of the target species and the desired vegetation; location of sensitive areas and potential environmental impacts in the immediate vicinity; anticipated costs; equipment limitations; and meteorological and vegetative conditions of the treatment area at the time of treatment.

An average range between 500-1200 acres would be treated each year under this alternative; the actual acreage of treatments may be more or less and will depend on annual funding levels (see treatment summary table, below). Depending on funding and project progress, up to 300 acres per year of Russian olive would be treated in conjunction with the Escalante River project.

Integrated Weed Management

Departmental Manual 517 (Pesticides) defines integrated pest management as a sustainable approach to managing pests by combining biological, physical, and chemical tools in a way that minimizes economic, health, and environmental risks. Integrated weed management selects one or more methods for preventing, containing, and controlling noxious weeds and/or invasive plants. Combining treatment methods that interact provide better control than any one method might provide alone. Integrated weed management includes coordination with other resource management activities to achieve desired vegetation conditions.

The Integrated Weed Management Plan for GSENM under the Proposed Action allows for use of weed treatment methods including manual, mechanical, biological, chemical, and fire (see Table 3 below). These methods would be used to prevent, contain, control, and/or eradicate noxious weeds and invasive plants. In addition, the Integrated Weed Management Plan will include revegetation when needed. Integrated weed management is species-specific, is tailored to target certain growth requirements of a noxious weed or invasive plant, and is designed to be practical with minimal risk to other organisms and their habitats. Integrated weed management requires an ecologically based, interdisciplinary approach. Selection of treatment methods is based on information such as the biology of particular noxious weed or invasive plant, site location, proximity to water, and size of the infestation. Multiple treatments may be required to treat the noxious weeds or invasive plants and meet the objectives for each treatment area. Treatments may be repeated on an annual basis; any herbicide application will follow label specifications. Similarly, herbicide used at a treatment area may change over time as the presence of noxious weeds or invasive plants and/or site conditions change and to avoid chemical resistance.

Treatment Methods

Methods for treating noxious weeds and invasive plants include the use of chemicals (hand spraying, and painting), hand cutting, biological control agents, mechanical, and manual pulling. The proposed treatment methods are summarized in Table 3. Each of these methods has a place in the control of noxious weeds and invasive plants and will be evaluated for their effectiveness as projects are designed. Prescribed fire would be utilized for specific actions such as burning debris piles or small areas of aggressive species such as Russian thistle.

The method will depend upon:

- the treatment objectives (contain, control, or eradicate)
- the accessibility, topography, and size of the treatment area
- the vegetative conditions of the treatment area
- the characteristics of the target species and the desired vegetation
- the location of sensitive areas and potential environmental impacts in the immediate vicinity
- the anticipated costs and equipment limitations, and
- the meteorological conditions at the time of treatment.

Table 3: Treatment Methods, Proposed Action

Method	Description
Manual	
Hand pulling	Pulling or uprooting plants such as shrubs, tree saplings, and herbaceous plants.
Pulling Using Tools	Most plant-pulling tools are designed to grip the plant stem and provide the leverage necessary to pull its roots out. Tools vary in their size, weight, and the size of the invasive plant they can extract.
Clipping	Clipping is a means to remove seed heads and/or fruiting bodies to prevent future germination.
Chainsaws Mowing Trimming/Brushing	Hand tools and hand-operated power tools are used to cut, clear, or prune herbaceous and woody species.
Mechanical	
Wheeled Vehicles	Use of vehicles such as wheeled tractors, crawler-type tractors, or specially-designed vehicles with attached implements that cut, uproot, or chop vegetation.
Biological	

Method	Description
Domestic animals Insects Nematodes/mites Pathogens	Biological control involves the intentional use of domestic animals, insects, nematodes, mites, or pathogens (agents such as bacteria or fungus that can cause diseases in plants) that weaken or destroy vegetation (BLM 1991). Biological control introduces natural enemies that are specific to particular plants. Grazing by domestic animals, such as cattle, sheep, or goats, controls the top-growth of invasive plants and noxious weeds which can help to weaken the plants and reduce the reproduction potential. Plant-eating insects, nematodes, mites, or pathogens affect plants directly, by destroying vital plant tissues and functions, and indirectly, by increasing stress on the plant, which may reduce its ability to compete with other plants.
Chemical	
Hand Application	Hand application includes the use of hand sprayers to apply herbicide. Specific methods include: A. Wicking and Wiping - Involves using a sponge or wick on a long handle to wipe herbicide onto foliage and stems. B. Foliar/Spot Application - These methods apply herbicide directly to the leaves and stems of a plant. Spot applications spray herbicide directly onto small patches or individual target plants. C. Basal Bark - This method applies a 6 to 12-inch band of herbicide around the circumference of the trunk of the target plant, approximately one foot above ground. The width of the sprayed band depends on the size of the plant and the species' susceptibility to the herbicide. D. Frill or Hack and Squirt - The frill method, also called the "hack and squirt" treatment is used to treat woody species with large, thick trunks. The tree is cut using a saw or ax, or drilled. Herbicide is then immediately applied to the cut. E. Stem Injection - Herbicides can be injected into herbaceous

Method	Description
	stems using a needle and syringe. Herbicide pellets can also be injected into the trunk of a tree. F. Cut-stump - This method is often used on woody species that normally re-sprout after being cut. Herbicide is sprayed onto the exposed cambium layer (living inner bark) on the stump of a tree or shrub that has been cut down. The herbicide must be applied to the entire cambium layer within minutes after the trunk is cut.
Broadcast Boom spraying Spot spraying Aerial (Fixed or Rotor Wing)	Broadcast spraying includes using equipment to apply an herbicide that uniformly covers an entire area. A boom is a long horizontal tube with multiple spray heads that can be mounted or attached to a tractor, UTV, or other vehicle. The boom is then carried above the noxious weeds or invasive plants while spraying herbicide, allowing large areas to be treated rapidly with each sweep of the boom. The herbicide is carried in a tank and reaches the nozzles via tubing. Boom spray operations include electronic monitoring that delivers exact amounts of herbicides, through droplet size and area being covered, and keeps records on rates. Spot spraying from motorized vehicles with spray hoses target individual plants within a large area. Herbicides would be applied to individual plants to avoid spraying non-target vegetation. Aerial spraying from a rotor or fixed wing aircraft may include liquid or pelletized herbicide. The project area would be loaded into the ships GPS guidance system and would be delivered to the designated area with precision. (Within the Monument, aerial applications may only be used in limited circumstances (see NW-5). a. Accessibility is so restricted that no other alternative means is available, b. It can only be demonstrated that non-target sensitive species or other monument resources will not be detrimentally affected, and c. noxious weeds are presenting a significant threat to monument resources)
Fire	

Method	Description
Pile Burning	The debris from vegetation removal via manual or mechanical methods can be placed into piles. Personnel would utilize equipment such as a drip torch and ignite each debris pile with a mixture of diesel/gas mixed in proportions to the fuel conditions.
Prescribed Fire	A management ignited fire that burns under specified conditions and in a predetermined area to attain resource management objectives. Burning of noxious weeds and invasive species may be utilized in an area where the invasive species has supplanted the ecological site vegetation. Fires may be ignited with aerial, hand, or wheeled equipment.
Revegetation	
Seeding and Planting	Re-establish vegetation through seeding or planting. Methods include planting live grasses, forbs, shrubs or trees; aerial broadcasting of seed; drill seeding; or broadcasting seed following by raking, dragging, or harrowing.

Treatment summary table

Treatment type	Where?	Size (total), ac/yr	Size (individual), ac
Manual: Hand-pulling, pulling using tools	Monument-wide	~1 ac/yr	<1 ac
Manual: Clipping	Monument-wide	~50 ac/yr	<1 ac
Manual: Chainsaws, mowing, trimming/ brushing (Russian olive, tamarisk)	Riparian	<300 ac/yr; 6-20 river miles depending on riparian width	<10 ac
Mechanical: Wheeled vehicles (primarily UTV; no chemicals)	Uplands, transportation corridors	<100 ac/yr	<10 ac
	Offroad		
	Riparian		
Biological (domestic animals, insects, nematodes/mites, pathogens); limited use	Monument-wide	<200 ac/yr	<10 ac
Chemical: Hand application	Monument-wide	<300 ac/yr	<10 ac

Treatment type	Where?	Size (total), ac/yr	Size (individual), ac
	(ERWP)		
Chemical: Broadcast, boom spraying, spot spraying (shrubs and grasses, not trees)	Monument-wide	<350 ac/yr	<10 ac
Chemical: Aerial (fixed or rotor wing); limited use, as allowed by Monument Management Plan	Monument-wide	~500 ac/yr	10-50 ac
Fire: Pile burning (associated with cutting)	Monument-wide, mainly riparian	<150 ac/yr	<10 ac
Fire: Prescribed fire	Monument-wide	<200 ac/yr	10-20 ac
Revegetation: Seeding and Planting	Monument-wide	<600 ac/yr	<20 ac

As per BLM Manual 9011 (Chemical Pest Control), all herbicide applications on BLM lands require the submission of a Pesticide Use Proposal (PUP) to the BLM Utah State Office. This proposal requires information on the target pests, chemicals to be used, rates of application, locations of applications, and identification of any issues of concern. For herbicides, only those formulations on the BLM approved list may be used. Pesticide use proposals are typically approved for 3 years. After herbicides are applied, a Pesticide Application Record must be completed. Information that must be recorded includes applicator information, project information, weather conditions, equipment used, pesticide information, rates used, acres treated, and pest information. All Pesticide Application Records are turned into the Utah State Office Weed Coordinator along with an Annual Pesticide Use Report.

For biological control introductions, a Biological Control Agent Release Proposal must be approved by the BLM Utah State Office prior to any releases. The release proposal identifies the biological agent name, release site, number to be released, pest species being treated, appropriate transfer permit for the biological agent, sensitive aspects and precautions and precautions necessary to protect the control agent. Biological control agents currently used by the BLM have been tested by the USDA Agricultural Research Service to ensure that they are host specific and will feed only on the target plant and not on crops, native flora, or endangered or threatened plant species.

Site Selection and Treatment

Integrated weed management on GSENM is based on management objectives and priorities that are influenced by noxious weed and invasive plant infestations and site

susceptibility. These criteria provide direction for the weed program and allow for site-specific and adaptive decision making. The overriding goal is to prioritize treatment based on (1) restoring desirable vegetation, (2) treatment effectiveness (likelihood of success, and (3) minimizing impacts on the environment. Treatment priorities would be based on the type of plant to be treated and the size and type of infestation. In order noxious weeds and invasive plants to be treated:

Federally listed noxious weeds
States noxious weeds by Class (A, then B, then C)
Other invasive plants deemed important for control by GSENM (e.g. Russian olive)

The following information related to size and types of infestations would be used to prioritize treatments.

- First Priority: New aggressive infestations in an un-infested area or small infestations in areas of special concern (e.g., wilderness study areas).
  Management objective: Eradicate.
- Second Priority: Areas of high traffic or sources of infestation and larger infestations in areas of special concern.
  Management objective: Control.
- Third Priority: Existing large infestations or roadside infestations where spread can be checked or slowed.
  Management objective: Contain.

Revegetation and Restoration

After noxious weeds and invasive plants are contained or eradicated, some areas may need to be restored or re-vegetated to prevent re-infestation. Revegetation is the process of putting vegetation back in an areas where vegetation previously existing. Restoration is the process of returning disturbed areas to a natural array of native plant association. The re-establishment of native vegetation is a priority in any revegetation or restoration activity. The Restoration and Revegetation section in the Monument Management Plan outlines the requirements for restoring disturbed sites. Depending on site-specific factors, site restoration such as seeding or planting may be included in the treatment. If a need for site restoration is identified after noxious weeds and invasive plant treatments have occurred, the appropriate environmental analysis will be undertaken before proceeding.

Monitoring

To ensure treatment methods are implemented as designed and are achieving their objectives, monitoring is a key component of an integrated weed management strategy.

Implementation monitoring for non-herbicide treatments is accomplished through site revisits performed during the growing season of the target species to determine if treatments were implemented correctly and the best time for any follow-up treatments. Implementation monitoring for herbicide treatments is accomplished through the use of PUPs and Pesticide Application Records. Both documents are required in order to track pesticide use annually.

Effectiveness monitoring can range from site visits to compare the targeted population size against pre-treatment inventory data, to comparing pre-treatment and post-treatment photo points, to more elaborate transect work, depending on the species and site-specific variables. The objectives of monitoring should be to answer questions such as the following:

- What changes in the distribution, amount, and proportion of noxious weed and invasive plant infestations have resulted due to treatments?
- Has infestation size been reduced at the project level or larger scale (such as a watershed)?
- Which treatment methods, separate or in combination, are most successful for a particular species?

For treatment projects, monitoring will be established in key areas to determine effectiveness of methods and presence of noxious weed or invasive plant species. Treatments will be monitored annually for effectiveness.

Included in Appendix D is an example of the long-term monitoring protocols established by the Escalante River Watershed Partnership for Russian olive removal.

2.4 Alternative B (No Action)

The No Action alternative would continue herbicide use and other treatment methods authorized in the 1998 Noxious Weed Control Environmental Assessment for the Cedar City District, Escalante Resource Area. This area included lands within Grand Staircase Escalante National Monument. Under this alternative, the BLM would continue use of the active ingredients previously approved under the Final EIS for Vegetation Treatments on BLM Lands in Thirteen Western States (BLM 1991), with the exception of the six herbicide active ingredients (2,4-DP, asulam, atrazine, fosamine, mefluidide, and simazine) that were not approved for use in the 2007 ROD (BLM 2007c). An average of 500-700 acres would be treated by chemical each year, and ~200-400 acres would be mechanically/manually treated; the actual acreage of treatments may be more or less and will depend on annual funding levels.

Table 4: Treatment Methods, Alternative B

Method	Description
Manual	
Hand pulling	Pulling or uprooting plants such as shrubs, tree saplings, and herbaceous plants.
Pulling Using Tools	Most plant-pulling tools are designed to grip the plant stem and provide the leverage necessary to pull its roots out. Tools vary in their size, weight, and the size of the invasive plant they can extract.
Clipping	Clipping is a means to remove seed heads and/or fruiting bodies to prevent future germination.
Chainsaws Mowing Trimming/Brushing	Hand tools and hand-operated power tools are used to cut, clear, or prune herbaceous and woody species.
Mechanical	
Wheeled Vehicles	Use of vehicles such as wheeled tractors, crawler-type tractors, or specially-designed vehicles with attached implements that cut, uproot, or chop vegetation.
Biological	
Domestic animals Insects Nematodes/mites Pathogens	Biological control involves the intentional use of domestic animals, insects, nematodes, mites, or pathogens (agents such as bacteria or fungus that can cause diseases in plants) that weaken or destroy vegetation (BLM 1991). Biological control introduces natural enemies that are specific to particular plants. Grazing by domestic animals, such as cattle, sheep, or goats, controls the top-growth of invasive plants and noxious weeds which can help to weaken the plants and reduce the reproduction potential. Plant-eating insects, nematodes, mites, or pathogens affect plants directly, by destroying vital plant tissues and functions, and indirectly, by increasing stress on the plant, which may reduce its ability to compete with other plants.
Chemical	
Hand Application	Hand application includes the use of hand sprayers to apply herbicide.

Method	Description
	Specific methods include: A. Wicking and Wiping - Involves using a sponge or wick on a long handle to wipe herbicide onto foliage and stems. B. Foliar/Spot Application - These methods apply herbicide directly to the leaves and stems of a plant. Spot applications spray herbicide directly onto small patches or individual target plants. C. Basal Bark - This method applies a 6 to 12-inch band of herbicide around the circumference of the trunk of the target plant, approximately one foot above ground. The width of the sprayed band depends on the size of the plant and the species' susceptibility to the herbicide. D. Frill or Hack and Squirt - The frill method, also called the "hack and squirt" treatment is used to treat woody species with large, thick trunks. The tree is cut using a saw or ax, or drilled. Herbicide is then immediately applied to the cut. E. Stem Injection - Herbicides can be injected into herbaceous stems using a needle and syringe. Herbicide pellets can also be injected into the trunk of a tree. F. Cut-stump - This method is often used on woody species that normally re-sprout after being cut. Herbicide is sprayed onto the exposed cambium layer (living inner bark) on the stump of a tree or shrub that has been cut down. The herbicide must be applied to the entire cambium layer within minutes after the trunk is cut.

Method	Description
Broadcast Boom spraying Spot spraying	Broadcast spraying includes using equipment to apply an herbicide that uniformly covers an entire area. A boom is a long horizontal tube with multiple spray heads that can be mounted or attached to a tractor, UTV, or other vehicle. The boom is then carried above the noxious weeds or invasive plants while spraying herbicide, allowing large areas to be treated rapidly with each sweep of the boom. The herbicide is carried in a tank and reaches the nozzles via tubing. Boom spray operations include electronic monitoring that delivers exact amounts of herbicides, through droplet size and area being covered, and keeps records on rates. Spot spraying from motorized vehicles with spray hoses target individual plants within a large area. Herbicides would be applied to individual plants to avoid spraying non-target vegetation.
Fire	
Pile Burning	The debris from vegetation removal via manual or mechanical methods can be placed into piles. Personnel would utilize equipment such as a drip torch and ignite each debris pile with a mixture of diesel/gas mixed in proportions to the fuel conditions.
Prescribed Fire	A management ignited fire that burns under specified conditions and in a predetermined area to attain resource management objectives. Burning of noxious weeds and invasive species may be utilized in an area where the invasive species has supplanted the ecological site vegetation. Fires may be ignited with aerial, hand, or wheeled equipment.
Revegetation	
Seeding and Planting	Re-establish vegetation through seeding or planting. Methods include planting live grasses, forbs, shrubs or trees; aerial broadcasting of seed; drill seeding; or broadcasting seed following by raking, dragging, or harrowing.

For the Monument, the current management direction in the Cedar City District, Escalante Resource Area Noxious Weed Control EA (BLM 1998a) would be followed. The weed strategy in that EA was designed to control noxious and invasive weeds on lands in Garfield and Kane counties that are managed by the Bureau of Land Management. All species of noxious and invasive weeds will be treated as locations are identified and budget constraints allow. These species include, but are not limited to, White top (*Cardaria* spp.) and Knapweed (*Centaurea* spp.). All methods of treatment (manual, mechanical, biological, prescribed burning and chemical) were approved for use on BLM lands.

Appendix B contains the standards, stipulations, and standing operating procedures included in the 1998 Noxious Weed Control EA.

2.5 Alternative C (No Herbicide)

Under Alternative C, the BLM would not be able to treat vegetation using herbicides and would not be able to use new chemicals that are developed in the future. The BLM would be able to treat vegetation using fire, mechanical, manual, and biological control methods to manage noxious weeds and invasive plants using an integrated weed management approach. On average 400 acres or less would be treated each year based on the increased cost of treatments of mechanical and manual control; the acreage of treatments may be more or less and will depend on annual funding levels.

Integrated Weed management

The BLM treats vegetation using an integrated vegetation management program, each management option is considered, recognizing that no one management option is a stand-alone option and that each has its own strengths and weakness. Utilizing the strengths of each allows for a more effective and environmentally sound program. When the BLM plans vegetation control management projects, all control methods should be available for use, allowing the BLM to select the one method, or the combination of methods, that optimizes vegetation control with respect to environmental concerns, effectiveness, and cost of control.

No individual method will control undesirable vegetation in a single treatment; diligence and persistence will be required over a number of years to subdue vegetation such as weeds. The success of different treatment methods depends on the type of vegetation being controlled.

Treatment Methods

Methods for treating noxious weeds and invasive plants include mechanical, manual, biological and fire (see Table 4). These are the same treatment methods described in Table 3, with the exception of chemical methods.

Table 5: Treatment Methods, Alternative C

Method	Description
Manual	
Hand pulling	Pulling or uprooting plants such as shrubs, tree saplings, and herbaceous plants.
Pulling Using Tools	Most plant-pulling tools are designed to grip the plant stem and provide the leverage necessary to pull its roots out. Tools vary in their size, weight, and the size of the invasive plant they can extract.
Clipping	Clipping is a means to remove seed heads and/or fruiting bodies to prevent future germination.
Chainsaws Mowing Trimming/Brushing	Hand tools and hand-operated power tools are used to cut, clear, or prune herbaceous and woody species.
Mechanical	
Wheeled Vehicles	Use of vehicles such as wheeled tractors, crawler-type tractors, or specially-designed vehicles with attached implements that cut, uproot, or chop vegetation.
Biological	
Domestic animals Insects Nematodes/mites Pathogens	Biological control involves the intentional use of domestic animals, insects, nematodes, mites, or pathogens (agents such as bacteria or fungus that can cause diseases in plants) that weaken or destroy vegetation (BLM 1991). Biological control introduces natural enemies that are specific to particular plants. Grazing by domestic animals, such as cattle, sheep, or goats, controls the top-growth of invasive plants and noxious weeds which can help to weaken the plants and reduce the reproduction potential. Plant-eating insects, nematodes, mites, or pathogens affect plants directly, by destroying vital plant tissues and functions, and indirectly, by increasing stress on the plant, which may reduce its ability to compete with other plants.
Fire	
Pile Burning	The debris from vegetation removal via manual or mechanical methods can be placed into piles. Personnel would utilize

Method	Description
	equipment such as a drip torch and ignite each debris pile with a mixture of diesel/gas mixed in proportions to the fuel conditions.
Prescribed Fire	A management ignited fire that burns under specified conditions and in a predetermined area to attain resource management objectives. Burning of noxious weeds and invasive species may be utilized in an area where the invasive species has supplanted the ecological site vegetation. Fires may be ignited with aerial, hand, or wheeled equipment.
Revegetation	
Seeding and Planting	Re-establish vegetation through seeding or planting. Methods include planting live grasses, forbs, shrubs or trees; aerial broadcasting of seed; drill seeding; or broadcasting seed following by raking, dragging, or harrowing.

Site Selection and Treatment Priorities

Site Selection and Treatment Priorities would be the same as described for the Proposed Action.

Revegetation and Restoration

Revegetation and Restoration in Alternative C are the same as that described for the Proposed Action.

Monitoring

Monitoring would be the same as that described for the proposed action, except there would be monitoring for past herbicide treatments.

Another important element of preventing the establishment of invasive plants is utilizing an early detection/rapid response strategy. Early detection/ rapid response refer to the immediate treatment of newly discovered noxious weed and non-native invasive plant infestations, particularly those small infestations that are new to the Monument or new to a particular area of the Monument.

> **Class A** - Early Detection Rapid Response (EDRR) declared noxious weeds are not native to the State of Utah and pose a serious threat to the state. They should be considered as a very high priority for treatment.

Class B - Control declared noxious weeds are not native to the State of Utah. They pose a threat to the state and should be considered a high priority for control.

Class C - Containment) declared noxious weeds are not native to the State of Utah. These weeds are widely spread and pose a threat to the agricultural industry and agricultural products. These weeds should be treated with a focus on stopping expansion.

Table 2-2 Summary of the Alternatives

	ALTERNATIVE A (Proposed Action)	ALTERNATIVE B (No Action)	ALTERNATIVE C (No Herbicide)
Acres Treated (annual average)	700-1200	500-700	< 500
Chemicals	All Approved Chemicals (2,4-D, bromacil, chlorsulfuron, clopyralid, dicamba, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, tebuthiuron, triclopyr, imazapic, diquat, diflufenzopyr (in formulation with dicamba), and fluridone.)	6 fewer active ingredient (2,4-DP, asulam, atrazine, fosamine, mefluidide, and simazine)s	None
Methods (excluding chemical)	Manual Biological Fire Mechanical	Manual Biological Fire Mechanical	Manual Biological Fire Mechanical
Aerial Application	Yes*	No	No

*Only under Monument Management Plan Direction

2.6 Alternatives Considered but Eliminated from Detailed Study

As directed by various guidance documents, including the Department of Interior, Integrated Pest Management Policy1; the Federal Insecticide, Fungicide, and Rodenticide Act; Partners Against Weeds: An Action Plan for the Bureau of Land Management (BLM 1996),

- No Weed Treatment
  An alternative that would not control noxious weeds and invasive plants was considered but eliminated from detailed study. Most noxious weeds and invasive plants are aggressive and displace native plants. Allowing noxious weeds to be introduced and/or spread without efforts to control them is inconsistent with the goal in the MMP to manage to achieve a natural range of native plant associations. The VEG-1 decision in the MMP also places a priority on the control of noxious weeds and the prevention of the introduction of new invasive species.

- No Non-Integrated Control
  BLM is directed to use an integrated management approach to managing noxious weeds and invasive species. Thus, the use of any one control technique, i.e. biological, manual, or physical exclusively, was not considered in this EA due to its not meeting the Purpose and Need and objectives.

3.0 AFFECTED ENVIRONMENT

3.1 Introduction

This chapter presents the affected environment of the impact area as identified in the Interdisciplinary Team Checklist found in Appendix A. The interdisciplinary team determined that the resources discussed below would be affected by the proposed action or alternatives. This chapter provides the baseline for comparison of consequences described in Chapter 4.

3.2 General Setting

Grand Staircase-Escalante National Monument (GSENM) is located in Garfield and Kane Counties in south-central Utah. GSENM includes approximately 1.9 million acres with about 9,000 acres of private inholding. State Highway 12 traverses the northern portion of GSENM and US 89 provides access across the southern portion. The communities of Boulder, Escalante, Cannonville, Henrieville, Tropic, and Big Water are

adjacent to GSENM. GSENM is bounded by Dixie National Forest, Capitol Reef and Bryce Canyon National Parks, and Glen Canyon National Recreation Area.

3.3 Resources

3.3.1 Water Resources

The planning area encompasses portions of four broad hydrologic subbasins, all of which are part of the Colorado River system. The Escalante River system flows from the Aquarius Plateau and Boulder Mountain into the upper portions of Lake Powell. Last Chance Creek and Wahweap Creek are the principal streams of the Kaiparowits Plateau, flowing from their headwaters near Canaan Peak into the main body of Lake Powell. The Paria River Subbasin (including Hackberry Creek and Cottonwood Creek) extends from the Bryce Canyon-Bryce Valley area to the confluence of the Paria River with the Colorado River near Lee's Ferry below Glen Canyon Dam. On the west side of the Monument, the Kanab Creek Subbasin (including Johnson Wash and its tributaries) drains to the Colorado River in the Grand Canyon.

Surface Water
Streams on the Monument are mostly ephemeral (flowing only during rain events), with some intermittent streams that flow seasonally from groundwater discharge (and rain events) and a few perennial streams that flow year-round in all but the driest years from groundwater discharge (and rain events). Altogether, there are approximately 2,500 miles of stream channels and washes. Less than 10% of these are perennial streams and primarily include the upper reaches of the Escalante River and tributaries, the Paria River, and portions of Wahweap and Last Chance Creek.

Groundwater
Local groundwater within the Monument generally occurs as shallow or perched aquifers associated with springs and seeps, the discharges of these small, locally recharged aquifers. More extensive regional aquifers are found at depths from several hundred to over a thousand feet below ground surface. The principle regional aquifer underlying the Monument is the Navajo Sandstone; other significant regional aquifers include the Entrada and Wingate Sandstones (Blanchard 1986). Typical of high elevation lands, much of the Monument serves as recharge areas for shallow and regional aquifers, eventually discharging groundwater to springs, seeps and streams in lower elevation valleys (Turaski 2006).

Groundwater recharge and flow patterns in the region are determined primarily by geology. Mesozoic sandstone formations (Navajo, Entrada, and Wingate) form the primary aquifers. They are primarily recharged via outcrops on the Aquarius Plateau (Boulder Mountain), but also through overlying Tertiary sediments and igneous

intrusives. The Tertiary formations generally have low primary but high secondary permeability allowing them to transmit infiltrated precipitation and runoff through fractures and solution channels to the underlying Mesozoic sandstones. These formations generally dip toward the southeast, making the principle groundwater flow direction from northwest to southeast. Groundwater quality varies depending upon the aquifer's geologic properties and the water's proximity to the recharge area.

Springs and Seeps

Other than the few perennial streams, springs and seeps are perhaps the most important sources of water on the Monument. Many of the water rights held by BLM and/or grazing permittees are to springs (approximately 170 proven water rights; USGS 2013). Systematic inventory and monitoring of Monument springs has been limited. The water right proof documents usually include some information on flow (discharge). The USGS database (USGS 2013) has location information for 262 springs, and sometimes information on the source formation. In some cases, springs have been visited to collect discharge and other data (such as water quality). Some springs have been studied as part of groundwater-surface water studies (Rice and Springer 2006), and a few have been sampled periodically as part of the cooperative agreement with the Utah Division of Water Quality (see below).

Water Quality

The Utah Division of Water Quality assigns beneficial uses to all waters within the state, in order to protect them from controllable pollution (UDWQ 2000). Streams and lakes that the state considers impaired, and thus not able to meet their designated beneficial uses, are reported on the state's 303(d) list (summarized by assessment unit, or watershed), which is updated every other year. Listed water bodies/watersheds are then scheduled for total maximum daily load (TMDL) development. Utah's list of 303(d) waters are categorized as follows (UDWQ 2010, 2014):

- Category 4C—Impaired for one or more uses but does not require a total maximum daily load because impairment is not caused by a pollutant.
- Category 5A – TMDL Required for River and Stream Segments, Lakes, and Reservoirs
- Category 5B – Request for removal of waters from the 303(d) list. Water quality standards are now being met, new delineation of assessment unit, changes in beneficial use classification, change in listing methods, awaiting approval letter from EPA, or change in water quality standards.
- Category 5C – Utah Pollutant Discharge Elimination System permit renewal TMDLs for most recent cycle.
- Category 5D – Lakes not fully supporting beneficial uses that will not be listed as Category 5A until two consecutive assessment cycles demonstrate impairment.

The Utah State Division of Water Quality (the State) assesses the quality of its surface water resources to protect it for beneficial uses, including drinking, fishing, boating, irrigation, stock watering, and supporting aquatic wildlife. Water samples are collected

from streams/springs on a regular basis and then analyzed to determine whether they meet numeric criteria for defined beneficial uses. Approximately 90 sites on the Monument have been sampled for water quality periodically since 1970. Currently, 10-15 sites are sampled monthly (depending on funding available). Based on the results of that analysis the State defines the waters as fully supporting, partially supporting, or non-supporting of its beneficial uses. If a water body is determined to be partially supporting or non-supporting, section 303(d) of the Clean Water Act requires that the state place the water body on a list of "impaired" waters [(303(d) list] and prepare an analysis called a Total Maximum Daily Load (TMDL). The following table summarize the assessment units (watersheds) that the state has placed on its 303(d) list in 2010 (UT DWQ 2010) and/or tentatively placed on the 303(d) list for 2014 (UT DWQ 2014; pending USEPA approval). The second table shows those assessment units where there is insufficient data to make a determination whether to place the assessment unit on the 303(d) list, but there are exceedances of water quality standards for some samples, which indicate further sampling is needed.

Table 3-1 2010, 2014 303(d) list: Assessment Unit Category 5 (Need TMDL)

303(d) year	Assessment Unit ID	Assessment Unit Description	Assessment Unit Location	Assessment Unit Uses[2]	Stream Miles	Parameter(s), TMDL Priority (Low or Medium)
2014	UT14070005-001	Upper Valley Creek	Upper Valley Creek and tributaries from confluence with Birch Creek to headwaters	2B 4 3A HH3A	0.17	dissolved oxygen, (L) temperature (L)
2014	UT14070005-002	Birch Creek	Birch Creek and tributaries from confluence with Escalante River to headwaters	2B 4 3A HH3A	30.0	Temperature (L)
2014	UT14070005-003	North Creek	North Creek and tributaries from confluence with Escalante River to headwaters	2B 4 3A HH3A	49.8	dissolved oxygen (L), temperature (L)
2010, 2014	UT14070005-007	Calf Creek	Calf Creek ant tributaries from confluence with Escalante River to headwaters	3A HH3A	8.1	Temperature (L)
2010, 2014	UT14070005-012	Escalante River Upper	Upper Valley Creek and tributaries from confluence with Birch Creek to headwaters	2B 4 3B HH3B	28.1	OE bioassessment (L)

[2] Use designations defined by Utah Standards of Quality for Waters of the State (Utah Administrative Code Rules R317-2-6 and R-317-2-13)

303(d) year	Assessment Unit ID	Assessment Unit Description	Assessment Unit Location	Assessment Unit Uses[2]	Stream Miles	Parameter(s), TMDL Priority (Low or Medium)
2014	UT14070006-001	Wahweap Creek	Wahweap Creek and tributaries from Lake Powell to headwaters	2B 4 3A HH3B	0.1	selenium (L), temperature (L), total dissolved solids (L)
2010	UT14070006-004	(Last)[3] Chance Creek	(Last)[3] Chance Creek and tributaries from Lake Powell to headwaters	Cold water aquatic life	16.7	Benthic macroinvertebrate bioassessments (L)
2014	UT14070006-004	(Last)[3] Chance Creek	(Last)[3] Chance Creek and tributaries from Lake Powell to headwaters	2B 4 3A HH3B	16.7	OE bioassessment (L), total dissolved solids (L)
2010	UT14070007-001	Paria River-1	Paria River from start of Paria River Gorge to headwaters	Non-game fish and other aquatic life, agricultural	16.8	Benthic macroinvertebrate bioassessments (L), temperature (L), Total dissolved solids (M)
2014	UT14070007-001	Paria River-1	Paria River from start of Paria River Gorge to headwaters	2B 4 3C HH3C	31.5	Total dissolved solids (M)
2014	UT14070007-002	Paria River-2	Paria River from Cottonwood Creek confluence to start of Paria River Gorge	2B 4 3C HH3C	52.4	Temperature (L), total dissolved solids (M)

[3] Utah DWQ refers to this as Chance Creek. Local maps refer to it as Last Chance Creek.

303(d) year	Assessment Unit ID	Assessment Unit Description	Assessment Unit Location	Assessment Unit Uses[2]	Stream Miles	Parameter(s), TMDL Priority (Low or Medium)
2014	UT14070007-004	Cottonwood Creek	Cottonwood Creek and tributaries from confluence with Paria River to headwaters	2B 4 3C HH3C	6.3	Dissolved oxygen (L)
2010	UT14070007-005	Paria River-3	Paria River and tributaries from AZ-UT state line to Cottonwood Creek confluence	Non-game fish and other aquatic life	9.2	Benthic macroinvertebrate bioassessments (L)
2014	UT14070007-005	Paria River-3	Paria River and tributaries from AZ-UT state line to Cottonwood Creek confluence	2B 4 3C HH3C	11.0	OE bioassessment (L), total dissolved solids (M)
2010	UT15010003-002	Kanab Creek-1	Kanab Creek and tributaries from state line to the confluence with Fourmile Hollow near the White Cliffs	agricultural	17.6	Total dissolved solids (L)
2014	UT15010003-002	Kanab Creek-1	Kanab Creek and tributaries from state line to the confluence with Fourmile Hollow near the White Cliffs	2B 4 3C HH3C	18.0	Dissolved oxygen (L)

303(d) year	Assessment Unit ID	Assessment Unit Description	Assessment Unit Location	Assessment Unit Uses[2]	Stream Miles	Parameter(s), TMDL Priority (Low or Medium)
2014	UT15010003-003	Kanab Creek-2	Kanab Creek and tributaries from the confluence with Fourmile Hollow near the White Cliffs to Reservoir Canyon	2B 4 3C HH3C	8.1	Boron (M). cadmium (L), lead (L), total dissolved solids (M)
2010	UT15010003-004	Johnson Wash-1	Johnson Wash and tributaries from UT-AZ state line to Skutumpah Canyon confluence	agriculture	12.0	Total dissolved solids (L)
2014	UT15010003-004	Johnson Wash-1	Johnson Wash and tributaries from UT-AZ state line to Skutumpah Canyon confluence	2B 4 3C HH3C	22.1	Boron (M), selenium (M), temperature (M)
2014	UT15010003-005	Johnson Wash-2	Johnson Wash and tributaries from (including) Skutumpah Canyon to headwaters	2B 4 3A HH3A	27.2	Copper (M), dissolved oxygen (M), lead (M), temperature (M), total dissolved solids (M), zinc (M)

Table 3-2 2010, 2014 303(d) list: Assessment Unit Category 3 (Insufficient Data, Exceedances)

303(d) year	Assessment Unit ID	Assessment Unit Description	Assessment Unit Location	Assessment Unit Uses	Stream Miles	Parameter(s)
2014	UT14070005-004	Pine Creek	Pine Creek and tributaries from confluence with Escalante River to headwaters	2B 4 3A HH3A	33.5	Not stated
2010	UT14070005-013	Escalante tributaries	Escalante tributaries not previously defined from Boulder Creek to Birch Creek	2B 4 3A HH3A	0.01 (?)	Not stated
2010	UT14070005-014	Alvey Wash Upper	Alvey Wash and tributaries from Tenmile Spring to headwaters	2B 4 #B HH3B	0.01 (?)	Not stated
2010	UT14070005-015	Alvey Wash Lower	Harris Wash and tributaries from confluence with Escalante River to Tenmile Spring	2B 4 3B HH3B	8.9	Not stated
2010	UT14070005-016	Wolverine Creek	Wolverine Creek and tributaries from confluence with Escalante River to headwaters	2B 4 3B HH3B	0.01 (?)	Not stated
2014	UT14070005-017	Coyote Gulch	Coyote Gulch and tributaries form confluence with Escalante River to headwaters	2B 4 3B HH3B	13.3	Not stated
2014	UT14070005-018	Boulder Creek	Boulder Creek and tributaries from confluence with Escalante River to headwaters	2B 4 3A HH3A	58.6	Not stated
2012	UT14070006-002	Warm Creek	Warm Creek and tributaries from Lake Powell to headwaters	2B 4 3B HH3B	2.5	Not stated
2010	UT14070006-003	Lake Powell Tribs-1	Lake Powell north side tributaries between Wahweap and Warm Creek	No record of uses	0.01 (?)	Not stated

303(d) year	Assessment Unit ID	Assessment Unit Description	Assessment Unit Location	Assessment Unit Uses	Stream Miles	Parameter(s)
2012	UT14070006-005	Croton	Croton Canyon and tributaries from Lake Powell to headwaters	2B 4 3B HH3B	2.4	Not stated
2012	UT14070006-006	Lake Powell Tribs-3	Lake Powell tributaries from Croton Canyon to HUC boundary	2B 4 3B HH3B	Non-perennial	Not stated
2010	UT14070006-008	Lake Powell tributaries-2	Lake Powell north side tributaries between Warm and (Last)[4] Chance Creeks	No record of uses	0.01 (?)	Not stated
2012	UT14070001-006	Navajo Long Creek		2B 4 3B HH3B	Non-perennial	Not stated
2012	UT14070005-005	Mamie Creek	Mamie Creek and tributaries from confluence with Escalante River to headwaters	2B 4 3A HH3A	Non-perennial	Not stated
2012	UT14070005-019	Lower Escalante tributaries		2B 4 3B HH3B	Non-perennial	Not stated
2010	UT15010003-006	Kanab Creek-3	Kanab Creek and tributaries from Reservoir Canyon to headwaters	No record of uses	0.03	

[4] Utah DWQ refers to this as Chance Creek. Local maps refer to it as Last Chance Creek.

3.3.2 Hydrologic Condition

Hydrologic condition refers to the various conditions of the land surface and subsurface that affects movement of water through the water cycle. This includes everything from precipitation to runoff, infiltration, soil moisture and movement of water through the ground (soil or rock), storage in aquifers, discharge and recharge of aquifers at the surface (groundwater-surface water interactions), and all surface water movements. In general, any activity with the potential to alter any of the normal processes that affect water movement (both groundwater and surface water hydrology) could affect hydrologic condition.

The hydrologic condition across the Monument is highly variable and dependent on local conditions. Hydrologic condition is generally not assessed or monitored directly, but as part of Rangeland Health Evaluations. An exception to this is that hydrologic condition has been evaluated periodically as a part of studies of groundwater-surface water interactions, such as studies of stream discharge and recharge (seepage studies), summarized by USGS (2013), and by inventories and monitoring of groundwater discharge at springs and seeps (see Section 3.3.1 Water Resources, above).

Hydrologic condition is evaluated as a primary component of Rangeland Health Standard 1 (Upland Soils: "Upland soils exhibit permeability and infiltration rates that sustain or improve site productivity, considering the soil type, climate, and landform."). RLH 1, and thus a significant part of overall hydrologic condition, is evaluated by several indicators: 1) whether there is sufficient cover and litter to protect the soil surface from excessive water and wind erosion, promote infiltration, detain surface flow, and retard soil moisture loss by evaporation; 2) the absence of indicators of excessive erosion such as rills, soil pedestals, and actively eroding gullies; and 3) the appropriate amount, type, and distribution of vegetation reflecting the presence of (a) the Desired Plant Community (DPC), where identified in a land use plan, or (b) where the DPC is not identified, a community that equally sustains the desired level of productivity and properly functioning ecological conditions.

Hydrologic condition is also a primary determining factor in riparian condition, Rangeland Health Standard 2 ("Riparian and wetland areas are in properly functioning condition. Stream channel morphology and functions are appropriate to soil type, climate and landform.") Here the indicators are all associated with stream and riparian processes: 1) streambank vegetation consisting of, or showing a trend toward, species with root masses capable of withstanding high stream flow events. Vegetative cover adequate to protect stream banks and dissipate stream flow energy associated with high water flows, protect against accelerated erosion, capture sediment, and provide for groundwater recharge. ; 2) vegetation reflecting: Desired Plant Community, maintenance of riparian and wetland soil moisture characteristics, diverse age structure and composition, high vigor, large woody debris when site potential allows, and providing food, cover and other habitat needs for dependent animal species.; 3)

revegetating point bars; lateral stream movement associated with natural sinuosity; channel width, depth, pool frequency and roughness appropriate to landscape position. ; 4) active floodplain. Riparian condition is assessed using Proper Functioning Condition methods (PFC; BLM 1998b, 2003).

Rangeland Health Evaluations (which include PFC assessments) are currently being conducted throughout the Monument. The last Evaluations were conducted in 2006, and are summarized in the 2008 Draft Rangeland Health Environmental Impact Statement (BLM 2008, Appendix 1).

3.3.3 Fish and Wildlife Excluding USFW Designated Species

The lands within the Monument provide a complex array of habitats for thousands of separate species ranging from insects to large mammals. There are 82 verified mammalian species along with 21 species suspected to be present and 4 introduced species (Flinders et al. 1998; Alston et al. 2000). There are also approximately 243 bird species (Parris et al. 2002), 20 different fish (Fridell 2003; Mueller et al. 1999), more than 1,900 invertebrates (Vinson 2002; Baumann and Riley 2002; Bosworth and Oliver 1998; Griswald and Messinger 2002) and 29 species of reptiles and amphibians (Graham 2000 and 2003), including 1 salamander, 4 frogs and toads, 13 lizards, and 11 snakes (Oliver 2003).

Each species or suite of species, within the Monument requires a specific set of habitat conditions in order to meet their particular needs for survival and reproduction. Different plant community seral stages are also important in providing habitat requirements. As seral stages move from one state to another, habitats are occupied by different wildlife species. For example, different seral stages of a sagebrush/grassland plant community provide habitat for the nesting and foraging requirements of a number of neotropical and upland birds (Parrish et al. 2002), as well as upland game animals. Some may require a more open sagebrush canopy with a greater percentage of grasses and forbs in the understory, while others would need a higher percentage of shrub canopy closure for nesting, protection of young from predators, and winter browse requirements for game species. For these and other reasons, it is usually important to provide for a mosaic pattern of various seral states of healthy plant communities composed of native species across the landscape in order to accommodate the needs of all wildlife. Riparian resources represented by stream systems, springs, and seeps are critically important to the needs of most wildlife species. Invasive species occur throughout the monument and occur in all habitats within the monument. Plants such as red brome, cheatgrass, tamarisk and Russian olive can be found in large stands. Other weedy species that have been treated on the monument include Scotch thistle, Russian knapweed, Canadian thistle, spotted knapweed, and on adjacent lands perennial pepperweed and leafy spurge. The populations of these species have been relatively small.

There are 19 wildlife species listed as sensitive species by both the Utah Bureau of Land Management and the Utah Department of Wildlife Resources. These species range from aquatic dependent species as the fish to other species that use the whole range of available habitat in the project area. These species are identified below.

Amphibians and Reptiles (3): Arizona Toad, Common Chuckwalla, and Desert Night Lizard

Fish (4): Colorado River Cutthroat Trout, Roundtail Chub, Bluehead Sucker, and Flannelmouth Sucker

Mammals (7): Townsend's Big Eared Bat, Spotted Bat, Allen's Big Eared Bat, Western Red Bat, Fringed Myotis, Big Freetailed Bat, and Kit Fox

Birds (5): Northern Goshawk, Bald Eagle, Short Eared Owl, Burrowing Owl, and Ferruginous Hawk

3.3.4 Threatened, Endangered or Candidate Animal Species

Several threatened or endangered species occur on or adjacent to the Monument. Below is a short description of those species known to or believed to occur in Kane and Garfield counties which encompass the project area.

Mexican Spotted Owl (*Strix occidentalis licida*)
The Mexican spotted owl was listed as a threatened species on April 15, 1993. The primary reasons cited were historic alteration of habitat by management for even-aged timber stands, and the threat of this practice continuing. Additional habitat was vulnerable to loss by catastrophic wildfire (U.S. Fish and Wildlife Service 1995). On the Colorado Plateau, Mexican Spotted Owls tend to select narrow, steep walled canyons as preferred nesting and roosting sites. They often nest in small clefts, cracks, and depressions in the canyon walls and use the canyons and adjacent uplands as foraging habitat. Extensive surveys have been conducted on the Monument attempting to locate Mexican Spotted owls. The existing recovery plan establishes Protected Activity Centers (PACs) around known spotted owl nest territories. There are currently seven PACs in the assessment area. A large area centering on the Paria River and Upper Wahweap drainages as well as some in the circle cliffs area has been designated critical habitat for the Mexican spotted owl.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)
The southwestern willow flycatcher was listed as endangered effective March 29, 1995. Approximately 900 to 1100 pairs exist across its range. A Final Recovery Plan for this species was approved in August 2002 (USFWS 2002). The southwestern willow flycatcher breeds in dense riparian habitats in southwestern North America, and winters in southern Mexico, Central America, and northern South America. Its

breeding range includes extreme southern portions of Utah. Migrants may occur in non-riparian habitats or in riparian habitats not suitable for breeding. This bird breeds in relatively dense riparian tree and shrub communities associated with rivers, swamps, and other wetlands. This habitat has experienced extensive loss or modification with consequent reductions in population levels. In addition increased brood parasitism on nests by the brown-headed cowbird (*Molothrus ater*) has caused declining reproductive success. The Recovery Plan is to increase and improve occupied, suitable, and potential breeding habitat; increase metapopulation stability; minimize threats to wintering and migration habitat; and track recovery progress. Multiple year surveys recently have been completed within suitable or potentially suitable habitat (Utah Division of Wildlife Resources 2001). In 1997, Peterson and O'Neill (1997) found southwestern willow flycatchers in both the Paria River and Escalante River riparian corridors. In addition, a habitat suitability model has been created and ground tested for potentially occupied habitat (Bureau of Reclamation 2002). No nesting pairs have been detected through either the surveys or modeling effort. Critical habitat for southwestern willow flycatcher was designated within GSENM on February 4, 2013. It is an 11.8-mile segment of the Paria River that occurs from the confluence with Cottonwood Wash on the north to Highway 89 on the south. Proper functioning condition assessments of this segment rated it functioning at risk with an upward trend. The segment contains numerous younger aged willows and cottonwoods and stands of tamarisk with little streamside herbaceous riparian vegetation. This segment of the river dries up during dry periods in the summer months. Other drainages throughout the Monument contain cottonwood and willow stands and may become suitable breeding habitat given time.

California Condor (*Gymnogyps californicus*)
The California condor was listed as endangered on March 11, 1967. On October 16, 1996, a population destined for release in northern Arizona was listed as an experimental, non-essential population under Section 10(j) of the Endangered Species Act. Six birds were released on December 12, 1996, from the Vermilion Cliffs in Arizona, just north of the Grand Canyon and south of the area. Condor releases continue from that location. The total northern Arizona releases exceed 50 birds. These condors have been sighted locally, but none have nested within GSENM.

Kanab Ambersnail (*Oxyloma haydeni kanabensis*)
Populations of the federally endangered Kanab ambersnail are found outside this analysis area. Potential habitat was surveyed in 1999 with no snails detected (Meretsky 2000) and (Meretsky and North 2000). There are no known records for this snail within the analysis area.

In addition to the above listed species, the federally endangered Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), humpback chub (*Gila cypha*), and bonytail chub (*Gila elegans*) are native to the adjacent Colorado River system, but are not identified in the project area. The Escalante River and its

tributaries are not considered by Fish and Wildlife Service as habitat for these fish (Yvette Converse, pers. comm.). Surveys have been conducted on the Escalante River, a tributary to the Colorado River, and no federally listed fish were recorded.

Yellow-Billed Cuckoo (*Coccyzus americanus*)

The yellow-billed cuckoo was listed as threatened on November 3, 2014. Yellow-billed cuckoos are one of the latest migrants to arrive and breed in Utah. They arrive in late May or early June and breed in late June through July. Cuckoos typically start their southerly migration by late August or early September. Yellow-billed cuckoos feed almost entirely on large insects which they glean from tree and shrub foliage. They feed primarily on caterpillars including tent caterpillars; they also feed frequently on grasshoppers, cicadas, beetles and katydids, and occasionally on lizards, frogs, and eggs of other birds, and rarely on berries and fruit (Ehrlich et al. 1988, Kaufmann 1996). Nesting habitat is classified as dense lowland riparian characterized by a dense sub-canopy or shrub layer (regenerating canopy trees, willows or other riparian shrubs within 100 meters of water. Over story in these habitats may be either large, gallery forming trees (10-27 meters) or developing trees (3-10 meters) usually cottonwoods. Nesting habitats are found at low to mid elevations (2500-6000 feet) in Utah. Nests have been observed in willow, cottonwood, tamarisk, and mesquite. Cuckoos winter in South America. The Paria and Escalante Rivers and Last Chance and Wahweap Creek drainages possess segments of cottonwood and willow stands but have not reached the size and density suitable for breeding habitat as described in the recovery plan. No cuckoos were detected in recent surveys conducted by the Utah Division of Wildlife Resources along the Escalante River.

Greater Sage Grouse (*Centrocercus urophasianus*)

Sage grouse occur only in western North America. At one time they were found in virtually all areas where sagebrush (especially *Artemisia tridentata*) occurred (Johnsgard 1983). In Utah, sage grouse inhabit sagebrush habitat of the Colorado Plateau and Great basin geographic regions from 6,000 to 9,000 feet in elevation. Sage grouse are dependent upon sagebrush (*Artemisia* spp.), primarily big sagebrush (*Artemisia tridentata*), and do not occur thoughout the year in areas where an abundance of this shrub is absent (Johnsgard 1983). Male sage grouse display on leks (strutting grounds) in early morning and late evening to attract females. Sites chosen for leks are usually openings with an abundance of sagebrush within 300 - 650 feet for escape cover. Nests are typically placed at the base of a live sagebrush plant. Historic leks are located near the Monument boundary on the Skutumpah Terrace in the southwest part of the Monument. There is sagebrush habitat all along the Skutumpah Terrace suitable for sage grouse use. Much of the sagebrush habitat in this historically occupied part of the Monument has seen heavy encroachment of pinyon pine and juniper. It is also possible that sage grouse historically and possibly still inhabit the Fifty Mile Mountain section of the Monument with unofficial reported sightings there. Surveys conducted there in 2011 came up with no sign of sage grouse in some areas they were suspected but all the possible habitat was not covered in the survey. Sage

grouse are also known to occur in John's Valley near the northwest corner of the Monument.

Utah Prairie Dog (*Cynomys parvidens*)

There are five species of prairie dogs, all of which are native to North America and all of which have non-overlapping geographic ranges (Hoogland 2003, p.232). The Utah prairie dog is the smallest species of prairie dog, with individuals that are typically 10 to 16 inches long (Hoogland 1995, p.8). The species range is limited to the southwestern quarter of Utah in Iron, Beaver, Washington, Garfield, Wayne, Piute, Sevier, and Kane Counties (USFWS 2012, p. 1.3-3). Utah prairie dogs occur in semiarid shrub-steppe and grassland habitats (McDonald 1993, p. 4; Roberts et al. 2000, p. 2; Bonzo and Day 2003, p.1). Prairie dogs are predominantly herbivores, though they also eat insects (Crocker-Bedford and Spillett 1981, p. 8; Hoogland 2003, p. 238). Prairie dogs form colonies with associated mounds and burrows, and food resources that are within calling distance. These units are genetically similar and vulnerable to local catastrophes including epizootic disease outbreaks. The Monument has no records of prairie dogs living within its borders although scattered habitat is present. The closest existing populations of prairie dogs can be found on the Paunsaugunt recovery unit which is in close proximity to shrub steppe habitat on the Monument that prairie dogs could possibly wander onto and colonize in the future.

3.3.5 Threatened, Endangered or Candidate Plant Species

Three plant species listed as Endangered or Threatened under the Endangered Species Act (ESA) are found in the project area: Jones' cycladenia, Kodachrome bladderpod and Ute ladies' tresses (Table 3-3). Three other federally listed species (Siler's pincushion cactus, Welsh's milkweed, and Navajo sedge) are known from just outside the boundaries of the project area.

Table 3-3. Threatened and Endangered Plant Species

Species	Family	Legal Status	Comments
Jones' cycladenia *Cycladenia humilis* var. *jonesii*	Apocynaceae	Threatened	Restricted to steep, sparsely vegetated slopes of Chinle shales below sheer cliffs of Wingate Sandstone in the Circle Cliffs region of GSENM and adjacent Glen Canyon NRA and Capitol Reef NP (Death Hollow, Moody, and Wagon Box Mesa Allotments and unallotted lower reach of the Escalante River Allotment). Potentially threatened by lack of pollinators and poor seed production. UT-CDC status = Rare.
Kodachrome bladderpod *Lesquerella tumulosa*	Brassicaceae (Cruciferae)	Endangered	Restricted to barren, whitish, slate-clay knolls of the Paria River Member of the Carmel Formation on GSENM lands south of Kodachrome State Park (Dry Valley, Upper Hackberry, and Upper Paria Allotments). Listed as Endangered in 1987 due primarily to threats from off-road vehicle recreation. UT-CDC status = Rare.
Navajo sedge*	Cyperaceae	Threatened	Found in seeps and springs on steep cliffs of Navajo

Carex specuicola			sandstone and in hanging gardens. The surrounding vegetation is Pinyon-juniper woodland at elevations from 1740 to 1824 meters. This species is known from the south and east of the Monument but no populations have been identified in the project area. UT-CDC status = Rare
Siler's pincushion cactus* *Pediocactus sileri*	Cactaceae	Threatened	Known from vicinity of GSENM on BLM Kanab FO lands. Potential habitat occurs on exposures of the Shnabkaib or Middle Red members of the Moenkopi Formation north of US Hwy 89 on GSENM lands. UT-CDC status = Rare
Ute ladies' tresses *Spiranthes diluvialis*	Orchidaceae	Threatened	Found in moist (but not flooded) stream terraces and abandoned channels along Deer Creek in the King Bench Allotment. Population has remained approximately stable since monitoring began in 1990. UT-CDC status = Rare.
Welsh's milkweed* *Asclepias welshii*	Asclepiadaceae	Threatened	Endemic to partially stabilized to shifting red sand dunes derived from Navajo Sandstone in the Coral Pink Sand Dunes and Sand Cove/Coyote Buttes areas. Potential habitat may occur on dunes west of Johnson Canyon and at the south end of the Cockscomb. UT-CDC status = Rare.

*Not currently known from GSENM, but potential habitat is present within the Monument.

Jones' cycladenia (*Cycladenia humilis* var. *jonesii*) is known from nine populations in the Circle Cliffs/Wolverine region of GSENM and adjacent areas of Glen Canyon National Recreation Area and Capitol Reef National Park.

Kodachrome bladderpod (*Lesquerella tumulosa*), listed Endangered, is restricted to sparsely vegetated whitish slate-clay outcrops of the Winsor member of the Carmel Formation (Welsh and Reveal 1977, Welsh et. al 2003)" and on the east side of the Paria River southeast of Cannonville. Demographic monitoring from 1997-2001 showed a high degree of mortality in 2000-2001, possibly from the recent drought.

Ute ladies' tresses (*Spiranthes diluvialis*) occur within the project area in moist but not flooded terraces and abandoned stream channels in the Deer Creek watershed. The other population is located in the Henrieville Creek.

Siler's pincushion cactus (*Pediocactus sileri*) is not known to occur within the project area. Areas of suitable habitat have been surveyed but no populations have been located.

Navajo Sedge (*Carex specuicola)* has not been located within the project area. While sensitive to dewatering from range improvements, no improvements will be implemented as result of this plan amendment. Future improvement implementation is proposed, but none of the proposals involve dewatering. Impacts on Navajo Sedge will be assessed in future, site specific, analysis when projects may impact it are proposed.

Under BLM Manual 6840, the State Director may designate plant species found on public lands as "Sensitive" if these species are at risk of becoming extirpated or listed as Threatened or Endangered under the ESA due to agency actions. The BLM Utah State Office last revised its official list of state Sensitive plant species in January 2003 (USDI Bureau of Land Management 2003). Presently, 16 Sensitive plant taxa are known and 2 additional species may potentially occur in the project area (Table 3-4). The status, distribution, and threats to each of these species are summarized below. In general, most of these species are edaphic endemics restricted to sparsely vegetated sites with specialized (and often harsh) soil or bedrock characteristics.

Table 3-4 BLM Sensitive Plant Species

Species	Family	Comments
Atwood's pretty phacelia Phacelia pulchella *var.* atwoodii	Hydrophyllaceae	Locally abundant in wet years on gypsiferous knolls of Moenkopi Formation along the US Hwy 89 corridor and Skutumpah roads. One report from Horse Mountain on the Kaiparowits Plateau may represent var. *sabulonum*. Known from at least 8 main populations (Black Rock, Cockscomb, Cottonwood, Headwaters, Mollies Nipple, and Vermilion allotments). Populations are strongly correlated with well-developed biological soil crusts on gypsum-rich soils. Primary threats may be from soil disturbance and competition from weedy annuals. UT-CDC status = Rare.
Chinle chia Salvia columbariae *var.* argillacea	Lamiaceae (Labiatae)	Recently described Utah endemic restricted to Chinle shale barrens in and near Zion National Park. Known from only 2 populations in the Kitchen Corral Wash area (Mollies Nipple allotment). UT-CDC status = Rare.
Chinle evening-primrose Oenothera murdockii	Onagraceae	Recently described Utah endemic. Restricted to 4-5 sites on barren slopes and outwash fans of the Chinle Formation in the Kitchen Corral Wash and Paria townsite areas (Cottonwood and Mollies Nipple allotments). Habitat supports little forage and receives low use by livestock. One colony in Kitchen Corral Wash may be expanding into a disturbed two-track that exposes bare shale soils. UT-CDC status = Rare.
Cronquist's phacelia Phacelia cronquistiana	Hydrophyllaceae	Known from 4 confirmed populations worldwide, all within Kane County, Utah. One occurrence is found in the Ford Well allotment on gypsum-rich soils of the Carmel Formation. UT-CDC status = Rare.
Cutler's lupine Lupinus caudatus *var.* cutleri	Fabaceae (Leguminosae)	According to Welsh and Atwood (2002), the entire range of var. *cutleri* in Utah is limited to the vicinity of the Cockscomb. Little is currently known of the distribution, abundance, or threats to this taxon across its range in Utah, Arizona, and New Mexico. Known from at least 4-5 populations in the Cockscomb, Clark Bench, and Headwaters Allotments and in the BLM Arizona Strip Field Office's Coyote Allotment. UT-CDC status = Additional Data Needed.
Gumbo milkvetch Astragalus ampullarius	Fabaceae (Leguminosae)	Restricted to barren outcrops of the Chinle Formation in Kane and Washington counties, UT and northern Arizona. Currently known from 11 populations (Cockscomb, Cottonwood, Mollies Nipple, and Vermilion allotments) and 24 populations in southern Utah. Local populations occur primarily along the base of the Vermilion Cliffs from Flag Point to the Cockscomb. UT-CDC status = Watch.
Hole-in-the-Rock prairie-clover Dalea flavescens *var.* epica	Fabaceae (Leguminosae)	Not currently known, but potential habitat present in sandy blackbrush or desert shrub habitats or slickrock areas in the Escalante Canyons east of the Hole-in-the-Rock Road. This taxon may be only a minor variant of typical *D. flavescens* with an abnormally thick flower spike. UT-CDC status = Taxonomic Problems.

Species	Family	Comments
Kanab thelypody Thelypodiopsis ambigua *var.* erecta	Brassicaceae (Cruciferae)	Endemic to southern Utah and northern Arizona. Known from three populations in the Seaman Wash, Petrified Hollow, and Kitchen Corral Wash areas (Mollies Nipple and Vermilion allotments). Found in desert shrub and Pinyon-juniper communities on clay soils derived from Chinle shale. UT-CDC status = Rare.
Kane breadroot Pediomelum epipsilum	Fabaceae (Leguminosae)	Endemic to southern Kane County, Utah and adjacent northern Arizona. Known from 8-9 populations on barren outcrops of reddish clay soils derived from the Moenkopi Formation along US Hwy 89 from Seaman Wash to Kitchen Corral Wash (Mollies Nipple, Vermilion, and White Sage allotments). Does not seem to favor sites with well-developed biological soil crusts. UT-CDC status = Rare.
Lori's columbine Aquilegia loriae	Ranunculaceae	Described as a new species in 2001 and thought to be endemic. Currently known from 7 extant populations in the White Cliffs and upper Wahweap drainage (Calf Pasture, Headwaters, Swallow Park, Upper Paria, and Vermilion allotments). Occurs primarily in hanging gardens and narrow, shady sandstone canyons. UT-CDC status = Rare.
Paria iris Iris pariensis	Iridaceae	Known only from the type collection from West Clark Bench, on the Bunting Well Allotment. Not relocated since 1976 despite several recent attempts. Some taxonomists have questioned whether this species is distinct, or just an unusual variant of *Iris missouriensis.* Iris species in general are toxic or unpalatable to livestock and are often increasers. Loss of wetland habitat may be the primary threat to this species. UT-CDC status = Historic (presumed extinct or only known historically throughout range).
Sandloving penstemon Penstemon ammophilus	Scrophulariaceae	Widely distributed in deep Navajo sand dunes in the White Cliffs, with at least one disjunct population in Navajo dunes associated with slickrock in the Escalante Canyons area. Known from at least 12 populations in the Antone Flat, Deer Spring Point, Granary Ranch, Johnson Canyon, Locke Ridge, Mollies Nipple, Second Point, Swallow Park, and Vermilion allotments. UT-CDC status = Rare.
Slender camissonia Camissonia exilis	Onagraceae	Small and readily overlooked annual forb restricted to gypsiferous outcrops with well-developed biological soils crusts derived from the Moenkopi and Carmel formations. Known from approximately 17 populations (Black Rock, Cockscomb, Cottonwood, Dry Valley, Ford Well, Mollies Nipple, Swallow Park, Upper Paria, Vermilion, and White Sage) in the vicinity of US Hwy 89 and the Skutumpah Road. Threatened primarily by degradation of biotic soil crust habitat and replacement by exotics. UT-CDC status = Rare.
Smoky Mountain mallow Sphaeralcea grossulariifolia *var.* fumariensis	Malvaceae	Recently described variety limited to the southern Kaiparowits Plateau and Buckskin Mountain. Found primarily on thermally-altered outcrops of the Straight Cliffs or Morrison formations. Known from only 10 main populations, 9 of which are in the Last Chance, Nipple Bench, Rock Creek-Mudholes, Upper Warm Creek, and Wiregrass allotments. UT-CDC status = Rare.
Spiny gilia Gilia latifolia *var.* imperialis	Polemoniaceae	Restricted to alluvial terraces and rocky benches derived from the Straight Cliffs Formation at the south end of the Kaiparowits Plateau. Currently known from 14 populations in the Cottonwood, Last Chance, Nipple Bench, and Upper Warm Creek allotments. Some populations are found in roadbeds through dry washes. UT-CDC status = Rare.

Species	Family	Comments
Tropic goldeneye Viguiera soliceps	Asteraceae (Compositae)	Annual restricted to barren gray clay flats and knolls of the Tropic shale at the south base of the Kaiparowits Plateau from Cottonwood Wash to Lake Powell. Known from 13 main populations in the Cottonwood, Coyote, Last Chance, and Wiregrass allotments. Populations may number in the hundreds of thousands during wet years but be absent in drought periods. Main threats are from habitat degradation and impacts by off-highway vehicles. UT-CDC status = Rare.
Utah spurge Euphorbia nephradenia	Euphorbiaceae	Endemic to barren gray clay slopes of the Tropic Shale in central and southern Utah. Known only from 3-4 populations at the south end of the Kaiparowits Plateau in the Cottonwood allotment. Mostly threatened by trampling and habitat degradation associated with off-highway vehicle recreation. UT-CDC status = Rare.

3.3.6 Vegetation

The project area is located along the western boundary of the Colorado Plateau physiographic province in south-central Utah. The vegetation communities and flora of the Colorado Plateau are sufficiently distinct and uniform to be recognized as their own ecologically-based land area or eco-region. Within the Colorado Plateau eco-region, variations in climate, geology, topography, and influences from adjacent eco-regions have resulted in localized differences in vegetation and species composition.

Despite its immense area and remoteness, the project area has a long history of botanical exploration and a relatively well-documented flora. Over the past seven decades, 958 vascular plant taxa have been documented. It is estimated that the area may contain as many as 1,100 taxa of vascular plants, representing approximately 50% of the flora of the Colorado Plateau floristic region and 30% of the flora of Utah. Seventy one percent of the flora (684 taxa) consists of relatively common species that are common across western North America. Another 18% of the flora (178 taxa) is comprised of species that are endemic to the Colorado Plateau or immediate vicinity.

The lower stairs of the Grand Staircase (Chocolate and Vermilion cliffs) and the vicinity of Lake Powell have been described as part of the "Dixie Corridor" and contain a number of Mohave or Sonoran desert species that reach the northern edge of their range along the Virgin and Colorado River watersheds in southern Utah. These species include Whipple's cholla, Mexican manzanita, Turbinella live oak, Anderson's wolfberry, Creosote bush, and Desert rue. In addition, the Dixie Corridor has an unusually high concentration of local endemics restricted to Navajo sand dunes (Welsh's milkweed, Escarpment milkvetch), Moenkopi clay flats (Kane breadroot, Meager camissonia, Atwood's pretty phacelia), and Chinle badlands (Gumbo milkvetch, Murdock's evening primrose, Chinle chia, and Kanab thelypody). Many of these endemics are listed as Threatened, Endangered, or BLM Sensitive.

Buckskin Mountain south of US Highway 89 and west of the Cockscomb contains the only extensive outcrops of Paleozoic and early Mesozoic limestone bedrock found on

the Monument and represents the northernmost extension of the Grand Canyon Plateaus floristic element. This region has relatively few endemics compared to the adjacent Canyonlands or Mohave Desert areas, but represents the northern boundary for several species including Chestnut milkvetch, Fern bush, Darrow's buckwheat, and Jones' false cloakfern.

The flora and vegetation of the Skutumpah Plateau, White Cliffs, and Canaan and Boulder mountains are influenced by their proximity to the Utah High Plateaus eco-region. These montane uplands serve as a corridor for migration of members of the Rocky Mountain floristic element, but also act as an effective barrier to desert species from the Great Basin region. In addition, this extension of the Utah High Plateaus region contains endemic species include MacDougal's aletes, Zion draba, Breaks draba, Canaan daisy, Zion daisy, Panguitch buckwheat, Paria breadroot, and Smooth penstemon.

Riparian

Riparian refers to vegetation and habitats that are dependent upon or associated with the presence of water. Riparian areas comprise the transition zone between permanently saturated soils and upland areas. These areas exhibit vegetation or physical characteristic reflective of permanent surface or subsurface water. Riparian areas are divided into two categories, lotic and Lentic. Lotic sites have flowing water and are linear in extent, streams are an example of this category. Lentic sites have pooled or standing water, examples are springs, marshes, and wet meadow.

The BLM has completed a Proper Functioning Condition (PFC) assessment for riparian areas within the planning area. The PFC method is a qualitative field evaluation that analyzes a riparian-wetland area's capability and potential; the PFC assessment is not an ecological rating of vegetation communities. The three components of a riparian-wetland area assessed during PFC are: (1) vegetation, (2) landforms/soils, and (3) hydrology. Based on the condition of these components, each riparian area is placed in one of four categories: Proper Functioning Condition (PFC), Functional-At-Risk (FAR), Non-Functional (NF), or Unknown. Streams and springs determined to be functioning at risk can be further subdivided by trend and contributing factors. An example of a contributing factor is diversion of water from a stream for irrigation. The dewatering of a stream or spring can reduce the vigor and continuity of riparian vegetation and result in a non PFC rating.

Riparian-wetland areas are functioning properly when energy associated with high water flows is dissipated by adequate vegetation, landform, or large woody debris. This dissipation reduces erosion, improves water quality, filters sediment, captures bedload, aids floodplain development, improves flood-water retention and ground-water recharge, develops root masses that stabilize stream banks, provides habitat necessary for fish production and waterfowl breeding, and supports greater

biodiversity. Proper functioning condition reflects the interactions among geology, soil, water, and vegetation.

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PFC assessment data were used to document the factors preventing streams and springs from attaining or trending towards proper functioning condition. Causative factors were documented, such as direct impacts of range management (dewatering caused by water developments, heavy livestock grazing, and heavy livestock trampling/trailing), indirect impacts of grazing (headcutting, exotic vegetation establishment, upstream conditions, watershed conditions), and/or factors not related to range management (non-BLM water diversions, roads, recreation impacts). Multiple factors may affect a single site, since several direct impacts may occur at a given location and indirect impacts may stem from direct impacts (e.g., heavy trampling may lead to development of headcuts).

Table 3-5 Planning Area Riparian Condition Summary

Functional Status	Trend	Miles Evaluated (Lotic)	% of Miles	Number of Sites (Lentic)	%
Proper Functioning Condition	N/A	221.05	49.7	56	40.00
Functioning at Risk	Upward	73.07	16.4	17	12.14
	Not Apparent	83.33	18.7	22	15.71
	Downward	35.24	7.9	31	22.14
Non Functioning	N/A	32.09	7.2	14	10.00
Total		**444.78**	**100**	**140**	**100**

The benefits of these vital areas, however, far exceed their relatively small acreage. The functions of wetland and riparian areas include water purification, stream shading, flood attenuation, shoreline stabilization, groundwater recharge, and habitat for aquatic, semiaquatic, and terrestrial plants and animals (USEPA 2001b).
Invasive plant species degrade wetland and riparian area function and present a challenge to vegetation management. Invasive plant species are one cause of

degradation of wetland function. The plants that are invasive in the riparian areas within the Monument are Russian olive and Tamerisk.

3.3.7 Soils

Most of the soils in the planning area are semiarid, young, and poorly developed. Chemical and biological soil development processes, such as rock weathering, decomposition of plant materials, accumulation of organic matter, and nutrient cycling, proceed slowly in this environment. In many areas, natural or geologic erosion rates are too fast to develop distinct, deep soil horizons. Most soils are less than one-half meter deep to bedrock. The deeper soils are formed in recent alluvium. Almost all of the local soils are derived from sedimentary rock. The dominant topographic features are structural benches, mesas, valley floors, valley plains, alluvial fans, stream terraces, hills, cuestas, and mountainsides.

The planning area is divided into three distinct soil regions which match the three provinces within the region: Escalante Canyons, Kaiparowits Plateau, and the Grand Staircase.

The Escalante Canyons Region has three sub-regions: the Circle Cliffs, the Canyon-Slick Rock, and the Hole-in-the-Rock.

> The Circle Cliffs sub-region is predominantly Moenkopi Formation and Shinarump Member of the Chinle Formation, which form dominantly lithic soils with deeper soils around the Lampstand area and in alluvial bottoms.
>
> The Canyon-Slick Rock sub-region is dominantly the Navajo Sandstone and Carmel Formation. Navajo Sandstone weathers into sandstone slick rock and deep sand with lithic soils around the edges of the slickrock. Sand sheets of Navajo sand dominate this area. The Carmel Formation overlies the tops of the mesas. The Carmel Formation, and a smaller component of the Kayenta Formation, primarily has lithic soils with pockets of deep eolian sand derived from Navajo Sandstone.
>
> The Hole-in-the-Rock sub-region is a mix of fan surfaces and bedrock with overlying deep soils. The deeper soils are on alluvial fans and pediments derived from Fiftymile Mountain. Soil textures range from silt clay loam to sand. As you move towards the Escalante River, the soils become deeper sand derived from the Entrada and Navajo formations. Of the three sub-regions, the Hole-in-the-Rock sub-region has the greatest concentration of deep soils.

In the Kaiparowits Plateau Region, the soils are formed from residual bedrock. The deeper soils are on the tops of benches or plateaus with lithic soils around the edges and on the side slopes. Unique features in this Region are the large landslide deposits.

The Grand Staircase Region has great diversity in geology creating tremendous soil variability. Generally, deeper soils are on the tread portion of the staircase and lithic soils are on the riser portion of the staircase. The unique feature in this region is a lava flow.

> The Buckskin sub-region has the majority of the limestone bedrock in the area. The limestone bedrock is primarily Timpoweap Member of the Moenkopi Formation. The soils are mostly moderately deep to bedrock.
>
> The Highway 89 Corridor sub-region is a mix of deep to shallow soils derived from alluvium and bedrock residuum from the Chinle and Moenkopi Formations.
>
> The Vermillion Cliffs / White Cliffs (Navajo Sandstone) sub-region is dominated by relatively productive deep sands.
>
> The North / Northwest White Cliffs sub-region has predominately deep soils with loamy soils residing in the middle of the benches, sandy soils towards the edges of the benches, and shallow soils at the edge of the escarpments.
>
> The Northwest Gray Cliffs sub-region northwest of the Gray Cliffs the majority of the soils are lithic, formed in residium from bedrock. Large alluvial fan remnants and stream terrace remnants are also present in this sub-region. These are characterized by having deeper, older soils, some with thick petrocalcic horizons.

Complete soil data are contained in the Grand Staircase-Escalante National Monument Soil Survey (NRCS 2005). The published survey is an archival copy that is not kept current. Rather, NRCS maintains and updates soils data electronically. The most current electronic data are available online through the Web Soil Survey http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx). The soil survey contains soil series descriptions, map unit descriptions and soils interpretations, among other useful information. Soils maps are not published, but can be created using the electronic data. The electronic data consist of a spatial dataset and a tabular dataset that must be imported into a Microsoft Access database before it may be used. Once imported, it becomes an ArcGIS file geodatabase that may be used with the spatial dataset. Complete instructions for doing so are included in data downloaded through the Web Soil Survey.

Soils in arid and semiarid regions are particularly critical to sustaining ecosystems because they can be more vulnerable to degradation from a number of natural and artificially induced disturbances. Management practices may affect the ability of the various soils to maintain productivity by influencing disturbances such as displacement, compaction, erosion, alteration of organic matter and soil organism levels. When soil degradation occurs in semiarid regions, natural processes are slow to return to site productivity. Soil bulk density (mass per unit volume), porosity, organic matter

content, hydraulic conductivity, moisture content, nutrient content, and soil temperature are affected to various degrees by surface disturbance. In turn, these factors affect soil-water interactions, productivity, nutrient cycling, water holding capacity, and soil erosion rates.

Soil productivity varies widely due to characteristics such as soil depth, nutrient status, available water holding capacity, and site characteristics including elevation, aspect, and slope gradient. The most productive soils for forage production are found in valley bottoms, drainage bottoms, and terraces.

3.3.8 Air Quality

Air quality refers to the ability of the air to support human and ecosystem health and welfare, including esthetics such as visibility. Air quality standards (National Ambient Air Quality Standards, or NAAQS) have been designated in the U.S. to prevent significant human health and welfare impacts caused by pollutants in the air. The Clean Air Act, as amended in 1990, establishes a mandate to reduce emissions of specific pollutants via uniform federal standards. As the agency responsible for implementing the Act, the USEPA established NAAQS for six pollutants to protect public health and welfare. These criteria pollutants are SO_2, NO_2, CO, O_3, lead, PM_{10}, and $PM_{2.5}$. In addition, the Clean Air Act stipulates that the air quality of most areas should not significantly deteriorate. Air quality is quantified by the atmospheric concentration of defined pollutants in a specific area. Air quality is affected by pollutant emission sources, as well as the movement of pollutants in the air via wind and other weather patterns.

The entire Monument area is in attainment for all NAAQS and is classified as a PSD Class II area. Air quality is regulated by the Utah Department of Environmental Quality, and is affected primarily by sources outside of the area. Emissions from coal-burning electric plants and vehicles in metropolitan areas to the west and southwest periodically reduce air quality. Additionally, air quality may be reduced on a temporary basis by wildland fire, wildland fire use, and prescribed fire within the area. In addition wildland and prescribed fires in this area has the potential to impact PSD Class I areas and influence regional haze in areas such as Glen Canyon National Recreation Area, Grand Canyon, Zion and Bryce National Parks.

3.3.9 Flood Plains

Floodplains are defined (44 CFR 59.1) as “any land area susceptible to being inundated by water from any source.” Areas of Special Flood Hazard are defined (44 CFR 59.1) as areas of land that would be inundated by a flood having a 1-percent chance of occurring in any given year (also referred to as the base flood or 100-year flood). On the Monument floodplains are primarily associated with the riparian zones of perennial and intermittent streams, but sometime also with lentic areas (large wet meadows).

Floodplains on the Monument have been delineated by the Federal Emergency Management Agency (FEMA) in cooperation with Garfield and Kane Counties. Floodplains are mapped on Flood Insurance Rate Maps (FIRMs). The most recent FIRMs available for the Monument date from 1978 (updated 1986) for Kane County, and from 1986 for Garfield County. These maps include the floodplains associated with all or parts of the following streams: Paria River (and parts of tributaries Sand Gulch, Henderson Canyon Creek, North Creek, Henrieville Creek, Little Creek, Sheep Creek, Willis Creek and Cottonwood Creek), Escalante River (and parts of tributaries Upper Valley Creek, North Creek, Birch Creek, Collett Canyon Creek, Coyote Gulch, Alvey/Harris Wash and David Gulch), Johnson Canyon Creek, Kitchen Corral Wash (and parts of tributaries Clay Hole Wash, Deer Spring Wash and Park Wash), Wahweap Creek (and parts of tributary Tommy Smith Creek), Last Chance Creek and Croton Canyon Creek.

In accordance with Executive Order 11988 on Floodplain Management (and Departmental Manual Part 520, Chapter 1, which implements this and related Executive Orders), BLM must conduct an eight-step review process as part of their decision making on projects that have potential impacts to or within floodplains, including the following:

1. Determine if a proposed action is in the base floodplain (that area which has a one-percent or greater change of flooding in any given year).
2. Conduct early public review, including public notice.
3. Identify and evaluate practicable alternatives to locating in the base floodplain, including alternative sites outside of the floodplain.
4. Identify impacts of the proposed action.
5. If impacts cannot be avoided, develop measures to minimize the impacts and restore and preserve the floodplain, as appropriate.
6. Reevaluate alternatives.
7. Present the findings and a public explanation.
8. Implement the action.

Typically, this review is conducted as part of a NEPA review.

3.3.10 Wild and Scenic Rivers

The main stems of both the Escalante and Paria Rivers and select tributaries are recommended as suitable for possible designation as a Wild and Scenic River (WSR) under section 5(d)(1) of the Wild and Scenic River Act. The Nationwide Rivers Inventory also lists both the Escalante River and Paria River as possessing values of national significance. As prescribed in the WSR Act and by BLM policy, the area included in the evaluation is the river area and tributaries within the river corridor and is usually measured ¼ mile from the mean high water mark on both sides of the channel. Both rivers were identified as objects of historic or scientific interest when the Monument was designated.

Suitable segments of the main stem and tributaries within the Escalante River system (140 miles) and the Paria River system (112 miles) are documented as possessing the following Outstanding Remarkable Values (ORV): **scenic** values; **recreational** values including ease of access; **geological** values including geologic features such as bridges, arches, deep and colorful canyons including slot canyons; **riparian** values: providing unique riparian corridors in an otherwise arid region which includes wildlife species who rely upon the river for habitat and sensitive plant species; and **historic** values including evidence of prehistoric cultures. The suitability recommendation discussion specific to the outstanding remarkable value of **riparian** identified the following for the Escalante River: 190 birds; 8 amphibians; 54 mammals; 20 native fish and 20 reptile species and for the Paria River: 242 birds; 7 amphibians; 59 mammals; and 21 reptiles. Both rivers identify special status species including threatened and endangered birds and birds protected under the Migratory Bid Act. All river segments have been tentatively classified as either *wild, scenic* or *recreational.*

BLM Manual 6400, *Wild and Scenic Rivers-Policy and Program Direction for Identification, Evaluation, Planning and Management* provides guidance that suitable segments should be managed to protect the free-flowing condition, water quality and outstanding remarkable values according to Section 10(a) of the Wild and Scenic Rivers Act. In addition, suitable river segments should be managed to maintain their tentative classifications (wild, scenic, or recreational) until Congress designates the river as a component of the National System or releases the river for other uses. Section G. *Vegetation Management* gives policy and program direction related to exotic weed removal on river segments determined eligible or suitable for inclusion in the Wild and Scenic Rivers System. Guidance in Section 3.6I1 *Invasive Species Management* states that the spread of terrestrial invasive species should be prevented and controlled, consistent with direction in the land use plan, other federal direction or authorities and available funding. It also allows that a full range of manual and chemical prevention and control methods may be used.

Eighty-two percent of the WSR segments on the Escalante River and nearly seventy-five percent of the Paria River segments are also contained within WSA boundaries within GSENM; hence WSA guidance would also apply to management of weeds and invasive species on WSR suitable segments of rivers and tributaries located inside WSAs. Actions occurring on WSR river corridors located outside WSAs on GSENM would also prioritize maintenance of tentative classification of wild, scenic or recreational and protect the wild and free-flowing nature of the river and the riparian habitat as an Outstanding Remarkable Value, unless further site specific and project specific NEPA is applied. Design features detailed in Section 2.2 guide allowable methods of treatment and restoration on WSR suitable corridors.

3.3.11 Fuels and Fire Management

There are five Fire Management Units (FMU) within the project area: Big Deer, The Blues, Collet-Fifty-Mile, Escalante-Circle Cliffs, and Kaiparowits. This section focuses on Russian olive and tamarisk because treatment of these invasive species may affect fuels and fire management. Other weed treatments are not likely to affect fuels and fire management. Russian olive and tamarisk treatments would primarily occur in the Big Deer and Escalante-Circle Cliffs FMUs; small areas would be treated in the other FMUs.

The Big Deer FMU is generally located west of Cottonwood Wash and the Cockscomb, east of Johnson Canyon and south/southeast of Bryce Canyon National Park. Within this FMU, Russian olive and tamarisk occur along the Paria River and its tributaries, springs, seeps, and other areas with seasonal moisture.

The Escalante-Circle Cliffs FMU is located in the northeast corner of the Monument. It includes the area around the towns of Escalante and Boulder, the Hole-in-the-Rock road, the Canyons of the Escalante, and the Circle Cliffs area. Russian olive and tamarisk occur throughout this FMU along riparian river bottoms and other areas with seasonal moisture.

None of the three alternatives analyzed would change the existing Fire Regime and Condition Class as described in the Southwest Support Area Fire Management Plan for the five FMUs located within the project area. These alternatives would not result in an increase or decrease in the number, frequency, or acres of fires that may occur in each of the FMUs located in the project area.

3.3.12 Recreation

Recreation is one of the major land uses within GSENM. Common activities include camping, hiking, backpacking, educational/therapeutic programs, hunting, wildlife viewing, photography, mountain biking, and off-highway vehicle (OHV) use. From 2000 through 2013 GSENM has seen a 17% increase in general public visitation; however during the same time Special Recreation Permits (Outfitters and Guides) have increased by 64% (Recreation Management Information Systems (RMIS). In 2013, GSENM received 759,587 general public visits and issued 86 Special Recreation Permits to guides and outfitters for hiking, backpacking, hunting, pack stock, fishing, sightseeing, photography, mountain biking, and heritage group tours and trip.

The Monument Management Plan designated six Special Recreation Management Areas (SRMA) and two Extended Recreation Management Areas' (ERMA). SRMAs are areas where more intensive recreation management may be needed because the area will be a focal point for visitation (Highway 12 and 89 corridors) or because recreational uses within the area needs to be closely managed or limited to prevent conflicts with other Monument resources (Escalante Canyons, Paria/Hackberry, and Fiftymile Mountain). The two SRMAs that receive the highest recreation visitation are the Escalante Canyons and Paria/Hackberry SRMAs. Recreation is heaviest along Highways

12 and 89 but includes the major interior travel routes (i.e. Skutumpah Road, Cottonwood Road, Hole-in-the-Rock Road and Burr Trail). Recreation decreases on secondary and tertiary routes of travel although these routes are key access routes to backcountry destinations within GSENM and Glen Canyon National Recreation Area. Recreation visitation continues to decrease on back-country trails accessible by foot or horseback; however, back-country travel (i.e. hiking, backpacking, equestrian use and camping) is a primary reason for many visitors coming to the area.

In addition to SRMA designations, there are four management zones. Management zones are used to display various management emphases and strategies that will best fulfill the established purposes of the Monument and the overall vision. These zones, which are delineated by geographic area, provide guidance to help define permitted or excluded activities and any stipulations pertaining to them. In this context, zones are tools that guide decision-making on permitting visitor uses and other activities within the Monument (MMP, p. 8-9).

The Frontcountry Zone (78,056 acres or 4 percent of the Monument) is intended to be the focal point for visitation by providing day-use opportunities in close proximity to adjacent communities and to Highways 12 and 89 which traverse the Monument. This zone will accommodate the primary interpretation sites, overlooks, trails, and associated facilities necessary to feature Monument resources. The zone boundaries were developed by locating a corridor along Highways 12 and 89, Johnson Canyon Road, and the portion of Cottonwood Canyon Road leading to Grosvenor Arch. The zone was then expanded or constricted to coincide with the dominant terrain features which provide identifiable boundaries on the ground. Existing destinations such as Grosvenor Arch, the Pahreah town site, and the Calf Creek Recreation Area were included in order to provide for necessary improvements and to accommodate expected visitation. Lands close to the Town of Escalante were also included due to extensive visitor use. In delineating this zone, Wilderness Study Areas (WSAs), threatened and endangered species habitat, relict plant areas, riparian areas, and other sensitive resources were avoided whenever possible. Highway 89, from the western boundary to The Cockscomb, lacks dominant terrain to delineate this zone. For this reason, a 1-mile buffer along each side of the highway was used.

The Passage Zone (39,037 acres or 2 percent of the Monument) includes secondary travel routes which receive use as throughways and recreation destinations. While rudimentary facilities necessary for safety, visitor interpretation, and for the protection of resources will be allowed in this zone, the Bureau of Land Management (BLM) will generally avoid directing or encouraging further increases in visitation due to the condition of routes and distance from communities. The primary criterion for developing the zone boundaries was again dominant terrain. The boundary does not constrict closer than 100 feet to designated routes, and encompasses most obvious imprints of human activities such as trailheads, transmission rights-of-way, and potential resource interpretation sites within 1/2 mile of the subject route. In many

cases, dominant terrain was not available along route segments. In these cases, a 660-foot (1/8 mile) buffer was used. Again, WSAs, threatened and endangered species habitat, relict plant areas, riparian areas, and other sensitive resources were avoided whenever possible.

The Outback Zone (537,748 acres or 29 percent of the Monument) is intended to provide an undeveloped, primitive and self-directed visitor experience while accommodating motorized and mechanized access on designated routes. Facilities will be rare and provided only when essential for resource protection. The remaining public routes not in the Frontcountry or Passage Zones are included in the Outback Zone. Dominant terrain was again a primary criterion for the zone boundary. The boundary does not constrict closer than 100 feet to the routes. WSAs were avoided wherever possible.

The Primitive Zone (1,210,579 acres or 65 percent of the Monument) is intended to provide an undeveloped, primitive and self-directed visitor experience without motorized or mechanized access. Some administrative routes are included in this zone, which could allow very limited motorized access. Facilities will be nonexistent, except for limited signs for resource protection or public safety. The zone is intended to facilitate landscape-scale research and therefore connects each of the three major landscapes (Escalante Canyons, Kaiparowits Plateau, and Grand Staircase), as well as linking low elevation areas to higher elevations. This zone is also intended to connect primitive and undeveloped areas on surrounding lands managed by other Federal agencies.

3.3.13 Livestock Grazing

The majority of public land administered by Grand Staircase-Escalante National Monument (GSENM) is allocated to livestock grazing allotments. GSENM currently administers grazing on 79 available/open grazing allotments with an active preference of 76, 957 AUMs. Each allotment covers a specific area, and may be managed via an Allotment Management Plan, which specifies season of use, class and number of livestock, and management objectives. 17 of the 79 grazing allotments are partially or wholly located on Glen Canyon National Recreation Area lands while an additional few include Kanab Field office and Arizona Strip Field office lands but due to their location grazing is administered by GSENM. A small percentage of allotments are used for summer and/or season-long grazing, while the majority are winter use, typically from mid-October to mid-March and the end of April. The majority of GSENM administered allotments are “Common” allotments, meaning that more than one permittee grazes livestock within its defined boundaries.

Within the individual allotments are a number of Range Improvement Projects usually constructed through cooperative agreements between the Bureau of Land Management (BLM) and the grazing permittee and are maintained by the permittee(s).

These improvements consist of water developments, livestock handling facilities, fencing and rangeland treatments and seedings. A few remote allotments have range line cabins as well. Due to the pattern of land ownership in Garfield and Kane Counties, livestock permittees are highly dependent on public rangeland for their ranching/grazing operations.

3.3.14 Paleontology

The Monument contains an abundant and globally significant paleontological resource. Exposed within its borders are Permian to Cretaceous age bedrock, and surficial deposits of Plio-Pleistocene to Holocene age. Permian, Triassic, Jurassic, and Cenozoic units are locally rich with important fossils but remain little studied (see Foster et al. 2001 for updated summaries), although the last few years have seen some advances, especially in the Triassic Chinle Formation. Historically, the emphasis of most research and inventory has been on the rich exposures of Cretaceous strata exposed primarily on the Kaiparowits Plateau, but also in the upper portion of the Grand Staircase, below the Claron supported cliffs of Bryce. Knowledge of Cretaceous-age brackish and marine invertebrates, especially those with high-bio stratigraphic resolution, was summed up by Cobban et al. (2000). Freshwater invertebrates and paleo-botanical diversity remain virtually un-documented. Paleontological potential exists anywhere ancient bedrock formations crop out near the surface or in alluvial deposits that are older than 10,000 years.

Since 2000, Monument-sponsored fieldwork conducted by the Natural History Museum of Utah, the Denver Museum of Nature and Science, the Alf Museum (Claremont, CA), the Museum of Northern Arizona, and the Utah Geological Survey has shown that the potential for large macrovertebrate remains is highest in the Kaiparowits, Wahweap, and Tropic Formations, with large skeletons occurring regularly in all three. This is based on analysis of thousands of new sites found since 2000 by systematic inventory. It is estimated the approximately 12-15% of fossiliferous outcrops have been surveyed so the majority of even just the Kaiparowits Plateau can only be discussed in terms of potential. However certain key areas have emerged as consistent producers of scientifically significant resources. Plesiosaurs (e.g. *Trinacromerium, Brachauchenius, Eopolycotylus, Palmulasaurus*), turtles (*Desmatochelys, Naomichelys*), primitive mosasaurs (marine lizards) and large fish (xiphactinids) dominate the Tropic assemblages, but a single rare 70% complete therizinosaur (*Nothronychus* n. sp.) dinosaur has also been collected. The Tropic vertebrate remains are very well-preserved in many cases and the fauna contains several new species that are currently being described or in press. Macro-skeletal vertebrates collected from the Wahweap in the last 4 years include several species of turtles, several ceratopisd skulls (*Diabloceratops* and at least one other genus), hadrosaurs, pachycephalosaur (cf. *Stegoceras*), the tyrannosaur *Lythronax*, nodosaur dinosaurs, and the giant alligator *Deinosuchus*. In many cases the Wahweap material probably also represents new

species. Tracksites of large hadrosaur and theropod dinosaurs have also been documented in the Wahweap, adding to an already impressive record.

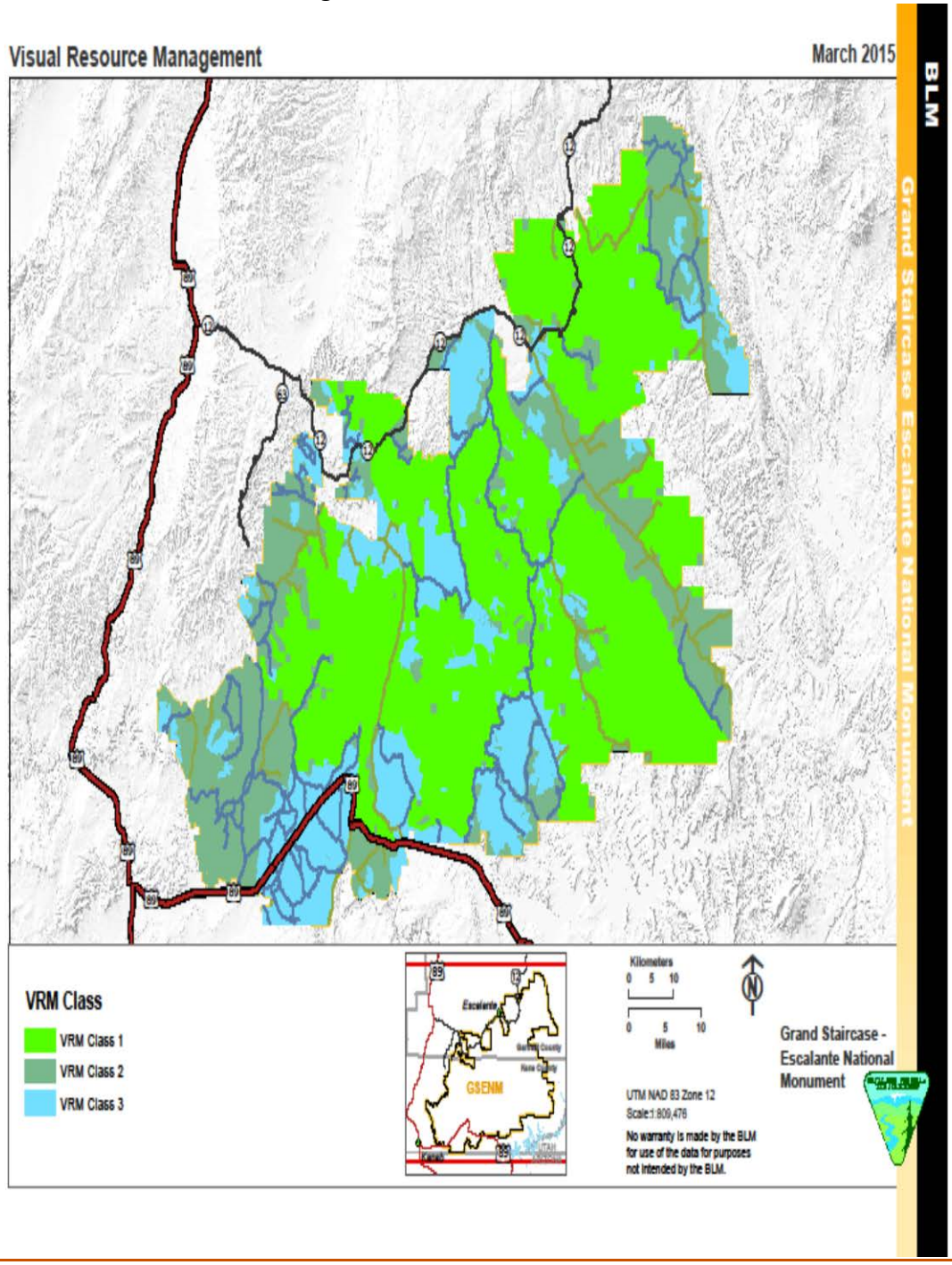
By far the highest number of new sites found since the 2000 effort began, are in the Kaiparowits Formation. Since 2001, crews from the BLM and the Utah Museum of Natural History have found and collected the skeletal remains of at least 16 new species of dinosaurs, including the following: crested (*Parasaurolophus cyrtocristatus*) and non-crested (*Gryposaurus* spp.) hadrosaurs, hypsilophodontids, ornithomimids, oviraptorid theropods (*Hagryphus giganteus*), two kinds of ankylosaurs, a nodosaur, the chasmosaurs *Kosmoceratops richardsoni* and *Utahceratops gettyi*, the centrosaurine *Nasutoceratops titusi*, the tyrannosaur *Teratophoneus curriei*, at least two kinds of pachycephalosaurs, the raptor *Talso sampsoni* and a new kind of pro-hadrosaur animal. Non-dinosaur taxa include numerous genera of turtles, fish (including *Lepisosteus* and *Melvius* sp.), the most-diverse Late Cretaceous crocodilian assemblage known in the world (represented by a giant goniopholid, the giant alligator Deinosuchus, smaller alligators, and caymans), and a host of smaller taxa such as birds, mammals, amphibians, snakes, and lizards.

No macrofossils have been reported from the Canaan Peak or Pine Hollow formations, although the former probably is, at least in part, Paleocene in age, while the latter formation is entirely Paleocene or younger. Most workers agree the published record represents only a fraction of the total potential diversity, and yet the Kaiparowits Plateau is already widely regarded as preserving one of the most complete records of Late Cretaceous terrestrial vertebrate ecosystems in a single region in the world (Titus et al., 2013). Overall this resource is globally significant for understanding the end of the age of dinosaurs and research will continue for the foreseeable future. For the purposes of planning and analysis, Utah BLM's and GSENM's Potential Fossil Yield Classification (PFYC) systems will be used in conjunction with literature searches, local expertise, and possible reconnaissance field inventories to determine treatment area potential.

3.3.15 Visual Resources

Visual Resource Management (VRM) classes were determined for Monument lands during the Monument Management Planning process and are decisions included in the *GSENM Management Plan* (effective February 2000). Lands within the Monument were designated either VRM Class II or III. Shortly after the management plan became effective, policy clarification in IM 2000-096 directed BLM to manage WSAs as VRM Class I either until they are designated by Congress as Wilderness or are released for other uses. Therefore, approximately 47% of the Monument is to be managed as VRM Class I, 21% as VRM Class II, and the remaining 32% is to be managed to meet VRM Class III objectives. Given the broad scope of the proposed action, weed treatments could be located within any of those three VRM management classes.

Figure 4 Visual Resource Management



The objective for VRM Class I is to preserve the existing character of the landscape. This class provides for natural ecological changes; it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

The objective for VRM Class II is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color and texture found in the predominant natural features of the characteristic landscape.

The objective for VRM Class III is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Any changes should repeat the basic elements of form, line, color and texture found in the predominant natural features of the characteristic landscape.

3.3.16 Lands with Wilderness Characteristics

The original BLM nationwide wilderness inventory process of 1980 under section 603 of FLPMA was supplemented by a subsequent re-inventory of BLM lands in Utah in 1996-1999. As part of this inventory process, an additional 457,049 acres within the Monument were found to possess the following wilderness characteristics: *Untrammeled; Natural; Undeveloped; Solitude and Primitive and Unconfined Recreation* as well as *Unique, Supplemental or Other Features*. Potential impacts to these areas, now referred to as *Lands with Wilderness Characteristics (LWC)* are required to be addressed in any project proposals or NEPA as directed by *BLM Manual 6320-Consideration of Lands with Wilderness Characteristics in the BLM Land Use Planning Process (2012.*

The NEPA planning effort for the MMP/EIS in 1999 addressed the management of LWC lands by zoning these areas within the boundaries of the designated primitive zone which allows for an undeveloped, primitive and self-directed visitor experience without mechanized or motorized access (MMP/EIS). Since the inventoried LWC lie within the primitive zone and were evaluated in a prior NEPA process, overall protection of wilderness characteristics is directed by MMP decisions regarding allowable actions within the primitive zone as well as Monument-wide direction for treatment of invasive species removal and restoration. Due to the contiguous nature of LWC bounding or bordering WSAs within the primitive zone, the presence of wilderness characteristics within the primitive zone is prioritized for protection, subject to the presence of grandfathered existing uses. Design features are included to address protection of wilderness characteristics through implementation of weed removal, treatment and restoration activities for future site-specific projects that may occur on LWC.

3.3.17 Wilderness Study Areas

The Monument contains 16 Wilderness Study Areas (WSAs), totaling approximately 881,997 acres. In 1978-1980, BLM directed that BLM lands be inventoried and these 16

WSA's (now within GSENM) were inventoried and/or identified at that time, as part of the nationwide wilderness inventory process. Each WSA was found to contain the following wilderness characteristics : *Untrammeled; Natural; Undeveloped; Solitude and Primitive and Unconfined Recreation* as well as *Unique, Supplemental or Other Features* as guided by the 1964 Wilderness Act.

BLM Manual 6330-Management of BLM Wilderness Study Areas (2012) sets forth policy and program direction for WSA's and states: "During the period of review of such areas and until Congress has determined otherwise, the Secretary shall continue to manage such lands according to his authority under this Act and other applicable law in a manner so as not to impair the suitability of such areas for preservation as wilderness." This language is referred to as the "non-impairment" mandate which guides evaluation of all uses or proposals occurring within WSA's.

Intact native ecosystems are integral to the sustainability of wilderness study area settings. The wilderness characteristic of "natural" is attributed to a lack of development, roads or presence of man-made structures as well as the presence of native plant communities and ecosystems. Exotic species can displace native species on a large scale and invade sensitive species habitats, contributing to degradation of the wilderness characteristic related to "natural". BLM Manual 6330 Section 1.6 C. details an allowable exception for activities or uses which are clearly related to the protection or enhancement of wilderness characteristics or values. Many weed removal activities and restoration activities are anticipated to cause surface disturbance. However, the activity would meet the allowable exception if a) it clearly demonstrates that it protects or enhances wilderness characteristics and b) is conducted in a manner that is "least impairing". Section D.8 Vegetation Management in BLM Manual 6330 also provides guidance for weed-removal and restoration activities to promote the restoration of ecological integrity and the enhancement of "naturalness".

4.0 ENVIRONMENTAL IMPACTS

4.1 Introduction

As identified in Chapter 3, Fish and Wildlife Excluding USFW Designated Species, Paleontology, Recreation, Threatened, Endangered or Candidate Plant Species, Threatened, Endangered or Candidate Animal Species, Visual Resources, Invasive Plant Species, Fuels and Fire Management, Lands with Wilderness Characteristics, and Wilderness Study Areas will be analyzed. Each issue identifies current policies and procedures required by local, state and federal agencies. The proposed action incorporates design features in lieu of mitigation measures

4.2 General Analysis Assumptions and Guidelines

Affected resources analyzed in this EA are addressed from a monument-wide approach and will look at each individual resource.

Acreage and treatment areas assumptions. Under Alternative A which would allow the use of all approved active ingredients, and adjuvants approximately 700-1200 acres would be treated annually depending on funding. Areas treated would typically consist of 0-5 acre polygons with most being ~1/10 acre in size and scattered across the monument. Treatments would seldom be noticeable. Under Alternative B treatment acreage would run between 500-700 acres and treatments would use six fewer chemicals than Alternative A.

4.3 Direct and Indirect Impacts

Direct effects 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.

4.3.1 Proposed Action – Herbicide use

4.3.1.1 Water Resources

The proposed herbicide treatments have the potential to affect water resources by altering water flows, surface water and groundwater quantity and quality, and rates of groundwater recharge. The probability, severity and extent of any effects depends on the size of area treated: smaller treatments are less likely to cause adverse effects, and the effects are likely to be minor or localized, while larger treatments are more likely to cause adverse effects, and the effects will be more sever or more extensive. Herbicides treatments could affect water quantity by altering both the magnitude of base flows and the frequency and magnitude of peak flows. For some treatment areas, the removal of vegetation, especially in large quantities, could improve groundwater recharge by limiting the amount of water lost through sublimation or plant evapotranspiration. In this case, base flows, which are dependent on the quantity of groundwater discharge, would increase. Under some circumstances, vegetation removal could result in the reduction of groundwater discharge and base flow as a function of reduced infiltration rates. Reduced infiltration rates result in more surface runoff reaching streams and lakes immediately after a rain event, thus increasing the velocity, frequency, and magnitude of peak stream flows. These changes in water quantity could alter the physical characteristics of stream channels and affect the speed of water movement. Any changes would last until the site is revegetated. Shallow groundwater is at greater risk for contamination than deeper aquifers (BLM 2007a).

Water quality data for the surface water and groundwater resources of the Monument (described under Section 3.3.1 Water Resources, above) do not include any data on herbicide contamination. However, streams and watersheds in some parts of the Monument do not meet water quality standards (see Tables in Section 3.3.1 Water Resources, above). Thus, actions that further deteriorate water quality or watershed health need to be carefully evaluated before being implemented. Based on the analysis of impacts associated with specific herbicides in the PEIS (BLM 2007a, pp. 4-24ff), use of Standard Operating Procedures described in 2007 ROD (BLM 2007c; Appendix B-2 herein) will minimize any potential for adverse effects on water resources. The 2007 ROD concludes that "Several herbicide active ingredients have been identified as groundwater contaminants (e.g., 2,4-D, glyphosate, picloram, simazine). The BLM will adhere to herbicide product labels with regards to application restrictions associated with groundwater protection and will use other SOPs and mitigation measures to further reduce risks to groundwater. Effects to surface water would be minor, and herbicide concentrations in surface water should not exceed safe levels for human health. There is potential for herbicides to be transported in surface water and impact non-target vegetation and the BLM will use buffers to reduce or avoid this risk." (BLM 2007c, p. 4-7). Standard mitigation measures recommended by 2007 ROD will be applied (BLM 2007c; Appendix B-4 herein).

Non-herbicide treatments could also affect both surface water and groundwater quality and quantity. As with herbicide treatments, the probability, severity and extent of any effects depends on the size of area treated: smaller treatments are less likely to cause adverse effects, and the effects are likely to be minor or localized, while larger treatments are more likely to cause adverse effects, and the effects will be more sever or more extensive. Removal of vegetation could affect surface water by increasing surface runoff, promoting erosion and sedimentation, reducing shading and increasing water temperature (Clark 2001), and limiting the amount of organic debris entering water bodies (BPA 2000). Erosion in areas with natural saline soils can lead to higher levels of salinity in nearby water bodies (USGS 1996). Removal of vegetation could temporarily affect water flows by altering the magnitude of low flows and the frequency and magnitude of peak flows, as compared to pre-treatment conditions. The removal of vegetation, especially over large areas, would improve groundwater availability over the short term by reducing water lost through evapotranspiration of plants. Low flows, which are dependent on the quantity of groundwater, would temporarily increase. The removal of vegetation could cause short-term increases in surface runoff, as there would be reduced interception of precipitation and evapotranspiration by plants. Vegetation treatments that affect the interception of precipitation could increase the magnitude and frequency of peak flows and could subsequently alter the physical characteristics of the stream channel. If channel morphology has not been substantially altered, effects would persist until vegetation is reestablished. Restoration of native plant communities and vegetation structure would

ultimately improve hydrologic function and watershed processes long term (BLM 2007b, p. 4-20).

Increased surface water runoff resulting from vegetation removal could contribute to increased erosion, particularly in high gradient watersheds. This could further contribute to increased sediment loadings and the potential reduction in surface water quality. Sediment, which has been described as the greatest non-point source of pollution, increases turbidity and contributes to reduction in dissolved oxygen (Spence et al. 1996; BLM 2007b, p. 4-21). Erosion and sediment (particulate)-borne pollutants (TDS, metals) are at least part of the reason that some streams do not meet water quality standards (see 303(d) table, Section 3.3.1 Water Resources, above)

Any treatment that removes vegetation, whether by herbicide or non-herbicide treatments, could affect water quality by reducing nutrient uptake by plants, resulting in a pulse of nutrients to nearby water bodies. Soluble nutrients, such as nitrogen, would likely enter streams or other water bodies via groundwater, while nutrients adsorbed to soil particles (e.g., phosphorous) could be carried to surface water in runoff. Nitrogen as nitrate is most often the nutrient of concern (BLM 2007b, p. 4-21f).

Mechanical treatments: The effects of mechanical treatments on water quality would largely depend on the techniques used, the proximity of the treatment site to a stream or water body, and the slope of the site. The likelihood of soil and plant material being carried into streams by surface runoff would vary as a function of the degree of soil disturbance caused by machinery used. In addition, the compaction of soil by heavy equipment would increase the likelihood of surface runoff by reducing the soil's infiltration capacity (BLM 2007b, p. 4-23).

Manual treatments: Because manual treatments would occur over small areas and would involve minimal soil disturbance or vegetation removal, the effects to water resources would be minimal. Manual treatment seldom results in exposed soil, and plant materials would remain in the treatment areas, minimizing the risks of sedimentation and alterations to water flow (BLM 2007b, p. 4-23).

Fire: The potential effects of fire on water resources would depend largely on the severity and size of the fire: a small fire or a low severity burn is less likely to degrade water quality and quantity than a large fire or a severe burn. Also, proximity to a water body increases a fire's potential to affect water quality. Fires generally result in an increase in surface runoff and sediment inputs to water, and a decrease in infiltration and thus groundwater recharge. The amount of runoff would be a function of the timing and severity of the fire, the slope of the treatment site, and the timing, amount, and intensity of precipitation. High severity fires tend to burn much of the organic material on a site, exposing mineral soil, and sometimes forming hydrophobic soil layers. Loss of vegetation and erosion in areas with extensive natural sources of salt in

the soil can lead to higher levels of salinity in nearby water bodies (USGS 1996; BLM 2007b, p. 4-22f).

Biological treatments: Most biological control methods would involve using insects and pathogens to control noxious weeds and invasive plants. There would be minimal effects to water resources as a result of introducing insects or pathogens into treatment sites (BLM 2007b, p. 4-24).

As with use of Standard Operating Procedures for herbicide treatments from the 2007 ROD (BLM 2007c; Appendix B-2 herein), use of SOPs described in the PER (BLM 2007b; Appendix B-3 herein) will minimize any potential for adverse effects of non-herbicide treatments on water resources.

4.3.1.2 Hydrologic Condition

Potential adverse effects on hydrologic condition are included in Section 4.3.1.1 Water above. As noted in Section 3.3.2 Hydrologic Condition, p. 46, hydrologic condition includes everything from precipitation to runoff, infiltration, soil moisture and movement of water through the ground (soil or rock), storage in aquifers, discharge and recharge of aquifers at the surface (groundwater-surface water interactions), and all surface water movements. Thus, everything noted above that affects any of these processes is affecting hydrologic condition. Potential adverse effects of non-herbicide treatments on hydrologic condition are also discussed in the PER in the section on soil resources (reduced infiltration, increased runoff: BLM 2007b, pp. 4-12ff). As with water resources, following SOPs described in the 2007 ROD (BLM 2007c; Appendix B-2 herein) and PER (BLM 2007b; Appendix B-3 herein) for both herbicide and non-herbicide treatments, and standard mitigation measures recommended by 2007 ROD (BLM 2007c; Appendix B-4 herein) will minimize the potential for adverse effects to hydrologic conditions.

4.3.1.3 Fish and Wildlife Excluding USFW Designated Species

An integrated weed control program could potentially result in both beneficial and adverse effects to migratory birds and other wildlife. Loss of non-target and targeted vegetation used by many species would occur under this alternative. Loss of large populations of plants such as Russian olive and tamarisk within riparian corridors could result in reduced nesting and breeding habitat for bird species and a reduction in cover for other species that live in these areas. The removal of these species and others could reduce the amount of food resources, especially in the case of Russian olive, available for wintering birds, coyotes, foxes and other animals that utilize the olives. These affects could be offset to some degree by establishing native plants with food resources for animals during the winter months such as bullberry (*Shepherdia argentea)* and wild rose (*Rosa woodsii*). Spraying and mechanical removal would affect animals adversely when done in the timeframe where breeding and brood raising activities are taking place. Care should be utilized in the timing of weed control activities. Limbs and trees that have been removed may be thrown into the waterways

and disrupt spawning beds and streambed structure and composition in turn affecting the ability for fish to find suitable areas to spawn in and possibly destroying some eggs. The removal of dense riparian invasive species may result in a change of streambed structure by increasing erosion from the removal of live root masses along streambanks and altering stream structure. This could be beneficial or adversely affect fish species in the treated areas. The streams are anticipated to become more complex creating a greater diversity of habitat for fish species with the removal of Russian olive and tamarisk. Dense Russian olive stands lining the banks tend to make the stream channelized and to have less pools formed. The removal of these riparian invasives would also change the amount of shade the waterway receives. This could change the temperature of the water and create unsuitable conditions for some fish species. The removal of invasive vegetation would create an opportunity for native species to reoccupy the area and provide forage and cover for the native animals that have coevolved with them. The application of herbicide would have a more profound adverse effect on species too slow to escape or that remain hidden in the vegetation from direct exposure to the chemicals or being run over by the applicator. Some of these species would include amphibian species such as toads, insects and other bugs, and lizards and snakes. Because manual treatment methods would likely be used on small areas these methods are not anticipated to affect animal populations. Likewise, biological controls are not expected to result in any impacts because non-target vegetation is not generally affected. Mechanical methods and prescribed fire could potentially disturb large areas but these effects would be of short duration, lasting only until revegetation of desirable species occurs. In addition to loss of non-target vegetation, negative impacts from use of herbicides could include health effects from exposure to herbicides (BLM 2007a; p. 4-93). Under the Proposed Action alternative the BLM would be allowed to use new herbicides that have been found to have less impact on wildlife species. They have also been found to be effective in riparian areas without impacting water quality. Long-term positive impacts from all treatments would include improvements in habitat and ecosystem function.

Possible direct adverse effects to individual animals include death, damage to vital organs, change in body weight, decrease in healthy offspring, and increased susceptibility to predation. Adverse indirect effects include reduction in plant species diversity, caused by the loss of non-target species, and consequent availability of preferred food, habitat, and breeding areas; decrease in species population densities within the first year following application as a result of limited reproduction; habitat and range disruption (as wildlife may avoid sprayed areas for several years following treatment), resulting in changes to territorial boundaries and breeding and nesting behaviors; and increase in predation of small mammals due to loss of ground cover. Overall adverse effects to populations due to herbicide use are expected to be minor.

Treatment methods used as part of an integrated weed control program could potentially affect threatened/endangered and sensitive fish species. The hazards of different herbicides to aquatic organisms are analyzed in the PEIS (BLM 2007a; pg. 4-94). Risks to special status fish and aquatic invertebrate species can be minimized by

following the SOPs presented in Appendix B and the PEIS (BLM 2007a; pg. 4-93 and 4-94), such as pre-treatment surveys and appropriate buffer zones between treatment areas and water bodies with special status fish and aquatic invertebrates. The risk analysis in the PEIS concludes that according to risk calculations for realistic (typical) exposures, risks to aquatic species are low for all herbicides proposed for use.

4.3.1.4 Threatened, Endangered or Candidate Animal Species

Of the threatened, endangered, and candidate species listed for Garfield and Kane Counties only one, the Mexican spotted owl, is known to reproduce within the Monument. Southwest willow flycatchers have been documented along the Paria and Escalante Rivers but did not exhibit nesting or breeding behaviors and were assumed to be migrating along those riparian corridors. Designated critical habitat exists within the Monument for both of these species.

Mexican spotted owl (MSO)

The recovery plan for the Mexican spotted owl lists as primary constituent elements related to canyon habitat the presence of water and clumps or stringers of riparian vegetation. The plan also describes habitat as steep slickrock canyons. This would include much of the Monument especially riparian areas. Invasive and weedy plant species are likely to be found, or certainly have the potential to occur, in these areas that meet the criteria for Mexican spotted owl habitat along with designated protected activity centers (PACs) and designated critical habitat. Activities that could adversely affect owls would be the reduction of cover for prey species by herbicide application on target and non-target plant species, a change in vegetation type from the removal (mechanically, biologically, or with fire) of existing plant communities, and disturbing owls by removal and treatment related activities, especially during the breeding season (March-August) and disrupting their breeding pattern or causing the owl or owls to leave the area. Invasive species treatments that would require the use of chainsaws or heavy equipment and/or require people to remain in areas where MSOs could be nesting roosting or foraging have the potential to adversely affect owls. The Paria River corridor contains the greatest amount of known owl nesting areas and PACs within the Monument. The Paria River drainage also has more Russian knapweed than any other in the Monument and it is probable that treatments will be necessary in the future to manage these plants. The PACs and numerous miles of potential habitat in the Monument all contain riparian communities with Russian olive and tamarisk within them. Treatment of Russian olive on the Monument has been with the use of large groups (12+) of folks with chain saws or hand saws that require camping to achieve the treatment objectives in the remote areas along our riparian areas.

4.3.1.5 Threatened, Endangered or Candidate Plant Species

In general, the potential effects to special status plant species from the proposed treatments would be similar to those described for vegetation. However, the rarity and

sensitivity of special status species and their habitats make them more likely to be affected by disturbances associated with treatments. For all treatments, additional mitigation is required. In addition, populations of special status species may in some cases benefit more from fuels reduction and control of non-native species than plants with secure populations.

Effects of Chemical Treatments

The potential effects of herbicide treatments on special status plant species would depend on a number of factors, including the location of the application in relation to special status populations, the type of application method utilized, the type of chemical formulation used, and the timing of the application in relation to the phenology of the special status species. In the case of special status plant species, manual spot applications of herbicides may be the only suitable means of applying herbicides that can adequately ensure the protection of sensitive populations.

All of the herbicides analyzed would pose risks to terrestrial special status plant species in a situation where plants were directly sprayed. Herbicides with the greatest likelihood of harming special status plants would include bromacil, chlorsulfuron, clopyralid, diflufenzopyr, diquat, imazapyr, metsulfuron methyl, Overdrive®, picloram, sulfometuron methyl, and triclopyr. These herbicides would also present the most risk to terrestrial special status plant species as a result of drift from a nearby application site. The herbicide with the lowest risk to terrestrial plants is imazapic, which, according to its ERA, can be broadcast sprayed by ground methods 25 feet from a sensitive plant without risk (ENSR 2005c-l; Syracuse Environmental Research Associates, Inc.[SERA] 2005). Herbicides with the greatest likelihood of affecting special status plant species via surface runoff include imazapyr, metsulfuron methyl, picloram, and triclopyr. Of these herbicides, picloram has the longest soil half-life (see Soil Resources section). Herbicides with the least likelihood of affecting special status terrestrial plant species include imazapic, chlorsulfuron, glyphosate, and bromacil.

Effects of Mechanical and Manual Treatments

Because mechanical treatments are intended to control entire stands of vegetation or to enhance structural diversity, they could result in injury or mortality to any special status plants present on the treatment site if these plants were not avoided. In instances where the top layer of soil was removed, the seed bank of the species would also be negatively affected. Species with small populations or very limited distributions could be extirpated by such an occurrence. Populations of annual special status plants, however, should not be adversely affected, provided seedbank and germination conditions were not negatively affected by the treatment. Effects to the habitat of special status plant species, in addition to the potential long-term benefits from the removal of weeds, would include short-term adverse effects such as erosion and hydrologic alteration, as discussed under effects to vegetation.

Over the long term, the suitability of the treatment site for supporting special status plant species would depend on the suite of species that became established after the

site was cleared. A site cleared but not replanted or reseeded would typically favor early successional species, and would be expected to be beneficial for early successional special status plants. However, noxious weeds are also well-adapted to disturbed sites, and in many cases can out compete special status plant species. It is expected that mechanical treatments would occur on sites with a large amount of undesirable vegetation, and it is likely that propagules of these species would be able to recolonize the site. Thus, it is possible that mechanical treatments alone would have no long-term effect on special status species habitat, or would have a negative effect. However, if replanting or reseeding with native species was also done at the site, long-term effects could be positive, by eventually replacing a site dominated by non-natives species to one dominated by native species.

Manual treatments would potentially provide benefits to special status species without causing injury to individual plants, provided workers were able to identify special status species and avoid disturbing them.

Effects of Biological Treatments

Containment by Domestic Animals. Adverse effects to special status plants and/or their habitat from weed containment by domestic animals could include foraging of individual plants, trampling, compaction of soils, and, for wetland species, hydrologic alteration. Although plants are typically able to recover from removal of their aboveground portions, heavy grazing could cause a reduction in plant biomass, vigor, and seed production (Kauffman 1988, Heady and Child 1994). In the case of non-secure populations of special status plants, the stresses associated with grazing could cause long-term adverse effects, particularly if special status plants were browsed or grazed before producing seed, or during times of drought or other environmental stress, or if the same plants were grazed repeatedly. Although treatments with domestic animals can improve the habitat of some special status species by reducing the cover and vigor of non-native or undesirable species, grazing can reduce the quality of habitat by spreading weed propagules. Since many populations of special status species occur in areas that have a large component of native species, introduction of weed propagules into these areas would be expected to have long-term adverse effects on special status populations.

Other Biological Control Agents. No adverse effects to special status plant species are expected from the use of biological control agents, since these insects and pathogens generally do not affect non-target plant species or habitats. Under the review process, biological control agents undergo an extensive screening and testing process by USDA Animal and Plant Health Inspection Service before an organism can be released. Despite these safeguards, there is always a risk that the release of an agent into a habitat in which it does not occur could result in unforeseen ecological repercussions.

Impacts of Fire

The potential effects of fire treatments on special status plant species would vary depending on a number of factors. The timing of the burn; the area, frequency, and

severity of the burn; the level of resistance or adaptation by individual species to fire; the presence of fire-adapted vegetation; and the historical fire disturbance regime of the habitat would all influence the effects on special status population in the area. In most cases, mortality of some plants would occur if a fire were to burn directly through a population. The negative effect on the population would increase if a severe fire were to kill subsurface reproductive structures, or buried seeds. If an entire population was burned, extirpation of that population could potentially occur. Low intensity burns in fire adapted habitats could potentially benefit some special status species by increasing flower production and/or seed germination.

The indirect effects on special status plant species as a result of changes in habitat would largely depend on conditions of the site. In some cases special status plants would need to be protected from fire while the surrounding habitat was burned.

In habitats where non-native species have become adapted to fire (often in rangelands), fire treatments would be expected to further degrade the quality of the habitat because the fire-adapted invasive species would potentially outcompete native special status species in occupying sites cleared by burning.

As discussed in the BA, the majority of desert special status species (in Temperate Desert and Subtropical Desert ecoregions) occur in desert shrub communities. Pending an assessment at the local level prior to treatment, it is assumed that most special status plant species in desert habitats would be adversely affected by fire treatments because they are not likely to be adapted to fire. It is also assumed that the majority of special status plant species in the Subtropical Steppe Ecoregion would be adversely affected by fire. Many of these species are members of stable, climax communities that would not be expected to benefit from fire treatments.

Beneficial Effects of Treatments

Many special status plant species are threatened by the spread of non-native plants. The continued spread of non-native plants is expected to result in further encroachment on rare or sensitive plant populations, possibly resulting in reduced population size and vigor, and even extirpation of particularly vulnerable populations. Therefore, all vegetation treatments that limit the spread of non-native plants in habitats occupied by special status species would benefit these vulnerable populations. Improvement of habitat near populations of special status species could also be extremely beneficial by providing suitable habitat for expansion of populations, perhaps aiding in their recovery.

Because populations of special status plants are often small and isolated from other populations, they are highly susceptible to extirpation by catastrophic wildfires, even in habitats that are, or were once, adapted to fire. Therefore, vegetation treatments that reduce fuels in and near populations of special status species would be expected to provide long-term benefits to these species by reducing the likelihood that a future wildfire would extirpate or further weaken sensitive populations (Sheppard and Farnsworth 1997).

Hand removal of competing vegetation and fuel sources within populations of special status species would likely help improve or maintain the vigor of these populations.

Though not feasible over large areas, manual treatments are often the most appropriate means of improving habitats occupied by threatened and endangered species.

Standard Operating Procedures
The BLM would implement SOPs to minimize the risks to special status plant species from vegetation treatments. Examples of SOPs include surveying for species of concern if the project may impact federally- and/or state-listed species; minimizing direct impacts to species of concern from fire treatments, unless studies show that these species will benefit from fire; minimizing the use of ground-disturbing equipment near species of concern; and using temporary roads when long-term access to treatment sites is not required.

4.3.1.6 Vegetation (includes Invasive, Noxious Weeds and Wetlands and Riparian)

Impacts of Chemical Treatments

Non-target Plants
Herbicides could come into contact with and impact non-target plants through drift, runoff, wind transport, or accidental spills and direct spraying. Potential impacts include mortality, reduced productivity, and abnormal growth. Risk to off-site plants from spray drift is greater under scenarios with smaller buffer zones and application from greater heights (i.e., aerial application or ground application with a high boom). Risk to off-site plants from surface runoff is influenced by precipitation rate, soil type, and application area. Plant receptors would be at risk under most accidental exposure scenarios (i.e., direct spray or spill). Persistent herbicides (e.g., bromacil) adsorbed to soil particles could also be carried off-site by wind or water, affecting plants in other areas. Risk assessments predicted no risk to plant receptors from wind transport of herbicide particles under all of the evaluated scenarios. (However, an incident of extensive damage to crop species has been reported as a result of drift of sulfometuron methyl over a large area [see ENSR 2005j]). Application rate is a major factor in determining risk, with higher application associated with greater risk to plants under various exposure scenarios.

Target Plants
Herbicides offer an effective and often resource-efficient means of treating and managing unwanted vegetation. Mechanical and manual methods are often more time and labor intensive than herbicide application, and cause soil disturbance, which can provide the appropriate conditions for invasive weeds to resprout from roots and rhizomes or grow from dormant seeds. In addition, herbicide use may be seen as less dangerous than treatment with prescribed fire in dry areas that have high fire risk. The use of herbicides would benefit plant communities with weed infestations by decreasing the growth, seed production, and competitiveness of target plants, thereby releasing native species from competitive pressures (e.g., water, nutrient, and space

availability) and aiding in the reestablishment of native species. The degree of benefit to native communities would depend on the toxicity of the herbicide to the target species and its effects on non-target species, as well as the success of the treatments over both the short and long term.

Use of preemergence and postemergence soil residual herbicides is common in ROWs, near oil and gas and other facilities, and along roads where vegetation must be eliminated for safety, to reduce fire hazards, and for aesthetic purposes. Other treatment methods, such as manual methods and use of fire, are often not as effective at eliminating vegetation and may not be as safe to use as herbicides.

Some treatments are very successful at removing weeds over the short term, but are not successful at promoting the establishment of native species in their place. In such cases, seeding of native plant species would be beneficial. Weeds may resprout or reseed quickly, outcompeting native species, and in some cases increasing in vigor as a result of treatments. The success of treatments would depend on numerous factors, and could require the use of a combination of methods to combat undesirable species. In addition, repeated use of a particular herbicide on a particular site could cause target weeds to develop a certain level of resistance to that herbicide over time, reducing the effectiveness of long-term treatments.

The effects of herbicides on target plants depend on their mode of action. Contact herbicides (e.g., diquat) only kill the plant parts that they touch, while translocated herbicides (e.g., dicamba) are transported throughout the plant. Herbicides that provide long-term weed management (e.g., bromacil) affect plants when they are present in the soil, with the degree of damage and non-selectivity often increasing with herbicide concentration (Holecheck et al. 1995). Selective herbicides only affect certain plant species, whereas non-selective herbicides affect all or most plant species. The non-selective herbicides evaluated in the PEIS include bromacil, diquat, diuron, fluridone (except at low concentrations), glyphosate, sulfometuron methyl, and tebuthiuron. The other herbicides (2, 4-D, chlorsulfuron, clopyralid, diflufenzopyr, hexazinone, imazapic, imazapyr, metsulfuron methyl, Overdrive®, picloram, and triclopyr) exhibit some selective qualities and would be most effective when used to target certain plant species. Because of their selective nature, they may be able to be used in areas where non-target vegetation exists in communities with target vegetation. In addition, diquat and fluridone would be used exclusively for the management of aquatic plants; 2, 4-D, glyphosate, imazapyr, and triclopyr could be used for aquatic as well as terrestrial vegetation management.

The herbicides that create the most short-term risk to non-target plant species, given that application scenarios follow SOPs, are those that are applied in a manner that increases the likelihood for off-site transport (e.g., drift, surface runoff). The risk characterization process of the ERA indicated that risk to typical and special status

terrestrial plants is moderate under scenarios involving off-site drift of bromacil and chlorsulfuron and risk to special status terrestrial plants is moderate to high under scenarios involving off-site drift of diquat, diuron, and sulfometuron methyl. Diuron poses a moderate risk to aquatic plants under scenarios involving off-site drift associated with applications at the maximum application rate. None of the herbicides pose risk to non-target plants under wind erosion scenarios.

Impacts to non-target plants would be lessened for herbicides that selectively target the desired species type. However, some changes in species composition could occur in these communities despite lessened impacts to non-target species as a result of altered competitive relationships. The lasting effects of treatments using non-selective herbicides would depend on the species present in the seedbank to reestablish at the site. In many cases, reseeding or replanting treatments would be necessary after an application of a non-selective herbicide to ensure the presence of native species on the site following treatment.

The ALS-inhibiting herbicides evaluated in this PEIS are chlorsulfuron, imazapic, imazapyr, metsulfuron methyl, and sulfometuron methyl. These herbicides are applied at low application rates, with only small concentrations necessary to damage plants. The ERAs predicted some risks to non-target plants associated with those herbicides; however, the risks were similar to the risks associated with the other evaluated herbicides. Nevertheless, because of the potency of these herbicides, they may be most appropriate for use when the target plant is the dominant cover species, or when there is a particularly aggressive invasive species that has not successfully controlled by other methods (USDA Forest Service 2005).

Other Herbicides Previously Approved for Use on Public Lands

Asulam, atrazine, fosamine, mefluidide, simazine, and 2,4-DP (also known as dichlorprop) are currently approved for use on public lands. However, the historical use of these herbicides by the BLM has been quite limited, with only fosamine used in the last 7 years (on less than 50 acres annually). Asulam is used in post-emergent control of broadleaf weeds, perennial grasses, and nonflowering plants in forestry and rangeland areas and ROW (Information Ventures, Inc. 1995a). Atrazine provides selective weed control in conifer reforestation, and on ROW, and energy, mineral, cultural, and recreation sites. It is toxic to many plants and should not be used under windy conditions near desirable trees, shrubs, or plants (Information Ventures, Inc. 1995b). Fosamine is used to control brush and herbaceous plants. No acute effects to aquatic plants are expected from normal use of fosamine, but movement of fosamine from the treatment site due to drift or runoff can adversely affect non-target and non-target species (USEPA 1995d). Mefluidide is registered for forestry, rangeland, and ROW. Contact with non-target species may injure or kill susceptible plants (Information Ventures, Inc. 1995c). Simazine is a selective herbicide that is used to control broadleaf and grass weeds in forestry, rangeland, and ROW uses. It is toxic to many plants (Information Ventures, Inc. 1995d). 2,4-DP is registered to control aquatic weeds in

ditches and for a variety of upland uses. It is a broadleaf herbicide (Pesticide Management Educator Program 2001).

Impacts of Manual and Mechanical Treatments

Mechanical and manual treatments would allow for more precise control of vegetation in the treatment area than other methods. In addition, mechanical and manual treatments pose fewer human health risks than fire use and use of herbicides, and would thus be favored for treatments in the WUI, along ROWs, and near high public use areas. They are more effective in sensitive areas, such as wetland and riparian habitat, or near the habitat of plant and animal species of concern, where greater control over treatment effects is required or effects to non-target species are a concern.

Manual Treatment

Manual treatments would generally benefit native plant communities on public lands, without the risks of adverse effects to non-target species associated with most of the other treatment methods. Manual methods are highly selective, causing injury and mortality only to target plants/fuels, and because of their high cost, would only be used in limited areas where other treatment methods were not feasible.

Manual treatments could result in small amounts of trampling or accidental removal of non-target plants, particularly since repeated treatments are often required to prevent the reestablishment of aggressive weeds. There would also be minor risks associated with spilling oil and fuels from hand-held equipment, such as chainsaws, which could kill or harm plants. The overall effects to native communities, however, would be minimal and short term in duration.

Mechanical Treatment

Mechanical treatments would injure or kill plants by removing some or all of the plant material on the treatment site. Undesirable vegetation and fuel loads would be targeted, with an overall goal of restoring ecosystem health. Mechanical treatments are typically selective and would minimize damage to non-target plants present at the treatment site.

Mechanical methods are effective in removing thick stands of vegetation, but have limited use for noxious weed control, unless followed up with herbicide treatments, because the machinery can spread seed and

Methods that remove entire plants by plowing or cutting roots would cause the most mortality to non-target plants, limiting their ability to recover without seeding. In many cases, revegetation would be required after treatments to ensure the recovery of the plant community and limit the invasion of the treated site by non-native species. Thus, mechanical treatments associated with revegetation, such as drill-seeding, would typically have both short-term and long-term positive effects by aiding in the recovery of native plant communities on a treated site. Methods that remove only aboveground

plant biomass (e.g., mowing) would have few lasting effects on native plant communities, as non-target species would typically be able to recover quickly by resprouting.

Mechanical treatments would generally have the greatest effect on woody plant species, which typically take about 10 years or longer to recover and regain their dominance, depending on the effectiveness of control and the reproductive success of the species. Herbaceous plants would typically be more resilient to top-removal treatment methods, as many of these species die back annually. Growth of herbaceous plants often increases after mechanical treatments as a result of reduced competition with woody species for light, nutrients, and water (Cox et al. 1982). Treatments occurring during the growing period and prior to seed maturation and dispersal would have the greatest potential effects on herbaceous species.

The use of vehicles and other mechanical equipment could negatively affect native plant communities by bringing the propagules of non-native species into treatment sites and creating sites for weed establishment. In addition, repeated mechanical treatments, or treatments that remove large areas of vegetation, could adversely affect native communities by altering species composition.

Effects of Fire Treatments

Fire treatments would injure and kill plants, causing the most harm to species that are intolerant of fire, and in most cases benefiting fire-adapted or fire-dependent species. Fire would also stimulate the growth of certain plants, such as grasses and aspen. Many woody species would be top-killed by fire. Forbs, grasses, shrubs, and deciduous trees that have the capacity to resprout would be capable of recovering quickly. Some species readily reproduce from seed. Established perennial plants that can recover vegetatively would typically have a short-term competitive advantage over plants developing from seed because their well-developed root systems and stored energy reserves support rapid regrowth. Plants with growing points near the surface (e.g., black grama) or dense growth at their base that concentrates heat (e.g., bluegrasses, Idaho fescue, and needle-and-thread grass) are more likely to be negatively affected by fire (Paysen et al. 2000). Plants with their growing points protected by soil, such as perennial forbs and shrubs with deep roots, would generally respond more favorably to burning.

Effects of Biological Treatments

The use of grazing animals has a greater likelihood of affecting non-target vegetation than insects and pathogens. Although grazing animals such as goats, sheep, and cattle are often looked upon negatively in terms of effects on vegetation, they can beneficially alter the appearance productivity, and composition of plant communities if used in moderation and at appropriate stocking densities (Payne and Bryant 1998). Other Biological Control Agents In general there would not be adverse impacted to vegetation expected from the use of biological control agents, since these insects and

pathogens generally do not affect non-target plant species or habitats. Under the review process, biological control agents undergo an extensive screening and testing process by USDA Animal and Plant Health Inspection Service before an organism can be released. Despite these safeguards, there is always a risk that the release of an agent into a habitat in which it does not occur could result in unforeseen ecological repercussions.

Wetland and riparian Areas.

Effects of Manual Treatments

Manual treatments, which can target smaller areas, would be less likely to affect wetland and riparian areas than the other methods. Manual treatments would occur on approximately 350 acres of wetland and riparian habitat. Treatments would involve the use of chainsaws and seeding or planting.

Hand treatments would remove the overstory and would cause little soil disturbance or erosion. In most cases, unwanted vegetation near a wetland or riparian area could be removed without disturbing more desirable species. Typically, plant debris would be mulched and left on site. Fuel and lubricant spills that could result from using chainsaws and trimmers would be contained or cleaned up before contamination spread to surrounding sensitive areas.

The effects of mechanical treatments on wetland and riparian areas would be related to the types and amounts of soil disturbance and vegetation removal, the proximity of the treatment to a wetland or riparian area, and the incidence of accidental spill.

Impacts of mechanical treatments

Wheeled vehicles

The use of heavy equipment can result in soil compaction, particularly in areas of moist soils that can increase surface runoff from the surrounding treated areas. Compaction by vehicles and other heavy equipment can reduce the porosity of soils, thus limiting water infiltration. The magnitude of effects to wetlands would depend on soil compaction and weather. One means to minimize the effect of heavy equipment on soil involves the use of tracked or low-pressure tires, which distribute vehicle weight over a larger area, thus reducing pressure on soil. Treatment by mechanical methods during dry months can also minimize the effects to wetlands by reducing the potential for surface water runoff into wetlands.

Spills resulting from fueling, equipment maintenance, and operation could adversely affect water quality and the health of wetland or riparian areas. These risks would be minimized by having provisions for incident response in the SOPs.

Impacts of biological control

In most cases, these biological treatments would involve the release of organisms intended to weaken or kill vegetation. Vegetation would remain in place, resulting in little soil disturbance in the treatment area. If treated successfully, the plant community near or within the wetland or riparian area should improve.
Insects have been used effectively for biological control. For example, *Diorhabda elongata deserticola*, a leaf beetle from central Asia, has been used as a biological control agent for saltcedar. This insect can defoliate large areas of saltcedar (USDA 2003).

Although most biological control in wetlands and riparian areas would be accomplished using insects, there could be some use of livestock. The degree of effect to wetlands and riparian areas from treatments using domestic animals would be dependent on the timing, duration, and intensity of grazing. Direct effects could include stream channel/wetland morphology alteration, and loss of native wetland or riparian vegetation. Improper grazing management can have a considerable effect on vegetation vigor and biomass, and species diversity (Kauffman and Krueger 1984). The potential loss of vegetation as a function of improper grazing management can lead to further loss of aquatic habitat as channels widen and water depths become shallower (Hubert et al. 1985; Platts and Nelson 1985; but see George et al. 2002). These potential impacts highlight the need for very carefully planned prescribed grazing which would require control of the timing, amount, and duration of grazing to limit these potential impacts. Temporary electric fencing, short term use of a pasture, preconditioning livestock to encourage grazing of the targeted vegetation, and herding are examples of measures that could be taken to minimize impacts.

Impacts from Herbicides Applied to Wetlands and Riparian Areas
Use of herbicides to control aquatic and riparian vegetation can improve habitat quality for fish and wildlife, improve hydrologic function, and reduce soil erosion.

Most aquatic herbicides are non-selective and could cause adverse impacts to non-target wetland and riparian species diversity, competitive interactions, species dominance, and vegetation distribution (Kleijn and Snoeijing 1997). Herbicide applications could reduce plant cover, leading to increased sedimentation, increased nutrient loading, alterations in native vegetation, and changes to temperature and hydrologic conditions.

An increase in soil erosion and surface water runoff could result from vegetation reduction, which could lead to streambank erosion and sedimentation in wetlands and riparian areas (Ott 2000). The amount and likelihood of streambank erosion and sedimentation would be directly proportional to the size of the treatment area (i.e., larger treatment areas would lead to increased risk of streambank erosion and sedimentation). Additionally, sedimentation could result in a reduction in the acres of wetland and riparian habitat.

Non-target wetland and riparian areas could be exposed to herbicides through a variety of routes, including accidental spills or direct spray, local spray drift from adjacent target areas, surface water runoff, and soil erosion (Karthikeyan et al. 2003). Risks to wetland and riparian non-target species would depend on a number of factors, including the amount, selectivity, and persistence of the herbicide used; the application method used; the timing of the application; and the plant species present. Risks to wetlands and riparian areas from surface runoff would be influenced by precipitation rates, soil types, and proximity to the application area. Some herbicides (e.g., sulfometuron methyl) that adsorb onto soil particles could be carried off site, increasing their risk of affecting vegetation in wetlands and riparian areas.

Unintentional applications can have severe negative impacts on wetland and riparian systems. In particular, accidental spills near wetland and riparian areas could be particularly damaging to wetland and riparian vegetation. Spray drift can also degrade water quality in wetland and riparian areas and could damage non-target vegetation.

The BLM's ability to use four new chemicals (fluridone and diquat for aquatic applications, and imazapic and Overdrive® for terrestrial applications), and new herbicides as they would become available and approved for use, would provide new capabilities to the BLM for controlling problematic invasive species and would provide benefits to these wetland and riparian areas if invasive species were controlled or eliminated.

Risks to wetland and riparian areas from use of these herbicides are similar to or lower than for risks associated with currently-approved herbicides. The risks to wetland and riparian plants from accidental spill and drift scenarios would be lower with the proposed herbicides than with currently-approved herbicides. In addition, fluridone is specifically indicated for aquatic use, whereas none of the other currently-approved herbicides are strictly aquatic herbicides. Under the other herbicide treatment alternatives, diquat and fluridone would be used to treat aquatic vegetation, and both have shown to be effective in the control of Eurasian watermilfoil, water-thyme, water hyacinth, and giant salvinia. The other herbicides registered for aquatic use, glyphosate and triclopyr, are not as effective in controlling these species. However, disking with a follow-up spraying of Rodeo® (formulation of glyphosate), was effective in treating reed canarygrass in Washington State wetlands (Killbride and Paveglio 1999, Paveglio and Killbride 2000)

Overdrive® and imazapic would primarily be used on rangelands, but could still provide benefits. Overdrive® would be used to treat thistles and knapweeds, while imazapic could be used to control downy brome. These invasive plant species degrade riparian habitats and can lead to shortened fire cycles

Impacts of Fire and Pile burning

Fires in wetlands or riparian areas can have both a positive and negative effect on the ecosystem. In addition to restoring conditions that more closely resemble those that would occur under natural fire conditions, prescribed fire may decrease hazardous fuels, trigger germination of some plant species, stimulate growth of new vegetation, and open up and create new habitat for wildlife (Agee 1994, Brennan and Hermann 1994, Payne and Bryant 1998). By removing vegetative debris, cover burns temporarily release more desirable plants that have an earlier growing season than more objectionable plants, such as cordgrass.

Fire may provide indirect benefits to wetlands by raising the pH of soil in certain areas. Since nutrient availability is related to soil acidity, elements critical for plant growth, such as phosphorus and nitrogen, become more available to plants as the soil pH increases. Fire also helps to release nutrients that may be tied up in forms that are unavailable to plants, such as woody material. The burning of surface organic matter releases some nutrients onto the soil in the form of ash, resulting in increased calcium, phosphorus, and potassium. This influx of nutrients could contribute to vegetation growth (DeBano et al. 1998).

Fires that kill trees create a source of standing wood that ultimately provides fish habitat. The input of woody debris can continue for a year or more after a burn (Young 1994; Minshall et al. 1997; Berg et al. 2002). Large wood in streams and wetlands provides hydraulic roughness, serves as a food source for aquatic and wildlife species, and provides habitat for wildlife. Conversely, devastating fires that result in fewer trees on a site would limit the input of woody debris to aquatic systems.

Prescribed fire or low intensity fires would be more likely to kill shrubs and deciduous trees than larger conifers. Since many species of shrubs and trees resprout, soil stability should not be impaired and conifers could continue to serve as a source of wood to aquatic habitats. For a comprehensive treatment of a site, however, prescribed fire may be followed by additional treatment. For example, burning followed by mechanical treatment has proven to be a successful treatment for invasive vegetation such as saltcedar (Ball et al. 2001).

4.3.1.7 Soils

The proposed herbicide treatments inevitably result in contact with soils, either intentionally for systemic treatments, or unintentionally as spills, overspray, spray drift, or windblown dust. In addition to direct application, transmission to soil may occur when an herbicide is transported through the plant from sprayed aboveground portions to roots, where it may be released into soil. Also, some herbicides remain active in plant tissue and can be released into the soil during plant decay and result in residual herbicide activity (BLM 2007a, p. 4-13).

A primary concern addressed in the PEIS (BLM 2007a) pertains to the fate and transport of herbicide residues in soils. The fate and transport of herbicides in soil is a complex process that depends on their interaction with the soil environment, including chemical, physical, and biological soil processes (Bovey 2001). Herbicides dissipate from soils by transport with water or wind, through chemical or biological degradation processes, or by immobilization through adsorption onto soil surfaces. These processes and their effect on fate and transport of herbicides are discussed in the PEIS (BLM 2007, pp. 4-14ff).

Based on the analysis of impacts associated with specific herbicides in the PEIS (BLM 2007a, pp. 4-15ff), use of Standard Operating Procedures described in 2007 ROD (BLM 2007c; Appendix B-2 herein) will minimize any potential for adverse effects on soil resources. The 2007 ROD concludes that "None of the herbicides commonly used by the BLM appear to result in adverse impacts to soil." (BLM 2007c, p. 4-7). The ROD did not recommend any mitigation measure associated with soil resources (BLM 2007c), however, SOPs to minimize the potential for overspray and spray drift are included in Appendix B-2.

Non-herbicide treatments would potentially affect soils by altering their physical, chemical, and/or biological properties. Physical changes could include loss of soil through erosion or changes in soil structure, porosity, or organic matter content. Fire and other treatments would potentially alter nutrient availability and soil pH, and herbicide treatments would involve the addition of chemicals to the soil. Some vegetation treatments might also alter the abundance and types of soil organisms that contribute to overall soil quality, including mycorrhizae. Over the long term, treatments that remove invasive vegetation, reduce fuels, and restore native plants should enhance soil quality on public lands. The potential effects on non-herbicide treatments on soil resources are discussed and analyzed in depth in the PER (BLM 2007b, pp. 4-12ff).

As with use of Standard Operating Procedures for herbicide treatments from the 2007 ROD (BLM 2007c; Appendix B-2 herein), use of SOPs described in the PER (BLM 2007b; Appendix B-3 herein) will minimize any potential for adverse effects of non-herbicide treatments on soil resources.

4.3.1.8 Air Quality

The potential impacts of herbicide use on air quality originate primarily from ground vehicle (truck and all-terrain vehicle [ATV]) and aircraft (plane and helicopter) emissions, as well as fugitive dust (dust created by vehicle travel on unpaved roads) resulting from herbicide transport and application. In addition, spray drift (movement of herbicide in the air to unintended locations) and volatilization (the evaporation of liquid to gas) of applied herbicides temporarily results in herbicide particles in the air, which can be inhaled and deposited on skin or plant surfaces and affect humans, wildlife, and non-target plants. Herbicide particles can be transported away from the

target location, depending on weather conditions and the herbicide application method.

The PEIS (BLM 2007a, pp. 4-6ff) analyzes the effects of vehicle emissions and fugitive dust (particulate matter) from unpaved roads by modeling the effect of potential emissions on National Ambient Air Quality Standards (NAAQS). No exceedances of applicable threshold values (i.e., increases in background concentrations) were predicted. Because the herbicide use under this alternative entails the same methods as analyzed in the PEIS, the analysis can be applied here, meaning that no exceedances of NAAQS thresholds or standards from herbicide use are expected under this alternative. Further, the 2007 ROD concludes that "The Preferred Alternative would not result in emissions that exceed Prevention of Significant Deterioration thresholds or National Ambient Air Quality Standards." (BLM 2007c, p. 4-7).

Manual and mechanical treatments involving ground disturbance affect air quality by mobilizing particulate matter, depending on soil type and ground cover, and by leaving exposed bare ground. The effects of mechanical treatments on air quality were described in the PER (BLM 2007b, pp. 4-4ff). Because the mechanical treatments under this alternative entail the same methods described in the PER, those conclusions can be applied here, meaning that no exceedances of NAAQS threshold or standards from manual or mechanical treatments are expected under this alternative.

Prescribed fire affects air quality primarily due to the smoke produced. Smoke contains many of the criteria pollutants regulated under the Clean Air Act (CO, PM_{10} and $PM_{2.5}$) and may affect tropospheric ozone (O_3) production because of volatile organic compounds (VOCs) it contains. Minor amounts of other pollutants ($PM_{2.5}$, PM_{10}, CO, NO_2, SO_2, and VOCs) associated with vehicle exhaust and fugitive dust would be generated during travel to and from the treatment site by fire crews, and from mechanical treatments (e.g., bulldozing) associated with site preparation before burning. The PER (BLM 2007b, pp. 4-5ff) describes the adverse effects of fire treatments, all of which apply here.

For all manual and mechanical treatments, and prescribed fire, the PER concludes that "Provided SOPs are followed… and site-specific plans developed and reviewed before a treatment activity occurs, federal, state, and local air quality regulations would not be violated." (BLM 2007b, p. 4-4). For the reasons stated above, these conclusions apply here, too. SOPs are given in the PER (BLM 2007b; Appendix B-3 herein).

4.3.1.9 Floodplains

All treatment methods in this alternative (herbicides, manual and mechanical treatment, biological controls and fire) have the potential to remove woody vegetation on the floodplain, either as target species (e.g., Russian olive) or non-target species (e.g., willows). The absence of dense, flexible woody stems on the banks of the floodplain can increase the shear stress at the toe of the banks and lead to fluvial

erosion, bank undercutting and mass failure (Vincent and others, 2009). Standard Operating Procedures (SOP) as defined in the PER (BLM 2007b, p. 4-1f) would minimize or avoid adverse effects to floodplains as a result of treatment activities. Preservation of non-target native vegetation such as willows and other native riparian vegetation could dramatically reduce the potential for floodplain degradation.

Where floodplain vegetation is targeted (e.g., Russian olive), prompt reestablishment of desired vegetation would reduce floodplain impacts. Likewise, where upland vegetation is targeted, prompt reestablishment of desired vegetation will reduce runoff potential and decrease flood flows, thereby reducing floodplain impacts. Long-term benefit of replacing weeds with native vegetation includes improving the hydrologic function of floodplains, allowing the trapping of sediment and increasing riparian habitat.

4.3.1.10 Wild and Scenic Rivers

The proposed action occurring on managed eligible WSR corridors on GSENM would have the same impacts as detailed in the impacts for Wilderness Study Areas, (4.3.1.17) and would require the same design features as listed in Appendix A. Impacts to related resources such as Outstanding Remarkable Values including riparian corridors are also discussed in the following sections: Water Resources (4.3.1.1); Flood Plains (4.2.2.9); Fish and Wildlife (4.3.1.3); Threatened, Endangered and Candidate Animal Species (4.3.1.5) and Threatened, Endangered and Candidate Plant Species (4.3.1.5).

4.3.1.11 Fuels and Fire Management

Noxious weed and invasive plant treatments include cutting and removing vegetation such as Russian olive and tamarisk, and in some cases piling cut material. Cutting and removing vegetation using hand tools, hand-operated power tools (e.g., chainsaws), wheeled tractor, crawler type tractors, or specially-designed vehicles with attached implements that cut or uproot would result in short-term (1-2 years) increase in fuel loading. This increase in fuels is a direct result of stems, limbs, trees, and other vegetative debris.

When specially designed vehicles with attached implements that chop (e.g., bullhog or masticator) are used, the fuel loading would decrease (less than one year) compared to using other implement types tools. This slight decrease would be the result of the smaller size of the biomass after treatment.

4.3.1.12 Recreation

Weed treatments would potentially have a short term impact on recreational users of public lands. The primary impact would be temporary loss of use of a developed facility or dispersed recreation area while treatment occurs. This would apply to

mechanical and chemical treatments but not manual or biological treatments, which would have minimal impacts on recreation values. An additional temporary impact from mechanical treatments would be noise; recreationists outside the immediate treatment area but within hearing distance. Potentially the most serious impact stemming from herbicide treatments would be public exposure to chemicals. The highest potential for public exposure would occur during spraying at campgrounds and in high use areas. Chemicals may also be deposited in water ways that could be ingested as drinking water. SOPs dictate that herbicide application sites such as campgrounds and trailheads be posted with signs warning of herbicide use, in order to minimize risks to public safety. Potential impacts from burn pile disposal use include the presence of smoke, and the possibility of a fire escaping control. Following SOPs would enable managers to plan and conduct burn piles in such a manner as to minimize the potential that recreationists would be affected.

Weeds also negatively impact recreational values. Impacts include reduced forage availability for wildlife, affecting wildlife viewing and hunting opportunities, reduced wildflower viewing, and decreased desirability of campsites and fishing access areas that are overrun with weeds that may be spiny and unpleasant to walk through. Therefore the potential short term impacts of weed treatment would be outweighed by increased long-term benefits to recreational values. The Proposed Action alternative would increase treatment options and flexibility in choosing herbicides that best match treatment goals and application conditions, and are less toxic to humans and animals.

4.3.1.13 Livestock Grazing

Livestock grazing is a primary use of public land within the GSENM. An integrated weed treatment program that successfully reduces the level of noxious weeds and invasive plants on rangelands would increase the quality of available forage and the number of acres suitable for grazing. Soils could be disturbed by manual or mechanical treatments or by prescribed fire. Some non-target plants in close proximity to noxious weeds or invasive plants may be killed or damaged by herbicide drift, manual or mechanical treatments, or fire use. The potential short-term impact of weed treatment on allotment permittees would primarily stem from the possible need (depending on treatment type) to exclude livestock from treated areas for a at least 2 growing seasons, for example following prescribed fire or reseeding. As noxious weeds and invasive plants are controlled/contained/eradicated, desired vegetation would improve and the amount of available livestock forage would increase. The use of Standard Operating Procedures (SOPs), Mitigation Measures, and Protective Measures as outlined and explained in Appendix B would minimize human and animal health risks.

The Proposed Action would increase treatment options and flexibility to manage noxious weeds and invasive plants while minimizing risks to human and animal health. Using the new herbicides authorized under the 2007 PEIS would result in improved

control of targeted weeds, particularly annual grasses such as cheatgrass. This would reduce weed competition with native vegetation, resulting in increased forage quality, palatability and availability.

4.3.1.14 Paleontology

Of the nine different methods outlined as treatments using herbicides, only two involve ground disturbance extensive enough to affect paleontological resources: 1) Herbicide-Broadcast treatments using OHVs travelling off road; and 2) Wheeled Vehicle treatments that rake, harrow, plow, or rip up soil and vegetation. Both of these methods have the potential to crush, dislodge, scatter, break, and otherwise damage fossils on bedrock surfaces or in the shallow subsurface. Impacts would generally be relative to the size and weight of the vehicles involved (translating to surface pressure on each wheel) and the depth of ground disturbance. Light vehicles passing over relatively stable materials such as well consolidated sandstones might have little direct impact on fossils, while rakes and harrows running deep into the soil or regolith could essentially destroy a specimen. No other known direct impacts to fossil resources would result from these methods.

Mitigation for fossil resources in treatment areas that would be subjected to either of the two ground disturbing methods above would consist of proactive on-the-ground inventories of areas with a BLM Potential Fossil Yield Classification number of 4 or higher. Significant specimens found during the inventory would need to be collected or avoided during subsequent treatments. Inventory of a treatment area would be considered sufficient for the life of a treatment project and any subsequent maintenance treatments required.

4.3.1.15 Visuals

Factors that would determine the visual impacts of the Proposed Action include the size of treatment, the method of treatment, the type of vegetation treated, and the revegetation efforts undertaken post-treatment. The larger the size of treatment the more likely it would be to create a change in form, line, color, or texture in the characteristic landscape to the degree that it would attract the attention of the casual observer due to contrast. Larger treatments are likely to be those performed using wheeled mechanical vehicles, prescribed fire, biological agents, or aerial application of chemicals. Treating larger vegetation (i.e. trees) is likely to be more noticeable than treating smaller, low-growing vegetation (i.e. annuals) due to the physical structure of the plants. Successful revegetation efforts using native plant species appropriate for the treated site would in the long term blend with the landscape character but should revegetation efforts not be successful, the lack of vegetation or the establishment of other undesirable plants could create changes in the landscape character.

Manual treatment methods and hand application of chemicals are typically limited to covering small areas and are specific to discrete locations and plants. These treatment

methods would likely be unnoticeable to the casual observer due to the small scale of the project areas treated (5 acres or less).

Boom sprayers mounted to equipment typically are used to chemically treat larger areas and kill entire stands of vegetation that in the short term turn from green to brown or gold and for the long term often create unnatural parallel patterns on the landscape years after application based on the path the vehicle takes and how vegetation reestablishes, both of which have the potential to attract the attention of the casual observer.

Wheeled equipment used to cut, chop, or uproot vegetation is typically used to treat larger areas and can create obvious edge lines on the landscape between the treated and untreated areas. And similar to the use of boom sprayers, the revegetation efforts can create long term patterns on the landscape based on the path taken by the vehicle. The use of biological agents could have a range of impacts to visual resources. At the lower end of the spectrum would be the use of domestic animals where the post treated areas would likely be unnoticeable. At the upper end of the spectrum would be the use of insects, nematodes, mites, or pathogens to treat large expanses of vegetation. For example, the use of tamarisk beetle along the Colorado River left miles and 100s of acres of dead, brown to black tamarisk along the river corridor, which created a visual contrast in color for years.

Aerial application of chemicals is used to treat large areas and in the short term creates obvious edges between the treated and untreated areas where texture and color contrast result between the living (full and green) vegetation and the dead (crumpled and brown) vegetation.

Prescribed fire is also used to treat larger areas and has the potential to create visual contrast in the short term by forming obvious edges between the treated and untreated areas that are a result of color contrast between living (green) vegetation and burned (black) vegetation.

Pile burning is used to reduce woody vegetation debris from treatment sites to ashes. Prior to burning the piles are often large enough to be seen by the casual observer and their charred remains create localized small areas of blacked earth, but neither is of a scale to alter the landscape character.

Revegetation using drill seeding or broadcast seeding followed by dragging or harrowing has the potential to create unnatural parallel patterns on the landscape due to the direction the equipment follows across the land. Revegetation using installation of live plants, aerial broadcast of seeds, or broadcast seeding by hand and followed by raking, would be most likely to mimic natural vegetation establishment patterns and create little to no visual contrast.

4.3.1.16 Lands with Wilderness Characteristics

The proposed action would allow for a variety of weed control treatment methods (herbicide, manual, mechanical, biological and fire) to occur on Lands with Wilderness Characteristics as guided by the MMP management decisions. All treatments and methods would utilize design features to protect non-target vegetation and utilize "least impairing methods" in prioritizing long-term ecosystem health and recovery as a component of the wilderness characteristic of naturalness.

The presence of non-native invasive species and noxious weeds is a result of human disruption to natural successional processes on LWC lands. Intervention to remove exotics would work towards restoration of the natural conditions of the ecosystem that existed before the invasion of exotic vegetation. These actions serve to benefit the wilderness characteristic of "natural". Use of native plants and seeds in restoration activities will return disturbed areas to a natural array of plants and animals with beneficial impacts to the wilderness characteristic of "natural" and "untrammeled". Compliance with design features as detailed in Appendix B serve to mitigate impacts to wilderness characteristics on inventoried LWC. Methods of treatment, re-planting or restoration actions will be undertaken in methods that are least impairing to inventoried lands with wilderness characteristics LWC, unless further site specific NEPA.

Herbicide: Targeted herbicide use and biological control as applied in conformance with design features for protection of non-target plants and wildlife is anticipated to result in short term, temporary impacts with no threat to long-term eligibility. The use of targeted herbicides per the proposed action could offer the most targeted approach, reduce the need for continued treatments and could increase the amount of removal that could be accomplished annually, speeding the rate of recovery.

Manual: Most manual weed removal methods and hand application of chemicals are typically limited to covering small areas and are specific to discrete locations and plants. These treatment methods are anticipated to create little to no surface disturbance with no threat to wilderness characteristics.

Mechanical: Non-motorized tools and equipment will be prioritized for access and removal of exotic vegetation unless the use or treatment is evaluated and determined to be the "minimum tool" through use of the Minimum Requirement Decision Guide (MRDG). Impacts from any use of mechanized equipment such as chainsaws are anticipated to be short-term, temporary impacts and would not impact wilderness characteristics in the long-term.

The use of motorized chain saws will result in temporary impacts to the wilderness characteristic of "opportunity for solitude." Impacts to "opportunity for solitude" will be short-term, temporary and will be mitigated by project stipulations that will include signage at trailheads and notices at visitor centers to alert visitors of the potential

presence of work crews and activities that may be disruptive. This will allow visitors to select other locations for the duration of this project.

Due to the potential for long term surface disturbance, mechanical weed removal projects involving ground disturbance beyond the impact of a wheel or track, such as use of bulldozers, tractors and heavy equipment will not be allowed within LWC's without additional site-specific NEPA. Aerial and broadcast spraying also would not be allowed on LWC's without site specific NEPA to evaluate impacts to non-target species.

Fire: Impacts from the use of prescribed fire as a tool to mimic the natural role of fire within monument ecosystems is anticipated to be short-term, temporary.

Biological: Biological control using small insects, pathogens and livestock is not anticipated to cause any long-term impacts to wilderness characteristics but should meet the criteria for enhancement of wilderness characteristics using the least impairing methods.

Restoration: Restoration activities will be guided by design features to protect wilderness characteristics and MMP guidance. Use of native species for recovery will be a benefit to LWCs for wilderness characteristic of naturalness. Revegetation using installation of live plants and broadcast seeding by hand followed by hand raking, would be most likely to mimic natural vegetation create little to no further impacts to wilderness characteristics.

4.3.1.17 Wilderness Study Areas

The proposed action would allow for a variety of weed control treatment methods (herbicide, manual, mechanical, biological and fire) to occur within WSA's as long as they continue to meet the exception to the non-impairment standard (BLM Manual 6330 C.2.f) for enhancing wilderness characteristics and are conducted in the least impairing manner. Under these conditions, impacts are anticipated to be beneficial to the WSA setting but may have temporary, short-term impacts as recovery and restoration progresses. Removal of large-diameter exotic trees on river and tributary corridors within WSA's may cause down-stream erosion and changes to riparian conditions. All treatments and methods would utilize design features as detailed above to protect non-target vegetation in prioritizing long-term ecosystem health and recovery as a component of the wilderness characteristic of naturalness.

Herbicide: Targeted herbicide use and biological control as applied in conformance with design features for protection of non-target plants and wildlife is anticipated to result in short term, temporary impacts with no threat to long-term eligibility. The use of targeted herbicides per the proposed action could offer the most targeted approach,

reduce the need for continued treatments and could increase the amount of removal that could be accomplished annually, speeding the rate of recovery.

Manual: Most manual weed removal methods and small scale restoration projects are anticipated to create little to no surface disturbance with no threat to long-term eligibility.

Mechanical: Non-motorized tools and equipment will be prioritized for access and removal of exotic vegetation unless the use or treatment is evaluated and determined to be the "minimum tool" through use of the Minimum Requirement Decision Guide (MRDG). Impacts from any use of mechanized equipment such as chainsaws are anticipated to be short-term, temporary impacts and would not impact long-term suitability for designation as wilderness.

Due to the potential for long term surface disturbance, mechanical weed removal projects involving ground disturbance beyond the impact of a wheel or track, such as use of bulldozers, tractors and heavy equipment will not be allowed within WSA's without additional site-specific NEPA. Aerial spraying also would not be allowed in WSA's without site specific NEPA to evaluate impacts to non-target species.

Fire: The use of prescribed fire as a tool to mimic the natural role of fire within monument ecosystems is anticipated to be short-term, temporary.
Biological: Biological control using small insects, pathogens and livestock is not anticipated to cause any long-term impacts to eligibility if in compliance with conditions of BLM Manual 6330.

Restoration: Design features guide restoration activities promote natural ecosystem recovery which would be a benefit to WSA's. Use of native species for recovery will be a benefit to the natural setting and the wilderness characteristic of naturalness. Re-vegetation using installation of live plants and broadcast seeding by hand followed by hand raking, would be most likely to mimic natural vegetation creating little to no further impacts to wilderness characteristics.

4.3.2. Alternative B – No Action

4.3.2.1 Water Resources

Impacts to water quality under this alternative are essentially the same as described for Alternative A (Section 4.3.1.1 Water , p. 71). The primary difference comes from not using aerial chemical application, which will eliminate the potential for spray drift, although the potential for spray drift from other application methods remains. The only other change is that this Alternative allows use of fewer herbicides, two of which could be use in aquatic treatments in Alternative A (diquat and fluridone); this alternative would eliminate the potential for impacts to aquatic resources from those

herbicides. Otherwise, there would be no change to direct impact on water quality other than to eliminate the possibility of adverse effects from the ten herbicides that would not be used (the four that were approved in the 2007 ROD (BLM 2007c): diflufenzopyr + dicamba and imazapic (plus diquat and fluridone); and the six that were disallowed in the 2007 ROD (BLM 2007c): 2,4-DP, asulam, atrazine, fosamine, mefluidide, and simazine). However, there is still a potential for the same adverse impacts as Alternative A from the remaining herbicides that can be applied on and near aquatic resources under either alternative (2, 4-D, glyphosate, imazapyr and triclopyr).

4.3.2.2 Hydrologic Condition

As with impacts to water quality (Section 4.3.2.1 Water , above), potential impacts to hydrologic condition under this alternative are essentially the same as described for Alternative A, except for impacts associated with spray drift from aerial chemical application and the impacts associated with the ten herbicides that would not be used (the four that were approved in the 2007 ROD (BLM 2007c): diflufenzopyr + dicamba, imazapic, diquat and fluridone); and the six that were disallowed in the 2007 ROD (BLM 2007c): 2,4-DP, asulam, atrazine, fosamine, mefluidide, and simazine). There is still a potential for the same adverse impacts as Alternative A from the remaining herbicides that can be applied on and near aquatic resources under either alternative (2, 4-D, glyphosate, imazapyr and triclopyr).

4.3.2.3 Fish and Wildlife Excluding USFW Designated Species

Impacts to fish and wildlife excluding USFW designated species under this alternative are essentially the same as described for Alternative A (Section 4.3.1.1 Water , p.71. The primary difference comes from not using aerial chemical application, which will eliminate the potential for spray drift, although the potential for spray drift from other application methods remains. The only other change is that this Alternative allows use of fewer herbicides, two of which could be use in aquatic treatments in Alternative A (diquat and fluridone); this alternative would eliminate the potential for impacts to fish from those herbicides. Otherwise, there would be no change to direct impact on fish and wildlife other than to eliminate the possibility of adverse effects from the ten herbicides that would not be used (the four that were approved in the 2007 ROD (BLM 2007c): diflufenzopyr + dicamba and imazapic (plus diquat and fluridone); and the six that were disallowed in the 2007 ROD (BLM 2007c): 2, 4-DP, asulam, atrazine, fosamine, mefluidide, and simazine). However, there is still a potential for the same adverse impacts to fish as Alternative A from the remaining herbicides that can be applied on and near aquatic resources under either alternative (2, 4-D, glyphosate, imazapyr and triclopyr).

4.3.2.4 Threatened, Endangered or Candidate Animal Species

Impacts to threatened endangered or candidate animal species under this alternative are essentially the same as described for Alternative A p.**72**. The primary difference comes from not using aerial chemical application, which will eliminate the potential for spray drift, although the potential for spray drift from other application methods

remains. The only other change is that this Alternative allows use of fewer herbicides; this alternative would eliminate the potential for impacts to Mexican spotted owl (MSO), the only relevant threatened, endangered or candidate animal species, from those herbicides. Otherwise, there would be no change to direct impact on MSO other than to eliminate the possibility of adverse effects from the ten herbicides that would not be used (the four that were approved in the 2007 ROD (BLM 2007c): diflufenzopyr + dicamba and imazapic (plus diquat and fluridone); and the six that were disallowed in the 2007 ROD (BLM 2007c): 2, 4-DP, asulam, atrazine, fosamine, mefluidide, and simazine).

4.3.2.5 Threatened, Endangered or Candidate Plant Species

For special status plant species, risks for impacts from herbicide exposure should not be substantially different under either alternative A or B, since the Monument would design herbicide treatments to avoid risks to these species. Except that not using aerial chemical applications would reduce the risks of special status species of being damaged from chemical spray drift.

Under this alternative, only those herbicides currently used by the BLM would be used to treat vegetation. Based on herbicide usage in the past decade, the majority of the total acreage would be treated with picloram, tebuthiuron, and 2 ,4-D. Risks to terrestrial plants associated with picloram are relatively high. Risks associated with tebuthiuron are low to moderate. Risks associated with 2, 4-D are unknown, and given the lack of phytotoxicity information for this herbicide, assumed to be high. Risks to aquatic plants associated with picloram are very low. Risks associated with tebuthiuron range from low to high. Risks associated with 2, 4-D are low to moderate. Therefore, risks to most special status plants would likely vary from low to high under this alternative, depending on the herbicide used.

4.3.2.6 Vegetation

The No Action Alternative would be a continuation of current vegetation treatment practices, impacts to vegetation would be similar in nature to those that have occurred in the past, except that not using aerial chemical applications would reduce the risk to non-target vegetation.. As a result, invasive species would likely continue their rapid expansion across the Monument. Negative impacts to vegetation (i.e., harm to non-target plants) could be lower than under Alternative A based on the number of acres treated. However, long-term benefits to plant communities (i.e., eradication of unwanted vegetation and resulting improvements in ecosystems) would be much less under this alternative than the other alternatives. Invasive plant populations would likely continue to expand at the current rate or more quickly, increasing damage to native plant communities and inhibiting ecosystem functions.

Because the new herbicides proposed for use by the BLM (diquat, fluridone, imazapic, and Overdrive®) would not be used under this alternative, risks to vegetation would be different than under the other alternatives. The risks to terrestrial plants associated with exposure to these four herbicides (especially imazapic) under accidental direct spray, spill, and off-site drift scenarios are lower than those associated with exposure to bromacil and chlorsulfuron, and similar to or lower than the risks associated with exposure to the other pre-approved herbicides. Imazapic has been reported to successfully control the spread of aggressive invasives, including downy brome, Russian knapweed, and perennial pepperweed, and has had positive effects on native prairie restoration (Whitson 2001, Shinn and Thill 2002). In addition, risks to aquatic plants associated with use of the new herbicides are similar to or lower than those associated with use of the pre-approved herbicides (e.g., bromacil, diuron), under all application scenarios. Since the BLM would not use the new herbicides under the No Action Alternative, risks to terrestrial plants from accidents and off-site drift during each application event could be greater than under the other herbicide-use alternatives in situations where less harmful new herbicides would otherwise be appropriate. However, risks to special status terrestrial plants from surface runoff would be greatest with the use of diflufenzopyr, suggesting that per treatment risks to these species under surface runoff scenarios might be less under this alternative than under the other herbicide-use alternatives.

Riparian

Impacts to riparian and wetland resources under this alternative are essentially the same as described for Alternative A (Section 4.3.1.6 Vegetation) except that not using aerial chemical application will reduce the risk of impacts to non-target populations. This alternative allows use of fewer herbicides, eliminating potential impacts from two herbicides that could be used in riparian and wetland areas under alternative A (diquat and fluridone). However, there is still a potential for the same adverse and beneficial impacts from the remaining herbicides that can be applied in riparian and wet land under wither alternative (2-4D, glyphosate, imazapyr and triclopyr).

4.3.2.7 Soils

Impacts to soils under this alternative are essentially the same as described for Alternative A (Section 4.3.1.7 Soils, p. 88), except for impacts associated with spray drift from aerial chemical application and the impacts associated with the ten herbicides that would not be used (the four that were approved in the 2007 ROD (BLM 2007c): diflufenzopyr + dicamba, imazapic, diquat and fluridone); and the six that were disallowed in the 2007 ROD (BLM 2007c): 2,4-DP, asulam, atrazine, fosamine, mefluidide, and simazine).

4.3.2.8 Air Quality

Impacts to air quality under this alternative are essentially the same as described for Alternative A (Section 4.3.1.8 Air Quality, p. 89). The primary difference comes from not using aerial chemical application, which will eliminate all emissions associated with

aerial application (aircraft engine emissions and the potential for spray drift, although the potential for spray drift from other application methods remains). The only other change is that this Alternative allows use of fewer herbicides, which will have no direct impact on air quality other than to eliminate the possibility of adverse effects from spray drift of the herbicides that would not be used (the four that were approved in the 2007 ROD (BLM 2007c): diflufenzopyr + dicamba, diquat, fluridone and imazapic; and the six that were disallowed in the 2007 ROD (BLM 2007c): 2,4-DP, asulam, atrazine, fosamine, mefluidide, and simazine).

4.3.2.9 Flood Plains

Impacts to floodplains under this alternative are essentially the same as described for Alternative A (Section 4.3.1.9 Floodplains, p. 90) except that not using aerial chemical application will reduce the risk of impacts to non-target populations. This alternative also allows use of fewer herbicides, eliminating potential impacts from two herbicides that could be used in floodplains under Alternative A (diquat and fluridone). However, there is still a potential for the same adverse impacts from the remaining herbicides that can be applied in floodplains under either alternative (2, 4-D, glyphosate, imazapyr and triclopyr).

4.3.2.10 Wild and Scenic Rivers

Impacts to WSR segments in this alternative are essentially the same as those described in the proposed action for WSAs in Alternative A (4.3.17). The primary difference is that restrictions on targeted herbicides could slow the removal of exotic species and require repetitive treatments. This alternative also does not have the most comprehensive design features to best protect Outstanding Remarkable Values on WSR segments such as those related riparian fish, wildlife and plants.

4.3.2.11 Fuels and Fire Management

In the No action alternative, changes in fuel loading in each of the FMU would be similar to the Proposed Action because this alternative proposes the same methods to be used to treat noxious weeds and invasive plants such as Russian olive and tamarisk.

4.3.2.12 Recreation

In the No Action Alternative, an integrated weed management program would not be implemented. Recreation values would not likely change as most recreationalists are probably not able to identify the difference of native from non-native plants, as well as invasive or noxious weeds; however, this does not diminish the loss of the ecological and educational value for a healthy ecosystem which supports recreational values.

Presidential Proclamation 6920 establishing Grand Staircase-Escalante National Monument states “the monument presents exemplary opportunities for geologists, paleontologists, archeologists, historian and biologists.” The Monument “contains an abundance of unique isolated communities such as hanging gardens, tinajas, and rock crevice, canyon bottom, and dunal pocket communities, which have provided refugia

for many ancient plant species for millennia." The Monument was set aside as a scientific laboratory and does not mention recreation as an object or value; however many visitors come to the Monument to recreate and become better educated about the ecological mechanisms the region has to offer.

Under the No Action alternative weeds will likely spread and change the natural environment which in time may reduce the recreational/educational values of the Monument.

4.3.2.13 Livestock Grazing

The impacts of treatments using Manuel, Mechanical, Biological and Fire would be the same as those describe for Alternative A Proposed Action, except that not using aerial chemical application will reduce the risk of impacts to non-target forage species.

There is still a potential for the same adverse impacts as Alternative A from the remaining herbicides that can be applied on and near aquatic resources under Alternative A Proposed Action (2,4-D, glyphosate, imazapyr and triclopyr).

Because the new herbicides (diquat, fluridone, imazapic, and Overdrive®) would not be used under this alternative, risks to livestock would be different than under Alternative A Proposed Action. Fluridone and imazapic do not present any risks to livestock in modeled scenarios (similar to chlorsulfuron, metsulfuron methyl, and sulfometuron methyl), and Overdrive® poses low to moderate risk to large livestock under chronic exposure scenarios in which the animal ingests contaminated vegetation over a long time period. Diquat is fairly toxic to livestock, particularly under food ingestion scenarios (similar to 2, 4-D and diuron). However, because diquat would be used by the BLM as an aquatic herbicide, frequent exposure to livestock would not be expected.

Therefore, the No Action Alternative would prevent the Monument from using a greater repertoire of herbicides that are not injurious to terrestrial animals, possibly resulting in greater per area risks to livestock than alternative A Proposed Action, if more injurious herbicides (e.g., 2, 4-D, bromacil, diuron, tebuthiuron, triclopyr) were used instead of safer alternatives, as well as decreasing the possibilities of more effective rangeland improvements. Conversely, prohibiting the use of diquat, particularly in rangeland riparian areas, could result in somewhat lower per area risk to livestock than under the other alternatives. Instead, the BLM would use other herbicides, including triclopyr, sulfometuron methyl, bromacil, diuron, and Overdrive®, which are effective in controlling weeds and invasive vegetation, but have less risk to livestock

4.3.2.14 Paleontology

Under this alternative the fossil resources would be totally non-impacted by weed treatments. No other effects are known.

4.3.2.15 Visual Resources

Impacts to visual resources under this alternative are essentially the same as described for Alternative A (4.3.1.14 Visuals). The primary difference comes from not using aerial chemical application. The visual impacts associated with this aerial spraying (i.e. creating obvious edges between treated and untreated areas where texture and color contrast result between the living (full and green) vegetation and the dead (crumpled and brown) vegetation) would be eliminated. The other change is that this Alternative allows use of fewer herbicides, which will have no direct impact on visual resources beyond those disclosed in Alternative A.

4.3.2.16 Lands with Wilderness Characteristics

Impacts to LWC under this alternative are essentially the same as those described in the proposed action for Alternative A (4.3.1.16). The primary difference is that restrictions on use of full complement of herbicides could slow the removal of some wide spread exotic grasses or invasive tree species and require repetitive treatments in some cases which could affect the rate of recovery of "naturalness" as a wilderness characteristic. This alternative also does not have the most comprehensive design features to best protect wilderness characteristics.

4.3.2.17 Wilderness Study Areas

Impacts to WSAs under this alternative are essentially the same as those described in the proposed action for Alternative A (4.3.17). The primary difference is that restrictions on use of full complement of herbicides could slow the removal of exotic species and require repetitive treatments in some cases causing repetitive surface disturbance. This could also slow the rate of recovery of the natural setting. This alternative also does not have the most comprehensive design features to best protect WSAs and insure "least impairing methods" are evaluated.

4.3.3 Alternative C –No Herbicide Use

4.3.3.1 Water Resources

Impacts to water quality under this alternative are the same as described for Alternative A (Section 4.3.1.1 Water , p. 71) for non-herbicide treatments (manual and mechanical treatments and fire). The impacts associated with chemical (herbicide) application are irrelevant because this alternative does not include chemical use.

4.3.3.2 Hydrologic Condition

Impacts to hydrologic condition under this alternative are the same as described for Alternative A (Section 4.3.1.2 Hydrologic Condition, p. 74) for non-herbicide treatments (manual and mechanical treatments and fire). The impacts associated with chemical

(herbicide) application are irrelevant because this alternative does not include chemical use.

4.3.3.3 Fish and Wildlife Excluding USFW Designated Species

Impacts to fish and wildlife under this alternative are the same as described for Alternative A (Section, p.**Error! Bookmark not defined.**) for non-herbicide treatments (manual and mechanical treatments and fire). The impacts associated with chemical (herbicide) application are irrelevant because this alternative does not include chemical use.

4.3.3.4 Threatened, Endangered or Candidate Animal Species

Impacts to threatened endangered or candidate animal species under this alternative are the same as described for Alternative A (Section , p. **Error! Bookmark not defined.**) for non-herbicide treatments (manual and mechanical treatments and fire). The impacts associated with chemical (herbicide) application are irrelevant because this alternative does not include chemical use.

4.3.3.5 Threatened, Endangered or Candidate Plant Species

Under this alternative, no public lands would be treated with herbicides. Therefore, special status species on public lands would not be exposed to herbicides unless chemicals were transported onto the land from off-site. The risks to special status plant species for harm due to herbicide exposure would be near zero under this alternative, and therefore much lower than under the other alternatives. However, impacts to these species from herbicide exposure should not be substantially different than under the other alternatives, since measures to protect these species would be implemented under the other alternatives.

Under this alternative, the BLM would be less effective at controlling weed infestation than under the other alternatives. Non-native plant species, including those that compete with, or are a threat to, special status plant species, would spread at a faster rate than under the other alternatives. Although other treatment methods could be substituted for herbicide treatments, it is unlikely that these control measures would be as effective under all circumstances. Furthermore, some treatments must be combined with herbicide treatments to achieve the desired result (e.g., burning or mechanical treatments followed by spraying). These treatments would be used on their own under this alternative, and would not be as effective at controlling weed infestations.

Under this alternative, special status plant species and their habitats would not benefit from manual spot treatments of herbicides, which can be used to control weed infestations in areas that are too sensitive to receive more disturbing or wide-scale treatments. Under this alternative, the BLM would have fewer tools to control weeds near populations of special status species, many of which are threatened by non-native

species. Overall, less would be done to improve the habitat of these species, making them more at risk for future population declines or extirpations.

4.3.3.6 Vegetation

Under Alternative C, non-target plants would not be affected by herbicide use. Effects to vegetation would stem from other vegetation treatment methods In general, the potential negative impacts to non-target plants from manual and mechanical treatment methods are expected to be lower than those from chemical and prescribed fire methods (the impacts from biological methods are less certain). Positive ecosystem benefits as a result of vegetation management may be less than under the Preferred Alternative, as there are certain invasive species for which herbicide use is the only effective method of treatment or for which treatment by other methods is impractical due to cost, time, accessibility, or public concerns (e.g., saltcedar in riparian areas). For example, rough terrain may prevent treatment by methods that require ground vehicle and foot access, while aerial treatment with herbicides would be possible in these areas. Vegetation treatments on ROW and oil and gas production facilities would have to be done by manual and mechanical means, or not done at all. Both options may be unfeasible for ROW, while the latter option would compromise the safety of oil and gas production facilities (BLM 1991).

Riparian

Herbicides would not be used to manage vegetation under Alternative C. Primary effects to riparian and wetland vegetation would stem from other vegetation treatment methods including fire, manual, mechanical, and biological control and would be the same as those described for Alternative A..

The possible ecosystem benefits of not using herbicides would be the elimination of risks to non-target biota associated with accidental spills, drift, and persistence of herbicides.

Without herbicide treatments, it is likely than some invasive plants would continue to spread rapidly, resulting in dramatic and potentially irreversible effects on wetland and riparian areas. As discussed previously, invasive species out compete native vegetation and lead to widespread incidence of fire and other conditions that can result in loss of ecosystem function in wetlands and riparian areas.

Positive ecosystem benefits as a result of vegetation management could be reduced under this alternative, as there are certain invasive species for which herbicide use is the only effective method of treatment or the only practical method, based on cost, time, accessibility, or public concerns. For example, rough terrain that cannot be accessed for ground-based treatments could potentially be treated using herbicides applied by aircraft. Other treatment methods, such as mechanical, fire, and biological, can result in soil disturbance and sedimentation of aquatic bodies, and may not adequately treat the pest plant.

In addition, it is often difficult to eradicate some species (such as aquatic species and those that resprout from rhizomes) by means other than herbicide application. These species include Eurasian watermilfoil and water-thyme, which form dense mats of aquatic vegetation that crowd out native plants and degrade fish habitat (Bossard et al. 2000). Chemical treatments (including the use of 2,4-D, diquat, and fluridone) are more effective at controlling these species than other treatments, such as mechanical harvesters that tend to fragment and spread the weed.

4.3.3.7 Soils

Impacts to soils under this alternative are the same as described for Alternative A (Section 4.3.1.7 Soils, p. 88) for non-herbicide treatments (manual and mechanical treatments and fire). The impacts associated with chemical (herbicide) application are irrelevant because this alternative does not include chemical use.

4.3.3.8 Air Quality

Impacts to air quality under this alternative are the same as described for Alternative A (Section 4.3.1.8 Air Quality, p. 89) for non-herbicide treatments (manual and mechanical treatments and fire). The impacts associated with chemical (herbicide) application are irrelevant because this alternative does not include chemical use.

4.3.3.9 Flood Plains

Impacts to floodplains under this alternative are essentially the same as described for Alternative A (Section 4.3.1.9 Floodplains, p. 90) for non-herbicide treatments (manual and mechanical treatments and fire). Not using herbicides virtually eliminates the risk of impacts to non-target populations.

4.3.3.10 Wild and Scenic Rivers

Impacts to suitable segments of WSR under this alternative are the same as described for Alternative A (Section 4.3.10) for non-herbicide treatments (manual and mechanical treatments and fire). However, impacts for non-chemical (herbicide) application treatments would have the potential for unsuccessful eradication due to re-sprouting of especially pervasive root systems such as those associated with tamarisk and Russian olive. Repetitive treatments could be required resulting in increased time for ecosystem recovery. This alternative could also result in an overreliance on mechanical methods which could increase surface disturbance. Reliance on non-chemical (herbicide) treatments would insure no impacts to water quality and remove the threat to non-target species of plants and wildlife.

4.3.3.11 Fuels and Fire Management

Under Alternative C, changes in fuel loading in each of the FMUs would be similar to the Proposed Action because this alternative proposes the same mechanical and manual methods to be used to treat noxious weeds and invasive plants such as Russian olive and tamarisk. Because herbicides would not be used, plants are expected to re-

sprout and regrow. Multiple treatments would be necessary to control and contain Russian olive and tamarisk because these species re-sprout from the roots. Fuel loadings would be temporarily increased each time treatments occur. Over time, the amount of fuels would be less each time an area is treated; and fewer piles of debris will need to be burned or removed.

4.3.3.12 Recreation

Weed management methods utilized under this alternative would result in similar impacts to those described for the Proposed Action with the exception of those occurring from herbicide use. The main difference is the potential health and safety concern from herbicides would not be present. All other elements to this alternative would be the same as outlined in Alternative B. SOPs outlined in Appendix B identify the practices and procedures in manual, mechanical, biological control methods.

4.3.3.13 Livestock Grazing

Under Alternative C, livestock would not be affected by herbicide use. Primary impacts would stem from other vegetation treatment methods). Positive benefits to rangelands as a result of vegetation management could be reduced under this alternative, as certain invasive species are only effectively controlled by herbicides, and in some situations other methods are impractical due to cost, time, or public concerns. For example, mechanical and manual methods are impractical over large land areas, which are more effectively treated by broadcast herbicide applications. In addition, it is often difficult to eradicate some species (e.g., rabbitbrush, tamarisk and Russian Olive), by means other than herbicide application. Similarly, pre-emergent herbicides that persist in the soil are the most effective means of controlling invasive plants with seeds that remain viable for long periods of time.

Under this alternative, without the use of herbicides, invasive plant populations would likely continue to spread, possibly at increasing rates. The spread of invasive plant populations would cause further damage to susceptible native plant communities, including rangeland communities that provide forage for livestock, particularly in situations where other treatment methods would not be effective or feasible (e.g., large tracts of rangeland or grassland dominated by invasive, resprouting shrubs; or areas without enough fine fuels to carry prescribed fires). The spread of invasive plant populations would likely have deleterious effects on livestock. Rangeland that contains excessive or unpalatable brush cover is less useful for grazing and has reduced carrying capacity for domestic livestock. Similarly, capacity for cattle grazing decreases proportionately with loss of forage caused by weed infestation. Economic returns in terms of improved grazing value typically exceed herbicide treatment costs on lands where herbicides are used to control weeds (Olson 1999).

4.3.3.14 Paleontology

Of the seven different methods outlined as treatments in the no herbicide alternative, only one involves ground disturbance extensive enough to significantly affect paleontological resources: Wheeled Vehicle treatments that rake, harrow, plow, or rip up soil and vegetation. This method has the potential to crush, dislodge, scatter, break, and otherwise damage fossils on bedrock surfaces or in the shallow subsurface. Impacts would generally be relative to the size and weight of the vehicles involved (translating to surface pressure on each wheel) and the depth of ground disturbance. Light vehicles passing over relatively stable materials such as well consolidated sandstones might have little direct impact on fossils, while rakes and harrows running deep into the soil or regolith could essentially destroy a specimen. No other known direct impacts to fossil resources would result from these methods.

Mitigation for fossil resources in treatment areas that would be subjected to the ground disturbing method above would consist of proactive on-the-ground inventories of areas with a BLM Potential Fossil Yield Classification (PFYC) number of 4 or higher. Significant specimens found during the inventory would need to be collected or avoided during subsequent treatments. Inventory of a treatment area would be considered sufficient for the life of a treatment project and any subsequent maintenance treatments required.

4.3.3.15 Visual Resources

Impacts to visual resources under this alternative are the same as described for Alternative A (4.3.1.14 Visuals) for the methods that do not include use of chemicals (i.e. manual, mechanical without chemicals, biological, prescribed fire, pile burning, and revegetation).

4.3.3.16 Lands with Wilderness Characteristics

Impacts to LWC are the same as described for Alternative A (4.3.1.16) for the methods that do not include the use of herbicides (manual and mechanical treatments and fire). However, impacts for non-chemical (herbicide) application treatments would have the potential for unsuccessful eradication due to re-sprouting of especially pervasive root systems such as those associated with tamarisk and Russian olive. Repetitive treatments could be required resulting in increased time for ecosystem recovery. This alternative could also result in an overreliance on mechanical methods which could increase surface disturbance. The lack of herbicide use would be beneficial in the reduction of impacts to non-target native species.

4.3.3.17 Wilderness Study Areas

Impacts to WSA's are the same as described for Alternative A (4.3.1.17) for the methods that do not include the use of herbicides (manual and mechanical treatments and fire). However, impacts for non-chemical (herbicide) application treatments would have the potential for unsuccessful eradication due to re-sprouting of especially pervasive root systems such as those associated with tamarisk and Russian olive. Repetitive treatments could be required resulting in increased time for ecosystem

recovery. This alternative could also result in an overreliance on mechanical methods which could increase surface disturbance. The lack of herbicide use would reduce impacts to non-target native species.

4.4 Cumulative Impacts Analysis

"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.

4.4.1 Water Resources

The cumulative impacts analysis area for water resources is the entire Monument. A potential for cumulative impacts to water resources exist where direct and/or indirect impacts are the same in both the proposed action and past, present, reasonably foreseeable future actions, and the impacts overlap in time and space.

Direct and indirect impacts to water resources from the proposed action include impacts to water quantity (altered infiltration/runoff, altered base/peak flows, and altered stream channel morphology); water quality (increased total suspended solids [TSS} and turbidity, increased total dissolved solids [TDS], increased nitrogen and phosphorus from nutrient pulses, decreased dissolved oxygen [DO] and impaired benthic macroinvertebrate habitat); groundwater quantity (altered infiltration/runoff and discharge/recharge) and, where chemical are used, groundwater quality (contamination and transport). The severity of impacts depends on the size of the treatment area (greater impacts when larger areas are treated) and on physical environmental factors such as soil type, slope, precipitation and proximity to water.

Summary of direct and indirect impacts to water resources from different types of treatments under proposed action

Treatment type	Where?	Size (total), ac/yr	Size (individual), ac	Direct and indirect impact to water resources
Manual: Hand-pulling, pulling using tools	Monument-wide	~1 ac/yr	<1 ac	Negligible
Manual: Clipping	Monument-wide	~50 ac/yr	<1 ac	Negligible
Manual: Chainsaws, mowing, trimming/ brushing (Russian	Riparian	<300 ac/yr; 6-20 river miles depending	<10 ac	Negligible in small areas If large areas treated:

Treatment type	Where?	Size (total), ac/yr	Size (individual), ac	Direct and indirect impact to water resources
olive, tamarisk)		on riparian width		**Water quantity:** alter infiltration/runoff, alter base/peak flows, alter channel morphology **Water quality:** increase TSS/turbidity, increase TDS, nutrient pulses, decrease DO, impair benthic habitat **Groundwater quantity:** alter infiltration/runoff and discharge/recharge **Groundwater quality:** n/a
Mechanical: Wheeled vehicles (primarily UTV; no chemicals)	Uplands, transportation corridors	<100 ac/yr	<10 ac	Negligible in small areas If large areas treated: **Water quantity:** alter infiltration/runoff, alter base/peak flows, alter channel morphology **Water quality:** increase TSS/turbidity, increase TDS, nutrient pulses, decrease DO, impair benthic habitat **Groundwater quantity:** alter infiltration/runoff and

Treatment type	Where?	Size (total), ac/yr	Size (individual), ac	Direct and indirect impact to water resources
				discharge/recharge **Groundwater quality:** n/a
	Off-road			Requires additional analysis
	Riparian			Requires additional analysis
Biological (domestic animals, insects, nematodes/mites, pathogens); limited use	Monument-wide	<200 ac/yr	<10 ac	Negligible
Chemical: Hand application	Monument-wide (ERWP)	<300 ac/yr	<10 ac	Negligible in small areas; same as "Chemical: Aerial" if large areas treated
Chemical: Broadcast, boom spraying, spot spraying (shrubs and grasses, not trees)	Monument-wide	<350 ac/yr	<10 ac	Negligible in small areas; same as "Chemical: Aerial" if large areas treated Requires additional analysis in WSAs
Chemical: Aerial (fixed or rotor wing); limited use, as allowed by Monument Management Plan	Monument-wide	~500 ac/yr	10-50 ac	**Water quantity:** alter infiltration/runoff, alter base/peak flows, alter channel morphology **Water quality:** increase TSS/turbidity, increase TDS, nutrient pulses, decrease DO, impair benthic habitat **Groundwater quantity:** alter infiltration/runoff and

Treatment type	Where?	Size (total), ac/yr	Size (individual), ac	Direct and indirect impact to water resources
				discharge/recharge **Groundwater quality:** contamination, transport
Fire: Pile burning (associated with cutting)	Monument-wide, mainly riparian	<150 ac/yr	<10 ac	Negligible in small areas; same as "Fire: prescribed fire" if large areas treated
Fire: Prescribed fire	Monument-wide	<200 ac/yr	10-20 ac	Small, low severity, far from water: negligible Large, high severity, near water: **Water quantity:** alter infiltration/runoff, alter base/peak flows, alter channel morphology **Water quality:** increase TSS/turbidity, increase TDS, nutrient pulses, decrease DO, impair benthic habitat **Groundwater quantity:** alter infiltration/runoff and discharge/recharge **Groundwater quality:** n/a
Revegetation: Seeding and Planting	Monument-wide	<600 ac/yr	<20 ac	Negligible (reduce erosion effects once plants established)

The potential for cumulative impacts from the proposed action on water resources when considered in conjunction with past, present and reasonably foreseeable future

realty actions (lands actions such as rights-of-way, roads, utility corridors) is generally negligible, except in the case of large-scale utility corridor maintenance where vegetation removal results in the same direct and indirect impacts to water resources (water quantity/quality and groundwater quantity/quality).

Cumulative impacts from the proposed action on water resources could occur when considered in conjunction with past, present and reasonably foreseeable future actions associated with restoration (vegetation treatments), because vegetation removal prior to restoration will result in the same direct and indirect impacts to water resources (water quantity/quality and groundwater quantity/quality).

The potential for cumulative impacts from the proposed action on water resources when considered in conjunction with past, present and reasonably foreseeable future actions associated with livestock grazing, livestock developments (fences, cattle guards, water developments) and wildlife improvements is generally minor, except where large areas of disturbance from vegetation removal or erosion occur, resulting in the same direct and indirect impacts to water resources (water quantity/quality and groundwater quantity/quality).

The potential for cumulative impacts from the proposed action on water resources when considered in conjunction with past, present and reasonably foreseeable future actions associated with recreation and fuelwood cutting is negligible.

Summary of cumulative impacts to water resources

Past, present, or reasonably foreseeable future action	Cumulative impacts
Realty (lands: ROWs, roads, utility corridors)	Generally negligible; large scale utility corridor maintenance: same direct/indirect from veg removal (water quantity/quality, groundwater quantity/quality)
Restoration (vegetation treatments) NOTE: prescribed fire fits here	Yes; same direct/indirect from large-scale veg removal (water quantity/quality, groundwater quantity/quality)
Livestock grazing	Generally minor, but same direct/indirect for large areas of disturbances when veg removal or erosion occur(water quantity/quality, groundwater quantity)
Livestock developments (fences, cattle guards, water developments)	Generally minor: similar to livestock grazing, but usually smaller magnitude
Recreation (dispersed, developed)	Negligible
Wildlife improvements	Same as livestock developments
Fuelwood cutting	Negligible

4.4.2 Hydrologic Condition

Cumulative impacts to hydrologic condition are included in Section 4.4.1 Water Resources, above. As noted in Section 3.3.2 Hydrologic Condition, p. 46, hydrologic condition includes everything from precipitation to runoff, infiltration, soil moisture and movement of water through the ground (soil or rock), storage in aquifers, discharge and recharge of aquifers at the surface (groundwater-surface water interactions), and all surface water movements. Thus, everything noted above that affects any of these processes is affecting hydrologic condition (primarily the effects on water and groundwater quantity), and the cumulative impacts from the proposed action and past, present and reasonably foreseeable future actions on hydrologic condition are the same as for water and groundwater quantity.

4.4.3 Fish and Wildlife Excluding USFW Designated Species

The cumulative impacts analysis area for fish and wildlife excluding USFW designated species is the entire Monument. A potential for cumulative impacts to fish and wildlife exist where direct and/or indirect impacts are the same in both the proposed action and past, present, reasonably foreseeable future actions, and the impacts overlap in time and space.

Direct and indirect impacts on fish and wildlife from the proposed action include impacts to animal themselves and to their habitats, including food sources. Possible direct toxic effects on individual animals include death, damage to vital organs, change in body weight, decrease in healthy offspring, and increased susceptibility to predation. These effects may be more pronounced in slow, small and hidden species, including amphibian species such as toads, insects and other bugs, and lizards and snakes. Habitat alterations include: loss of target and non-target vegetation; reduction in plant species diversity; reduced migratory bird nesting, breeding and brood raising habitat; changes to territorial boundaries and breeding and nesting behaviors; and increased predation due to loss of cover. Habitat alteration may reduce population density of some species. Loss of food resources affecting wintering birds, coyotes, foxes and other animals could occur with Russian olive removal. Fish habitat could be directly affected by changes in shading and by dead vegetation choking stream beds and spawning habitat, and indirectly through impacts on stream structure such as substrate alteration by fine particles where bank erosion follows riparian vegetation removal. Manual treatment methods are not likely to affect animals because of small treatment areas. Biological controls are not likely to affect animals because non-target vegetation is unaffected. Mechanical methods and prescribed fire could potentially disturb large areas, altering habitat and displacing animal populations, but these effects would be of short duration, lasting only until revegetation of desirable species occurs.

Summary of direct and indirect impacts to fish and wildlife excluding USFW designated species from different types of treatments under proposed action

Treatment type	Where?	Size (total), ac/yr	Size (individual), ac	Direct and indirect impact to fish and wildlife
Manual: Hand-pulling, pulling using tools	Monument-wide	~1 ac/yr	<1 ac	Negligible
Manual: Clipping	Monument-wide	~50 ac/yr	<1 ac	Negligible
Manual: Chainsaws, mowing, trimming/ brushing (Russian olive, tamarisk)	Riparian	<300 ac/yr; 6-20 river miles depending on riparian width	<10 ac	Negligible in small areas If large areas treated: habitat alteration, loss of food sources
Mechanical: Wheeled vehicles (primarily UTV; no chemicals)	Uplands, transportation corridors	<100 ac/yr	<10 ac	Negligible in small areas If large areas treated: habitat alteration
	Offroad			Requires additional analysis
	Riparian			Requires additional analysis
Biological (domestic animals, insects, nematodes/mites, pathogens); limited use	Monument-wide	<200 ac/yr	<10 ac	None
Chemical: Hand application	Monument-wide (ERWP)	<300 ac/yr	<10 ac	Negligible in small areas; same as "Chemical: Aerial" if large areas treated
Chemical: Broadcast, boom spraying, spot spraying (shrubs and	Monument-wide	<350 ac/yr	<10 ac	Negligible in small areas; same as

Treatment type	Where?	Size (total), ac/yr	Size (individual), ac	Direct and indirect impact to fish and wildlife
grasses, not trees)				"Chemical: Aerial" if large areas treated Requires additional analysis in WSAs
Chemical: Aerial (fixed or rotor wing); limited use, as allowed by Monument Management Plan	Monument-wide	~500 ac/yr	10-50 ac	Toxic effects; habitat alteration
Fire: Pile burning (associated with cutting)	Monument-wide, mainly riparian	<150 ac/yr	<10 ac	Negligible in small areas; same as "Fire: prescribed fire" if large areas treated
Fire: Prescribed fire	Monument-wide	<200 ac/yr	10-20 ac	Short term habitat alteration, population displacement
Revegetation: Seeding and Planting	Monument-wide	<600 ac/yr	<20 ac	Negligible (restore habitat once plants established)

The potential for cumulative impacts from the proposed action on fish and wildlife when considered in conjunction with past, present and reasonably foreseeable future realty actions (lands actions such as rights-of-way, roads, utility corridors) is generally negligible, except in the case of large-scale utility corridor maintenance where vegetation removal results in the same direct and indirect impacts to fish and wildlife (habitat alteration), and in toxic effects if herbicides are used.

Cumulative impacts from the proposed action on fish and wildlife could occur when considered in conjunction with past, present and reasonably foreseeable future actions associated with restoration (vegetation treatments), because vegetation removal prior

to restoration will result in the same direct and indirect impacts to fish and wildlife (habitat alteration), and in toxic effects if herbicides are used.

The potential for cumulative impacts from the proposed action on fish and wildlife when considered in conjunction with past, present and reasonably foreseeable future actions associated with livestock grazing, livestock developments (fences, cattle guards, water developments) and wildlife improvements is generally minor, except where large areas of disturbance from vegetation removal or erosion occur, resulting in the same direct and indirect impacts to fish and wildlife (habitat alteration).

The potential for cumulative impacts from the proposed action on fish and wildlife when considered in conjunction with past, present and reasonably foreseeable future actions associated with recreation and fuelwood cutting is negligible.

Summary of cumulative impacts to fish and wildlife excluding USFW designated species

Action	Cumulative impact
Realty (lands: ROWs, roads, utility corridors)	Generally negligible; large scale utility corridor maintenance: same direct/indirect from veg removal (habitat alteration); toxic effects if chemicals used
Restoration (vegetation treatments) NOTE: prescribed fire fits here	Yes; same direct/indirect from veg removal (habitat alteration); toxic effects if chemicals used
Livestock grazing	Generally minor, but same direct/indirect for large areas of disturbances when veg removal or erosion occur (habitat alteration)
Livestock developments (fences, cattle guards, water developments)	Generally minor: similar to livestock grazing, but usually smaller magnitude
Recreation (dispersed, developed)	Negligible
Wildlife improvements	Same as livestock developments
Fuelwood cutting	Negligible

4.4.4 Threatened, Endangered or Candidate Animal Species

The cumulative impacts analysis area for threatened, endangered or candidate animal species is the entire Monument. A potential for cumulative impacts to threatened, endangered or candidate animal species exists where direct and/or indirect impacts are the same in both the proposed action and past, present, reasonably foreseeable future actions, and the impacts overlap in time and space.

Direct and indirect impacts to threatened, endangered or candidate animal species are limited to those affecting Mexican spotted owl (MSO) habitat (Protected Activity Centers, PACs), especially riparian zones. Impacts may occur with all treatment methods in the proposed action (manual and mechanical treatment, biological controls, chemicals and fire) as a result of removing riparian woody vegetation, either as target species (e.g., Russian olive) or non-target species (e.g., willows). Vegetation removal can affect owls by reducing prey cover or changing existing plant communities. Treatment activities themselves (presence of people) may disturb owls, especially during the breeding season (March-August), by affecting breeding patterns, causing owls to leave the area, or altering nesting, roosting or foraging behaviors.

The potential for cumulative impacts to threatened, endangered or candidate animal species (MSO) from the proposed action when considered in conjunction with past, present and reasonably foreseeable future realty actions (lands actions such as rights-of-way, roads, utility corridors) is generally negligible, except in the case of large-scale utility corridor maintenance where maintenance occurs in or near PACs.

The potential for cumulative impacts to threatened, endangered or candidate animal species (MSO) from the proposed action when considered in conjunction with past, present and reasonably foreseeable future actions associated with restoration (vegetation treatments), livestock grazing, livestock developments (fence, cattle guards, water developments), wildlife improvements, recreation and fuelwood cutting is generally negligible, except where those actions occur in or near PACs.

4.4.5 Threatened, Endangered or Candidate Plant Species

The cumulative impacts analysis area for threatened, endangered or candidate plant species is the entire Monument. A potential for cumulative impacts to exist where direct and/or indirect impacts are the same in both the proposed action and past, present, reasonably foreseeable future actions, and the impacts overlap in time and space.

Direct and indirect impacts to threatened, endangered or candidate plant species would be limited to those with in a weed treatment area. Impacts may occur with all the treatment methods in the proposed action (manual and mechanical treatment, biological controls, chemical and fire). A direct impact of chemical application would be unintentional from either overspray or drift.

The potential for cumulative impacts to threatened, endangered or candidate plant species from the proposed action when considered in conjunction with past, present and reasonably foreseeable future realty actions (lands actions such as rights-of-way, roads, utility corridors) is generally negligible, except in the case of large-scale utility corridor maintenance where maintenance occurs in or near a threatened, endangered or candidate plant species population.

The potential for cumulative impacts to threatened, endangered or candidate plant species from the proposed action when considered in conjunction with past, present and reasonably foreseeable future actions associated with restoration (vegetation treatments), livestock grazing, livestock developments (fence, cattle guards, water developments), wildlife improvements, recreation and fuelwood cutting is generally negligible, except where those actions occur in or near a threatened, endangered or candidate plant species population.

If all mitigation measures and Standard Operating Procedures (SOP) are implemented cumulative impacts would be negligible.

4.4.6 Vegetation

The cumulative impacts analysis area for vegetation is the entire Monument. A potential for cumulative impacts to vegetation exists where direct and/or indicate impacts are the same for both the proposed action and past, present, reasonably foreseeable future actions, and the impacts overlap in time and space.

Direct and indirect of Impact on vegetation from the proposed action to target and non-target includes the following :

Manual: Selective, causing injury and mortality to target plants/fuels; small amount of trampling or accidental removal of non-target plants; spilled oil and fuels; fewer human risks then other types of treatment.

Mechanical: precise control of vegetation to be treated; more effective in sensitive area; treatment causing injury and mortality to target vegetation; may bring weed seed into treated area; revegetation usually required after treatment; and spilled oil and fuel during treatment.

Fire: Injuries and kill vegetation; stimulates growth on certain types of plants, such as grasses, rabbitbrush, tamarisk.

Biological: Damage to non-target plants; No adverse impacts of using insects.

Chemical: Mortality, reduced productivity and abnormal growth on non-target vegetation; less labor to treat target plants then other types of treatments; less soil disturbance then other treatments, less fire risks;

Summary of cumulative impacts to Vegetation

Action	Cumulative impact
Realty (lands: ROWs, roads, utility corridors)	Generally negligible; large scale utility corridor maintenance: same direct/indirect from selective removal of vegetation on less than.

Restoration (vegetation treatments) NOTE: prescribed fire fits here	Yes; same direct/indirect from veg removal, damage to non-target plants (habitat alteration) simulates growth of some invasive plants, may bring weed seed into treated area,; toxic effects if chemicals used, soil disturbance and benefit plant communities by releasing native species competitive pressure and aids in reestablishment of native species. Overall impacts would be minor across the entire Monument with less than 2000 acres treated each year.
Livestock grazing	Generally minor, but same direct/indirect for large areas of disturbances with vegetation removal, spread weed seed and trampling of vegetation within treatment areas.
Livestock developments (fences, cattle guards, water developments)	Generally minor: similar to livestock grazing, but usually smaller magnitude
Recreation (dispersed, developed)	Negligible
Wildlife improvements	Same as livestock developments
Fuelwood cutting	Negligible, with removal of larger trees type of vegetation. Localized within the two fuelwood cutting areas on the Monument.

Wetlands and Riparian Areas

The cumulative impacts analysis area for vegetation is the entire Monument. A potential for cumulative impacts to vegetation exists where direct and/or indicate impacts are the same for both the proposed action and past, present, reasonably foreseeable future actions, and the impacts overlap in time and space.

Direct and indirect of Impact on wetland riparian areas from the proposed action are summarized below:

Manual: Removal of target vegetation .

Mechanical: Soil disturbance; vegetation removal; soil compaction limiting water infiltration; spills resulting from fueling, equipment maintenance, and operation could affect water quality and the health of wetland or riparian areas.

Biological: Release of organisms would weaken or kill vegetation; plant community should improve; the use of livestock could change stream channel/wetland morphology alteration and loss of native riparian vegetation

Chemical: Reduce plant cover; increased sedimentation; increase nutrient loading, alter native vegetation, change temperature and hydrologic conditions; non-target riparian plants could be damaged from accidental spills or diverted sprays, local sprays drift; increased surface water runoff and soil erosion.

Fire Decrease in hazardous fuels, trigger germination of some plant species; stimulate growth of new vegetation; create new wildlife habitat; release nutrients for plants species; removes targeted and non-targeted vegetation.

Summary of cumulative impacts to Wet Lands and Riparian areas:

Action	Cumulative impact
Realty (lands: ROWs, roads, utility corridors)	Generally negligible; large scale utility corridor maintenance: same direct/indirect from selective removal of riparian vegetation. This would occur on less than 2000 acres per year.
Restoration (vegetation treatments) NOTE: prescribed fire fits here	Yes there would be cumulative impacts; same direct/indirect impacts happening in the same space and time. These impacts would be from vegetation removal, soil disturbance soil compaction, spills resulting from fueling, equipment maintenance and operation that could affect water quality and the health of wetland and riparian area. Overall impacts would be minor across the entire Monument with only an overlap of time and space on less than 2,000 acres per year.
Livestock grazing	Generally minor, but same direct/indirect for large areas of disturbances with vegetation removal, change stream channel/wetland morphology alteration and loss of native riparian vegetation. Soil disturbance, soil erosion, Overall the overlap in time and space would be minor because there would be less than 2000 acres/year.
Livestock developments (fences, cattle guards, water developments)	Generally minor: similar to livestock grazing, but usually smaller magnitude
Recreation (dispersed, developed)	Negligible
Wildlife improvements	Same as livestock developments
Fuelwood cutting	No cumulative impact because fuel wood cutting is not allowed outside the two fuel wood areas on the Monument.

4.4.7 Soils

The cumulative impacts analysis area for soils is the entire Monument. A potential for cumulative impacts to soil resources exist where direct and/or indirect impacts are the same in both the proposed action and past, present, reasonably foreseeable future actions, and the impacts overlap in time and space.

Direct and indirect impacts to soil resources from the proposed action include impacts to chemical, physical and biological soil processes through erosion losses and alteration of soil structure and biota. A primary direct impact of chemical application is persistence of residues in soil, either through intentional or unintentional (overspray, drift) application. Residues may be transported through the soil thereby leading to adverse effects on non-target species or other resources (water or groundwater quality). Non-herbicide treatments would potentially affect soils by altering their physical, chemical, and/or biological properties. Physical changes could include loss of soil through erosion or changes in soil structure, porosity, or organic matter content. Fire and other treatments would potentially alter nutrient availability and soil pH, and herbicide treatments would involve the addition of chemicals to the soil. Some vegetation treatments might also alter the abundance and types of soil organisms that contribute to overall soil quality, including mycorrhizae. The severity of impacts depends on the size of the treatment area (greater impacts when larger areas are treated) and on physical environmental factors such as soil type, slope and precipitation.

Summary of direct and indirect impacts to soil resources from different types of treatments under proposed action

Treatment type	Where?	Size (total), ac/yr	Size (individual), ac	Direct and indirect impact to soil resources
Manual: Hand-pulling, pulling using tools	Monument-wide	~1 ac/yr	<1 ac	Negligible
Manual: Clipping	Monument-wide	~50 ac/yr	<1 ac	Negligible
Manual: Chainsaws, mowing, trimming/ brushing (Russian olive, tamarisk)	Riparian	<300 ac/yr; 6-20 river miles depending on riparian width	<10 ac	Negligible in small areas If large areas treated: erosion (soil loss)
Mechanical: Wheeled vehicles	Uplands, transportation	<100 ac/yr	<10 ac	Negligible in small areas

Treatment type	Where?	Size (total), ac/yr	Size (individual), ac	Direct and indirect impact to soil resources
(primarily UTV; no chemicals)	corridors			If large areas treated: erosion (soil loss), alter physical structure (compaction, porosity)
	Off-road			Requires additional analysis
	Riparian			Requires additional analysis
Biological (domestic animals, insects, nematodes/mites, pathogens); limited use	Monument-wide	<200 ac/yr	<10 ac	Negligible
Chemical: Hand application	Monument-wide (ERWP)	<300 ac/yr	<10 ac	Negligible in small areas; same as "Chemical: Aerial" if large areas treated
Chemical: Broadcast, boom spraying, spot spraying (shrubs and grasses, not trees)	Monument-wide	<350 ac/yr	<10 ac	Negligible in small areas; same as "Chemical: Aerial" if large areas treated Requires additional analysis in WSAs
Chemical: Aerial (fixed or rotor wing); limited use, as allowed by Monument Management Plan	Monument-wide	~500 ac/yr	10-50 ac	Soil persistence, transport, indirect effects on other resources (non-target vegetation, water or groundwater quality)
Fire: Pile burning (associated with cutting)	Monument-wide, mainly riparian	<150 ac/yr	<10 ac	Negligible in small areas; same as "Fire: prescribed

Treatment type	Where?	Size (total), ac/yr	Size (individual), ac	Direct and indirect impact to soil resources
				fire" if large areas treated
Fire: Prescribed fire	Monument-wide	<200 ac/yr	10-20 ac	Small, low severity: negligible Large, high severity: alter nutrient availability, pH, organic matter; alter soil microorganisms type, abundance
Revegetation: Seeding and Planting	Monument-wide	<600 ac/yr	<20 ac	Negligible (reduce erosion effects once plants established)

The potential for cumulative impacts from the proposed action on soil resources when considered in conjunction with past, present and reasonably foreseeable future realty actions (lands actions such as rights-of-way, roads, utility corridors) is generally negligible, except in the case of large-scale utility corridor maintenance where vegetation removal results in the same direct and indirect impacts to soil resources (erosion losses, alteration of physical structure—compaction and persistence/transport if chemicals are used).

Cumulative impacts from the proposed action on soil resources could occur when considered in conjunction with past, present and reasonably foreseeable future actions associated with restoration (vegetation treatments), because vegetation removal prior to restoration will result in the same direct and indirect impacts to soil resources (erosion losses, alteration of physical structure—compaction and persistence/transport if chemicals are used).

The potential for cumulative impacts from the proposed action on soil resources when considered in conjunction with past, present and reasonably foreseeable future actions associated with livestock grazing, livestock developments (fences, cattle guards, water developments) and wildlife improvements is generally minor, except where large areas of disturbance from vegetation removal or erosion occur (alteration of physical structure—compaction).

The potential for cumulative impacts from the proposed action on soil resources when considered in conjunction with past, present and reasonably foreseeable future actions associated with recreation and fuelwood cutting is negligible.

Summary of cumulative impacts to soil resources

Action	Cumulative impact
Realty (lands: ROWs, roads, utility corridors)	Generally negligible; large scale utility corridor maintenance: same direct/indirect from veg removal (erosion losses, alteration of physical structure (compaction), persistence/transport if chemicals used)
Restoration (vegetation treatments) NOTE: prescribed fire fits here	Yes; same direct/indirect from veg removal (erosion losses, alteration of physical structure (compaction), persistence/transport if chemicals used)
Livestock grazing	Generally minor, but same direct/indirect for large areas of disturbances when veg removal or erosion occur (alteration of physical structure—compaction)
Livestock developments (fences, cattle guards, water developments)	Generally minor: similar to livestock grazing, but usually smaller magnitude
Recreation (dispersed, developed)	Negligible
Wildlife improvements	Same as livestock developments
Fuelwood cutting	Negligible

4.4.8 Air Quality

The cumulative impacts analysis area for air quality is the entire Monument. A potential for cumulative impacts to air quality exist where direct and/or indirect impacts are the same in both the proposed action and past, present, reasonably foreseeable future actions, and the impacts overlap in time and space.

Direct and indirect impacts to air quality from the proposed action originate primarily from engine emissions (truck, ATV and aircraft) and from fugitive dust (dust created by vehicle travel on unpaved roads). Spray drift (movement of herbicide in the air to unintended locations) and volatilization (the evaporation of liquid to gas) of applied herbicides temporarily results in herbicide particles in the air. Herbicide particles can be transported away from the target location. Manual and mechanical treatments involving ground disturbance affect air quality by mobilizing particulate matter, depending on soil type and ground cover, and by leaving exposed bare ground. Prescribed fire affects air quality primarily due to the smoke produced. Smoke contains many of the criteria pollutants regulated under the Clean Air Act (CO, PM_{10} and $PM_{2.5}$)

and may affect tropospheric ozone (O_3) production because of volatile organic compounds (VOCs) it contains. Minor amounts of other pollutants ($PM_{2.5}$, PM_{10}, CO, NO_2, SO_2, and VOCs) associated with vehicle exhaust and fugitive dust would be generated during travel to and from the treatment site by fire crews, and from mechanical treatments (e.g., bulldozing) associated with site preparation before burning.

Summary of direct and indirect impacts to air quality from different types of treatments under proposed action

Treatment type	Where?	Size (total), ac/yr	Size (individual), ac	Direct and indirect impact to air quality
Manual: Hand-pulling, pulling using tools	Monument-wide	~1 ac/yr	<1 ac	Negligible
Manual: Clipping	Monument-wide	~50 ac/yr	<1 ac	Negligible
Manual: Chainsaws, mowing, trimming/brushing (Russian olive, tamarisk)	Riparian	<300 ac/yr; 6-20 river miles depending on riparian width	<10 ac	Negligible in small areas If large areas treated: Emissions from saws, mowers
Mechanical: Wheeled vehicles (primarily UTV; no chemicals)	Uplands, transportation corridors	<100 ac/yr	<10 ac	Negligible in small areas If large areas treated: Emissions from truck and ATV engines, fugitive dust
	Offroad			Requires additional analysis
	Riparian			Requires additional analysis
Biological (domestic animals, insects, nematodes/mites, pathogens); limited use	Monument-wide	<200 ac/yr	<10 ac	Negligible
Chemical: Hand	Monument-	<300 ac/yr	<10 ac	Negligible in

Treatment type	Where?	Size (total), ac/yr	Size (individual), ac	Direct and indirect impact to air quality
application	wide (ERWP)			small areas If large areas treated: spray drift and volatilization (impacts to non-target species)
Chemical: Broadcast, boom spraying, spot spraying (shrubs and grasses, not trees)	Monument-wide	<350 ac/yr	<10 ac	Negligible in small areas If large areas treated: engine emissions, spray drift and volatilization (impacts to non-target species) Requires additional analysis in WSAs
Chemical: Aerial (fixed or rotor wing); limited use, as allowed by Monument Management Plan	Monument-wide	~500 ac/yr	10-50 ac	Aircraft engine emissions, spray drift and volatilization (impacts to non-target species)
Fire: Pile burning (associated with cutting)	Monument-wide, mainly riparian	<150 ac/yr	<10 ac	Negligible in small areas; same as "Fire: prescribed fire" if large areas treated
Fire: Prescribed fire	Monument-wide	<200 ac/yr	10-20 ac	Smoke (carbon monoxide, particulate matter, VOCs); VOCs may affect tropospheric ozone (O_3)
Revegetation: Seeding and Planting	Monument-wide	<600 ac/yr	<20 ac	Negligible

The potential for cumulative impacts from the proposed action on air quality when considered in conjunction with past, present and reasonably foreseeable future realty actions (lands actions such as rights-of-way, roads, utility corridors) is generally negligible, except in the case of large-scale utility corridor maintenance where treatments result in the same direct and indirect impacts (mechanical treatments: engine emissions, fugitive dust; chemical treatments: spray drift and volatilization/impacts to non-target species).

Cumulative impacts from the proposed action on air quality could occur when considered in conjunction with past, present and reasonably foreseeable future actions associated with restoration (vegetation treatments), because vegetation removal prior to restoration will result in the same direct and indirect impacts (mechanical treatments: engine emissions, fugitive dust; chemical treatment: spray drift and volatilization/impacts to non-target species; and prescribed fire: smoke and associated pollutants).

The potential for cumulative impacts from the proposed action on air quality when considered in conjunction with past, present and reasonably foreseeable future actions associated with livestock grazing, livestock developments (fences, cattle guards, water developments) and wildlife improvements is generally negligible, except for minor amounts of fugitive dust in areas of concentrated disturbance.

The potential for cumulative impacts from the proposed action on air quality when considered in conjunction with past, present and reasonably foreseeable future actions associated with recreation and fuelwood cutting is negligible (minor emissions from saw engines) unless large areas are cut.

Summary of cumulative impacts to air quality

Action	Cumulative impact
Realty (lands: ROWs, roads, utility corridors)	Generally negligible; large scale utility corridor maintenance: same direct/indirect as mechanical treatments (engine emissions, fugitive dust); and spray drift and volatilization (impacts to non-target species) if chemicals used)
Restoration (vegetation treatments) NOTE: prescribed fire fits here	Yes; same direct/indirect as mechanical treatments (engine emissions, fugitive dust); spray drift and volatilization (impacts to non-target species) if chemicals used; and smoke and associated pollutants if prescribed fire used
Livestock grazing	Negligible
Livestock developments (fences, cattle guards,	Generally negligible: minor amounts of fugitive dust in areas of concentrated disturbance

water developments)	
Recreation (dispersed, developed)	Negligible
Wildlife improvements	Same as livestock developments
Fuelwood cutting	Generally negligible (minor emissions from saw engines) unless large areas are cut

4.4.9 Flood Plains

The cumulative impacts analysis area for flood plains is the entire Monument. A potential for cumulative impacts to flood plains exist where direct and/or indirect impacts are the same in both the proposed action and past, present, reasonably foreseeable future actions, and the impacts overlap in time and space.

Direct and indirect impacts to flood plains occur with all treatment methods in the proposed action (manual and mechanical treatment, biological controls, chemicals and fire) as a result of removing woody vegetation on the floodplain, either as target species (e.g., Russian olive) or non-target species (e.g., willows). The absence of dense, flexible woody stems on the banks of the floodplain can lead to fluvial erosion and associated floodplain loss.

The potential for cumulative impacts to flood plains from the proposed action when considered in conjunction with past, present and reasonably foreseeable future realty actions (lands actions such as rights-of-way, roads, utility corridors) is generally negligible, except in the case of large-scale utility corridor maintenance where maintenance occurs in flood plains.

The potential for cumulative impacts to flood plains from the proposed action when considered in conjunction with past, present and reasonably foreseeable future actions associated with restoration (vegetation treatments), livestock grazing, livestock developments (fence, cattle guards, water developments) and wildlife improvements, is generally negligible, except where those actions occur in flood plains.

The potential for cumulative impacts to flood plains from the proposed action when considered in conjunction with past, present and reasonably foreseeable future actions associated with recreation and fuelwood cutting is negligible.

4.4.10 Wild and Scenic Rivers

Cumulative Impact Area

The cumulative impact area of analysis for WSR is the 252 miles of suitable WSR segments of the Paria and Escalante Rivers within the Monument, measured approximately ¼ mile from the mean high water mark on both sides of the channel.

Cumulative Impacts

The cumulative impacts to suitable WSR from past, present, and reasonably foreseeable actions include removal, treatment and recovery of vegetation, noxious and native, on WSR segments throughout the Monument using all methods. The action alternatives would not contribute to a measureable increase in long term negative impacts to WSR eligible segments or Outstanding Remarkable Values if the guidance related to weed removal and restoration have the goal of natural ecosystem recovery. Re-vegetation efforts should recover native riparian plant communities and restore the resiliency of the riparian ecosystem. Compliance with WSA guidance insures use of "least impairing" methods on WSR suitable segments within WSAs.

Increases in downstream erosion from multiple projects could cause cumulative impacts due to the removal of woody vegetation on the river corridor, either as target species (e.g., Russian olive) or non-target species (e.g., willows) until the natural riparian ecosystem recovers. The absence of dense, flexible woody stems on the banks of the river corridors, tributaries and floodplains can lead to erosion and associated floodplain loss. However, the natural fluctuation and sediment loading nature of both the Paria and Escalante River is not expected to be significantly impacted long-term by erosion. Any cumulative impacts are not anticipated to create any long-term impact or threat to WSR tentative classifications or threat to eligibility for potential designation as part of the WSR system.

4.4.11 Fuels and Fire Management

The cumulative impacts to fuels from past present and reasonably foreseeable action would occur with Utility Power line right-of-way, vegetative restoration, fuel wood areas, structural Range Improvements, and Livestock Grazing and wildlife improvements.

The direct and indirect impact of Utility Power line right-of-way, Vegetative Restoration, fuelwood areas, structural range improvements, and wildlife improvements are the same as the indirect and direct impacts of the alternatives in this EA. These impacts are a slight increase in 100 to 1000 hour fuels on the ground and then a decrease over time with these same types of fuels. There also would be a structural change from a vertical structure to a horizontal one after treatment. The overlap in space would be relatively small with approximately 700 to 1,200 acre per year of treatments in the approximately 2 million acres within the Monument. Overall the cumulative impacts would be minor across the entire Monument.

The direct and indirect impacts of Livestock Grazing and the alternatives are similar in that they both would decrease fine fuels (10 hours) fuel within the analysis areas. The overall overlap would be relative small with approximately 700 to 1,200 acres of area that may be treated each year in 2 million total acres within the Monument. Overall the cumulative impact would be minor.

4.4.12 Recreation

The cumulative impact area for recreation includes the entire Monument; the majority of the impacts will be in the high use areas where people frequently visit. For all alternatives, direct and indirect impacts to recreation are anticipated to be minimal. Although noxious weeds and invasive plants do affect the area, weeds do not generally affect the general public's perception of naturalness on the landscape. In addition, weeds do not generally inhibit the public's ability to recreate on the land.
Direct effects may limit access during treatments for health and safety purposes i.e. fire, mechanical, chemical application, etc. These limitations are expected to be short term in nature. There are no long term direct effects identified. Long term indirect effects will likely be positive for the general public as sites will be restored to more natural ecosystem. Even though the public may not recognize changes in the landscape it is anticipated that a healthier ecosystem will be recognized, hence creating a positive perception of public land health for visitors. No short term indirect impacts were identified in this review.

Mitigation measures for recreation are not required as the EA outlines design features as identified in chapter 1.

4.4.13 Livestock Grazing

The cumulative impacts analysis area for Livestock Grazing is the entire Monument. A potential for cumulative impacts to Livestock Grazing exists where direct and/or indirect impacts are the same in both the proposed action and past, present, reasonably foreseeable future actions, and the impacts overlap in time and space.

Direct and indirect impacts on Livestock grazing from the proposed action include, increase quality of available forage, increased number of acres for grazing, increase amount of forage, non-target damage and removal by spay drift, manual or mechanical treatment or fire use, excluding livestock for up to two growing season on treated areas that are seeded.

Summary of cumulative impacts to Livestock grazing:

Action	Cumulative impact
Realty (lands: ROWs, roads, utility corridors)	Generally negligible; large scale utility corridor maintenance: same direct/indirect from vegetation removal.

Restoration (vegetation treatments) NOTE: prescribed fire fits here	Yes; same direct/indirect from veg removal toxic effects if chemicals used, improve amount of available forage, excluding livestock for up to two growing season on treated areas that are seeded Overall the impacts would be minor because of the small size of the treated acres compared to the entire Monument.
Livestock grazing	Generally minor, but same direct/indirect for large areas of disturbances when vegetation removal or erosion: possible.
Livestock developments (fences, cattle guards, water developments)	Generally minor: similar to livestock grazing, but usually smaller magnitude
Recreation (dispersed, developed)	Negligible
Wildlife improvements	Same as livestock developments
Fuelwood cutting	Negligible

4.4.14 Paleontology

The cumulative impact area is within the borders of the Monument. Reasonably foreseeable actions involving ground disturbing treatments would result in a minimal loss of significant paleontological resources because areas with high paleontological potential (Potential Fossil Yield Classification or PFYC of 4 and 5) would be surveyed and all sites either avoided or collected as a mitigation measure. This would likely not exceed more than one or two sites per year given the frequency with which such treatments are projected to be conducted in the Kaiparowits Plateau. Such rates of impact are not deemed significant over long periods of time, and the potential recovery of significant specimens would offset the loss of context for sites.

4.4.15 Visual Resources

Cumulative Impact Area (CIA)

The cumulative impact area of analysis for Visual Resources is the entire Monument and those areas outside the boundary where treatment projects would be visible.

Cumulative Impacts

The cumulative impacts to visual resources from past, present, and reasonably foreseeable actions include treatment of vegetation, noxious and native, throughout the Monument using all methods. The action alternatives would not contribute to a measureable increase in long term negative impacts to visual resources as the treatment projects would range in size from about 5 acres to 1200 acres in a landscape of more than 2 million acres, would individually be designed and implemented to blend with the natural landscape character, and successful revegetation efforts would return

areas to native plant communities thus improving the overall character of the landscape.

4.4.16 Lands with Wilderness Characteristics

Cumulative Impact Area

The cumulative impact area of analysis for LWC is the 457,059 acres of inventoried LWC within the Monument, found to possess wilderness characteristics that are surrounded by WSAs or are directly adjacent to WSAs.

Cumulative Impacts

The cumulative impacts to resources from past, present, and reasonably foreseeable actions include treatment of vegetation, noxious and native, throughout the Monument using all methods. The action alternatives would not contribute to a measureable increase in long term negative impacts to LWC if the guidance related to weed removal and restoration have the goal of natural ecosystem recovery and "least impairing methods are used for actions. Re-vegetation efforts would recover native ecosystems thus protecting and restoring wilderness characteristics.

4.4.17 Wilderness Study Areas

Cumulative Impact Area

The cumulative impact area of analysis for WSA is the 881,997 acres or 16 WSAs within the Monument.

Cumulative Impacts

The cumulative impacts to resources from past, present, and reasonably foreseeable actions include treatment of vegetation, noxious and native, throughout the Monument using all methods. The action alternatives would not create any threat to long-term eligibility for designation of wilderness if in compliance with BLM Manual 6330 guidance related to a) protection and enhancement of wilderness characteristics and using b) least impairing methods. Weed removal and restoration must have the goal of natural ecosystem recovery. Re-vegetation efforts would recover native plant communities and restore the natural setting and the wilderness characteristic of naturalness.

5.0 CONSULTATION AND COORDINATION

5.1 Introduction

The issue identification section of Chapter 1 identifies those issues analyzed in detail in Chapter 4. The ID Team Checklist provides the rationale for issues that were considered but not analyzed further. The issues were identified through the public and agency involvement process.

5.2 Summary of Public Participation

5.2.1, 2, 3 Comment Analysis, Commenters, Response to Public Comment

Number	Comment	BLM Response	Commenter
1	The Division of Drinking Water encourages the BLM to carefully consider effects on drinking water sources anywhere herbicides are proposed for use	Standard Operating Procedures and Guidelines, and Mitigation Measures recommended by the programmatic EIS and associated documents (BLM 2007a, 2007b, 2007c) to address this issue are included in Appendix B.	Kathleen Clarke, State of Utah, Dept of Environment Quality, Division of Water Quality
2	We would particularly encourage coordination of such applications with water systems when applications are proposed in source protection areas.	Standard Operating Procedures and Guidelines, and Mitigation Measures recommended by the programmatic EIS and associated documents (BLM 2007a, 2007b, 2007c) to address this issue are included in Appendix B.	Kathleen Clarke, State of Utah, Dept of Environment Quality, Division of Water Quality
3	Such applications can directly and indirectly affect water systems by potential contamination of drinking water sources, or by forcing a water system to do additional testing.	Standard Operating Procedures and Guidelines, and Mitigation Measures recommended by the programmatic EIS and associated documents	Kathleen Clarke, State of Utah, Dept of Environment Quality, Division of Water Quality

		(BLM 2007a, 2007b, 2007c) to address this issue are included in Appendix B.	
4	Decisions in the Programmatic EA must protect Monument objects of interest as required by the Proclamation 6920	Proclamation 6920 is the enabling language for the Monument. Monument objects and values are of primary concern in all programmatic and project level NEPA review. The interdisciplinary team review must consider objects and values when reviewing their disciplines. In addition, national laws as well as BLM policies, manuals (BLM MS6220 and others) and Instructional Memoranda and Bulletins provide guidance and direction when developing and implementing projects.	The Wilderness Society
5	Thus, values like the extraordinary and fragile vegetation species, including pinyon-juniper communities in the Timber Mountain area, or geological strata, like the Skutumpah Terrace within the Monument are identified by the proclamation as objects of interest for which the Monument was created and must be managed to protect. The protective management of these values and the natural processes and ecosystem that sustains and surrounds them must be the first	Monument objects and values are of primary concern in all programmatic and project level NEPA review. The interdisciplinary team review must consider objects and values when reviewing their disciplines. In addition, national laws as well as BLM policies, manuals (BLM MS6220 and others) and Instructional Memoranda and Bulletins provide guidance and direction when developing and	The Wilderness Society

	objective for proper management of this resource.	implementing projects. NEPA analyses of proposed actions within NLCS units will disclose the effects of each alternative on the values for which the area was designated.	
6	Proclamation 6920 and MMP recognize that these lands are not to be managed under the multiple use mandate of FLPMA but are instead controlled by Proclamation 6920 and the guiding direction for the NLCS. BLM's programmatic EA should fully reflect these laws and policies and identify any uses that may contribute to the spread of non-native invasive species within the region.	The Proclamation governs how the provisions of the Federal Land Policy and Management Act (FLPMA) of 1976 will be applied within the Monument. FLPMA directs the BLM to manage public land on the basis of multiple use and "in a manner that will protect the quality of scientific, scenic, historic, ecological, environmental, air and atmospheric, water resources, and archaeological values." The term "multiple use" refers to the "harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment." Multiple use involves managing an area for various benefits, recognizing that the establishment of land use priorities and exclusive uses in certain areas is necessary to ensure that multiple uses can	The Wilderness Society

		occur harmoniously across a landscape. (MMP, p. 3)	
7	BLM should reiterate a strong preference for the use of native species and against non-native invasive species within the monument. As required by the MMP, no alternative in the PEA should analyze using non-native species for restoration efforts.	See the purpose and need in chapter 1 and alternative A which focuses on integrated weed management. The focus of this EA is not for revegetation treatments or range improvement projects.	The Wilderness Society
8	BLM must prioritize native species in the Integrated Weed Management Program. These provisions [MMP22, 30, 31], express a strong priority for the use of a variety of native species for management and restoration as well as a strong policy for not using non-native invasive species for projects within the monument. BLM should analyze the effects of potential treatments in light of these provisions.	See the purpose and need in chapter 1 and alternative A which focuses on integrated weed management. The focus of this EA is not for revegetation treatments or range improvement projects. action, alt.	The Wilderness Society
9	BLM should also identify any treatment methods that may conflict with the purpose of containing the spread of and eliminating undesirable species from the Monument	Not proposing any treatment that conflicts [with MMP]	The Wilderness Society
10	BLM should analyze the impacts of livestock grazing on vegetation treatments and restoration. This programmatic EA should perform an evaluation of livestock grazing on vegetation and restoration in the monument and provide guidance for the appropriate management after treatment or	Outside the scope and the intent of this EA.	The Wilderness Society

	restoration efforts. BLM should also advance any of the management prescriptions in the MMP to the Integrated Weed Management Program.		
11	BLM should develop monitoring plots within the programmatic EA. This programmatic EA provides the agency with the opportunity to establish meaningful and lasting monitoring plots to study the effectiveness of vegetation treatments and to apply an adaptive management framework. As part of the programmatic EA, BLM should establish vegetation monitoring plots as described in the MMP.	NW-8 explains that that long term monitoring in regards to weed treatments need to occur in large scale projects I.e. ERWR. The ERWR project has a monitoring program to determine effectiveness of the treatment methods. See appendix D. Spot treatment doesn't fall into this category. The scope and the purpose and need is not for vegetation analysis. The BLM currently records infestations, population density, size and effectiveness of treatment methods. See monitoring section in chapter 2 alternative A.	The Wilderness Society
12	BLM should set more specific criteria for applying chemical treatments to invasive species in the GSENM so as to prevent harm to non-target species. Extraordinary care should be used when using chemical treatments so that native species and visitors to the Monument	SOP and mitigation measures which are described in appendixes C will be followed. All chemical applied will be in accordance with the chemical label. If the chemical label specifies to	The Wilderness Society

	are not harmed in the process.	keep personnel out of area after treatment these areas will be signed.	
13	Designated routes in the monument should be especially analyzed for causing the proliferation of non-native invasive species in the programmatic EA. BLM should take this into account when planning for projects within an Integrated Weed Management Program.	Recognizing that transportation corridors are spread vectors the BLM will focus on these areas while implementing the integrated weed management program.	The Wilderness Society
14	The BLM should incorporate findings from the Colorado Plateau Rapid Ecoregional Assessment into its analysis. The BLM should incorporate this information into the programmatic EA so that it has the most up to date scientific information on invasive species and other drivers of change to the landscape.	In general, the scale of the Colorado Plateau REA is much greater than that of this EA. However, its findings do provide context for addressing invasive species on the Monument, and as such have been included where appropriate.	The Wilderness Society
15	BLM should use information derived from the Rapid Ecoregional Assessments to inform the NEPA analysis in the programmatic EA and management options for an Integrated Weed Management Program within the Monument. This includes using the REAs to analyze and address the impacts of climate change on vegetation in the Monument and crafting solutions to allow	As noted under Comment #14, the Colorado Plateau REA provides broad context for addressing invasive species on the Monument, and for managing vegetation in general. Climate change is recognized in the EA as a stressor that affects all natural resources, including vegetation. The Monument's adaptive management-based approach to vegetation	The Wilderness Society

	vegetation to adapt to and minimize adverse effects of climate change. Science based monitoring should be incorporated into the programmatic EA and Integrated Weed Management Program in order to make adjustments to respond to climate change and other stressors.	management recognizes the potential for change from this and other stressors, and provides the framework within which management actions can be adjusted based on monitoring data.	
16	The presence of Russian olive trees has a double effect. Too many trees and the riparian area is largely destroyed of native plants. Conversely, a few trees can be very beneficial. The berries produced each year are a critical food source to several species of wildlife. In the last couple of decades, a lot of effort was made to re-introduce wild turkeys to several areas of the Monument, because they were able to exploit this consistent food source. If the Russian olive trees are completely removed from an area, it is predicted that wild turkeys will largely disappear. A management scenario of leaving a few scattered Russian olive trees, allowing the native vegetation to dominate the riparian corridors, would be most sensible.	Address in EA, Consequences control vs eradication.	Norm McKee, Panguitch , UT
17	If natural riparian watershed corridors is the goal, are the few remaining beaver on the Monument being recommended for protections? Is there consideration for re-introducing beaver in	This document will not discuss beaver re-introduction. Beaver introduction is beyond the scope of this document.	Norm McKee, Panguitch , UT

	appropriate areas of the Monument? If the goal is to restore naturally functioning riparian corridors, the presence of beaver has to be high on the priority list.		
18	Please analyze an alternative in the PEA that does not include the use of chemical or mechanical treatments in lands currently proposed for wilderness designation (i.e., land included in the America's Red Rock Wilderness Act, S.979, H.R. 1916 (112th congress) with the GSENM	Alternative C: No Herbicides Alternative analyzes removal of weeds and exotic species without the use of herbicides (chemicals) throughout GSENM. Analyzing a site-specific location within GSENM for use or non-use of a specific method or treatment is outside the scope and purpose and need of this EA. BLM is directed to use an integrated approach for weed and exotic species removal and treatment. Please see specific design features (Section 2.2) that address protection of wilderness study areas and lands with wilderness characteristics.	Neal Clark, Field Attorney, SUWA
19	Please analyze the effects of domestic livestock grazing and the relationship between domestic livestock grazing and the introduction and spread of non-native	Outside the scope of the purpose and need. The impact of each of the proposed treatments are analyzed in Chapter 4.	Neal Clark, Field Attorney, SUWA

	species in the PEA		
20	Please analyze the effects of horses, donkeys, mules, and/or llamas used in commercial tour operations and the relationship between the use of these domestic animals in the GSENM and introduction and spread of non-native species in the PEA.	Outside the scope of purpose of need of the EA.	Neal Clark, Field Attorney, SUWA
21	Although the MMP NW-5 describes in general terms when aerial chemical applications may be used, please address in the PEA the specific criteria that will govern the use of aerial treatments, as well as the use of mechanically broadcast chemicals, manually-applied chemicals and any other potential applications of chemical treatments.	Aerial application is included only in Alternative A. Other chemical treatments are included in both Alternatives A and B (Alternative C includes no chemical treatments). Criteria for chemical use are included in the descriptions of those alternatives and in the appendices.	Neal Clark, Field Attorney, SUWA
22	Please include a description of the type of monitoring program that will be instituted to monitor the progress and status of the PEA	Monitoring is a standard part of integrated weed management. Specific monitoring requirements for each treatment method are described under each alternative. An example monitoring program is included in Appendix C.	Neal Clark, Field Attorney, SUWA
23	I am concerned about the proposed "chemical methods using herbicides" to control unwanted plants	Chemicals will be applied according to the label.	L. Varga
24	I am specifically concerned about the effect of herbicides on native and honeybee populations in the Monument. If	Under label direction no harm to wildlife species should occur in the use of approved herbicides which effect	L. Varga

	herbicides must be utilized, please be sure to use a bee-friendly, short-lived product.	plant development. Insecticides under label direction should not affect the bee species as it is only used under very specific application.	
25	Due to the serious threat noxious weeds are to BLM lands, the BLM should consider economics and effectiveness of treatments so the greatest number of noxious weed areas can be controlled.	See the Purpose and Need and alternative A.	K. Heaton, USU extension faculty
26	I also encourage the BLM to add the chemical herbicide called "Milestone" to their approved herbicide list. Milestone has an extremely environmental friendly label and the BLM is about 6 years behind everyone in adopting this effective herbicide	BLM is provided direction and guidance as to what chemicals can be used on public lands. If this herbicide is not approved then GSENM would not be able to apply this in the implementation phase of the project.	K. Heaton, USU extension faculty
27	We support methods to contain, control, or eradicate noxious and newly invading non-native plant and weed species. The HPD-TCP, on behalf of the Navajo Nation has no concerns at this time.	Move to a different category	Tony H. Joe, Jr. Historic Preservation Department-Traditional Culture Program - The Navajo Nation
28	If the proposed project inadvertently discovers habitation sites, plant gathering areas, human remains and objects of cultural patrimony, the HPD-TCP request that we be notified respectively in accordance with the Native American Graves Protection and Repatriation Act (NAGPRA).	Such notification is part of BLM standard practice and will be done as required by specific projects.	Tony H. Joe, Jr. Historic Preservation Department-Traditional Culture Program - The Navajo Nation
29	We're concerned about the	Programmatic EAs are	Laura Welp, Western Watersheds

	overly broad nature of programmatic EAs in general. EAas typically address management actions proposed for a specific site. Without this information, it is hard for the public to understand and analyze exactly what is being proposed and where, what the management objectives are, and how those objectives will be met.	a common and accepted tool in NEPA practice, providing linkage between large-scale NEPA reviews (in this case, the programmatic EIS and associated documents: BLM 2007a, 2007b, 2007c) and small scale, project-specific reviews. The details and description of proposed actions in a programmatic analysis are different than those in project-specific analyses. The level of detail of the proposed action influences the assumptions and specificity of subsequent analyses. This programmatic EA identifies Monument-wide issues and impacts associated with managing invasive weeds. Project-specific NEPA analysis will be tiered off of this programmatic EA and will address any small-scale issues and effects not identified or addressed here.	Project
30	It's difficult for BLM staff to identify what they will be doing specifically, and nearly impossible for the signing authority to determine if proposed actions, or alternative actions, can be issued a Finding of No Significant Impact.	Programmatic EAs are a common and accepted tool in NEPA practice, providing linkage between large-scale NEPA reviews (in this case, the programmatic EIS and associated documents: BLM 2007a, 2007b, 2007c) and small scale,	Laura Welp, Western Watersheds Project

		project-specific reviews. The details and description of proposed actions in a programmatic analysis are different than those in project-specific analyses. The level of detail of the proposed action influences the assumptions and specificity of subsequent analyses. This programmatic EA identifies Monument-wide issues and impacts associated with managing invasive weeds. Project-specific NEPA analysis will be tiered off of this programmatic EA and will address any small-scale issues and effects not identified or addressed here.	
31	Relying on a general document without sufficient site-specific detail is not adequate under NEPA. In addition, it would violate the Monument Management Plan [MMP]. For example, NW-06 provides for the completion of project level EAs or other NEPA analysis prior to initiation of weed projects.	Programmatic EAs are a common and accepted tool in NEPA practice, providing linkage between large-scale NEPA reviews (in this case, the programmatic EIS and associated documents: BLM 2007a, 2007b, 2007c) and small scale, project-specific reviews. The details and description of proposed actions in a programmatic analysis are different than those in project-specific analyses. The level of detail of the proposed action	Laura Welp, Western Watersheds Project

		influences the assumptions and specificity of subsequent analyses. This programmatic EA identifies Monument-wide issues and impacts associated with managing invasive weeds. Project-specific NEPA analysis will be tiered off of this programmatic EA and will address any small-scale issues and effects not identified or addressed here.	
32	Since prescribed fire is one of the tools of Integrated Weed Management, RM-06 is relevant: It states that "specific objectives for all management ignited fires will be developed prior to its use in the Monument".	Site specific analysis and a burn plan will be prepared prior to any prescribed burning, Identifying goals and objectives of prescribed fire. .	Laura Welp, Western Watersheds Project
33	The public needs to know details such as which noxious weed species are present on GSENM, where they occur, and what the proposed actions and management objectives are. Maps detailing targeted weed species distribution on the Monument would be helpful.	See chapter 3 for noxious and invasive species list. See chapter 1 for the noxious weed infestation map.	Laura Welp, Western Watersheds Project
34	Presumably this document will also tier to the BLM's 2007 Final Vegetation Treatments Using Herbicides Programmatic Enfironmental Impact Statement {PEIS} and Vegetation treatments on Bureau of Land Management Lands in 17	Programmatic EAs are a common and accepted tool in NEPA practice, providing linkage between large-scale NEPA reviews (in this case, the programmatic EIS and associated documents: BLM 2007a, 2007b,	Laura Welp, Western Watersheds Project

	Western States Programmatic Environmental Report (PER). Again, we're concerned by the fact that those documents are extremely vague throughout- from the proposed actions to their predicted impacts - notwithstanding the fact that all vegetation treatments are site-specific in their effects and, moreover, must be selected from among definitive options.	2007c) and small scale, project-specific reviews. The details and description of proposed actions in a programmatic analysis are different than those in project-specific analyses. The level of detail of the proposed action influences the assumptions and specificity of subsequent analyses. This programmatic EA identifies Monument-wide issues and impacts associated with managing invasive weeds. Project-specific NEPA analysis will be tiered off of this programmatic EA and will address any small-scale issues and effects not identified or addressed here.	
35	Does the Monument intend to include site-specific information in the programmatic EA or provide that information in subsequent EAs? If the latter, what is the prupose of a programmatic EA if the overarching PEIS contains the general information and EAs contain the site specific information? Finally, the proposed programmatic EA is so general and covers such a large area that it could allow BLM carte blanche to do whatever is thought to be appropriate without public scrutiny.	Programmatic EAs are a common and accepted tool in NEPA practice, providing linkage between large-scale NEPA reviews (in this case, the programmatic EIS and associated documents: BLM 2007a, 2007b, 2007c) and small scale, project-specific reviews. The details and description of proposed actions in a programmatic analysis are different than those in project-specific analyses. The level of detail of the	Laura Welp, Western Watersheds Project

		proposed action influences the assumptions and specificity of subsequent analyses. This programmatic EA identifies Monument-wide issues and impacts associated with managing invasive weeds. Project-specific NEPA analysis will be tiered off of this programmatic EA and will address any small-scale issues and effects not identified or addressed here.	
36	Rare Species The project area contains populations of or habitat for several rare, BLM sensitive, and listed plant and animal species. The potential impacts of the various proposed treatments on these species are cause for concern. The BLM's Vegetation Treatment PEIS and PER admits that impacts to non-target species are possible with herbicide applications. Rare plant populations are usually small enough that weed control in and around their populations and habitat can be managed by hand. This method will minimize impacts as much as possible and should be the only control measure considered in these sensitive habitats. Please include maps of all the rare species the Monument (unless location is sensitive) and indicate what	See chapter 3 for special status plant and animal species. See chapter 4 for potential impacts to special status plant and animal species. SOP's, Conservation Measures for Plants (BLM 2007d) and mitigation measures identified in appendix c will be followed.	Laura Welp, Western Watersheds Project

	mitigation measures will be undertaken to avoid inadvertently damaging these species with herbicides.		
37	The Monument has conducted several recent vegetation treatment projects that should provide information on the direction future treatments should take (the Circle Cliffs and Five Mile seedings are two that come to mind). Given the potential for resource damage inherent in any soil disturbing treatment, it would be helpful to have statistics on the success of those treatments, with data on erosion, vegetation recovery, and invasive species colonization rates.	Not a vegetation treatment EA. Activities analyzed here differ from the projects mentioned. Small areas, spot treatments not thousands of acres.	Laura Welp, Western Watersheds Project
38	Information on past weed management actions on the Monument and their effectiveness would be appreciated. For example, the Monument used the herbicide Plateau on a test plot on the Mollie's Nipple allotment. What was the result of that experiment?	BLM monitors weed infestations and treatment areas to analyze the effectiveness of the treatment method. Site specific data is not included in this EA. Include a summarized project report in appendix in regards to this herbicide study.	Laura Welp, Western Watersheds Project
39	One of the most catastrophic results of failed treatments is the soil erosion that can leave an area devastated for decades. Removing vegetation can increase erosion and reduce water infiltration in the short term, and perhaps longer if the treatment is unsuccessful. The threat of	Soil erosion is a potential effect of noxious weed and invasive plant management, described in detail under “Soils” in Sections 4.3 and 4.4. Standard Operating Procedures and Guidelines, and Mitigation Measures	Laura Welp, Western Watersheds Project

	a failed seeding is why these treatments should only be undertaken if absolutely necessary to prevent resource degradation.	recommended by the programmatic EIS and associated documents (BLM 2007a, 2007b, 2007c) to minimize the potential for soil erosion are included in Appendix B.	
40	BSC Soil-00 and Soil-02. Bowker (2007) has developed a method for restoring bsc after surface disturbance using research he conducted on the Monument itself. The Monument should use this information to include bsc in vegetation restoration following noxious weed treatments (wherever crust would be expected). Another good resource for more information is Belnap and Eldridge's "Disturbance and Recovery of Biological Soil Crusts" (2001).	Weed treatments areas are relatively small and impacts to BSC would be minimal The proposed action will not impact the overall health of the existing soil crusts. Most weed populations are in disturbed areas resulting in minimal disturbance to soil crusts.	Laura Welp, Western Watersheds Project
41	The MMP (Veg-01, Rev-01) clearly emphasizes restoration with native species rather than revegetation with non-natives.. The seed mixes employed after these treatments should use non-natives only very judiciously.	The MMP will be followed. Follow/conform to MMP	Laura Welp, Western Watersheds Project
42	Nat-02 of the MMP states that "non-native plants may be used in limited emergency situations…" the plan obviously intends for non-natives to be used with great caution. Please include a detailed analysis of any project that the Monument feels justifies the use of non-native seed, and include a discussion	Outside the scope of weed control. Any planting seedings must conform to MMP. Anticipate very little seeding as a result of Noxious, non-native weed treatment projects.	Laura Welp, Western Watersheds Project

	detailing how GSENM will, over time, reduce the non-natives and restore the native vegetation.		
43	Please also explain in the EA what the Desired Future Condition for these treatments will be, taking into account the MMP's prescription for the restoration of native vegetation and ecological processes. We urge the Monument to use the Ecological Site Descriptions (ESD) as your benchmark for success. Other BLM units (e.f., the Cedar City Field Office) base their vegetation management goals on ESDs, and the Monument should make it clear in this EA that it is doing the same.	Objective is to eradicate, control, or contain noxious, non-native weed species. In many cases passive restoration may be allowed for native species to return to a site. ESD?	Laura Welp, Western Watersheds Project
44	The noxious weed removal program should not be used as a way to introduce new non-native seeding for forage for livestock and wildlife, which is contrary to the Plan (NAT-05).	The MMP will be followed and the noxious weed program will not be use to increase forage for livestock or wildlife.	Laura Welp, Western Watersheds Project
45	Please include detailed monitoring plans that would assess the degree to which the treatment met management goals. The BLM must substantiate its predicted effects with a record of site specific analysis and monitoring that ensures that the act of vegetative eradication does not bring about significant adverse impacts along or together with similar projects.	. Site specific motoring plans will be outlined in the site specific analysis.	Laura Welp, Western Watersheds Project
46	Prescribed Fire. Please	Prescribed fire	Laura Welp, Western Watersheds

	address how the prescribed fire treatment method will be used so that it comports with the mandate to mimic natural occurrences and frequencies of fires on the Monument.	analyzed in this EA is for control of noxious and invasive weeds not to mimic the natural occurrence of fire on the GSENM.	Project
47	Monument Advisory Committee Consultation. We would like to see {the commitment fulfilled, to develop recommendations from the MAC for management ignited fire}. Given the risks associated with fire and the historically low levels of fire, the acreage treated with fire should be minimal.	The Monument Advisory Committee is consulted at the discretion of the Monument Manager following the Monument Management Plan. While the use of prescribed fire for noxious weed and invasive plant management is evaluated as part of this EA (see Chap. 2, Alternative A), the potential amount is relatively small.	Laura Welp, Western Watersheds Project
48	the EA should focus on removing the underlying causes of noxious weed spread and developing preventative techniques. Since treating exotics is so difficult and expensive, the EA should provide an extensive discussion of the techniques the Monument will use to prevent additional intorduction and spread after treatments have recovered. More action is necessary. NW-07 details using weed free hay and washing vehicles is a good start.	Many underlying causes out of our control. Standard preventative techniques will be used i.e. weed free hay, clean vehicles, and clean equipment.	Laura Welp, Western Watersheds Project
49	The EA should consider how the full range of land use impacts has led to the introduction and spread of	See cumulative, direct and indirect impacts in chapter 4.	Laura Welp, WWP

	noxious and exotic species, either directly, indirect, or cumulatively, through factors including: fire suppression, livestock grazing, roads, motorized vehicles, and recreational activities.		
50	The MMP's travel management plan is not enforces. No citations have been issued since the plan was adopted. However, roads are correlated with the spread of noxious weeds, and restricting road use is necessary for slowing their spread.	The correlation between roads and the spread of noxious and invasive weeds is well-recognized, and treatment along roads is a major aspect of the Monument's program. Implementation and enforcement of the TMP is outside the scope of this EA.	Laura Welp, WWP
51	It may be a useful exercise to overlay the noxious weed populations over roads, range improvements, water sources, and other land use activities to determine where the worst infestations are and correlate them with use categories to see which activities most promote weed introduction and dispersal.	See purpose and need.	Laura Welp, WWP
52	We would like to see the GSENM fulfill its Proclamation and incorporate more science and innovation in controlling exotics. For example, Wooten and Morrison (1995) suggest categorizing the management area by infestation levels. Areas with intact ecosystem processes without large weed populations would be	Species, infestation levels, prioritize for treatments, ecological thresholds. Last sentence in outside the scope, plan level decision allowed/not allowed	Laura Welp, WWP

	treated first to keep weeds from overwhelming those areas. In addition no management activities that might facilitate introduction of weed species would be allowed in these areas. Another treatment category would be areas with invading non-native weeds that pose a threat to ecosystem processes, but their levels are low enough that control efforts might be successful. Management objectives should emphasize biological and mechanical control in these areas. The third priority would be areas that have been invaded, but the weeds aren't spreading fast and impacting ecosystem processes. These areas can wait longer than areas with more aggressive invasives, although no further management activities that might cause additional weed spread should be conducted here.		
53	Many of the principles and practices described above are summarized in the Restore Native Ecosystems Alternative that was created by The Restore Native Ecosystems Coalition (Restore Native Ecosystems Coalition, 2002). This is a citizen's alternative that was submitted to the BLM during the Preparation of	As noted, the "Restore Native Ecosystems Alternative" was submitted to BLM during the preparation of the Programmatic EIS (PEIS, BLM 2007a), from which this EA is tiered. The alternative was presented and analyzed in Appendix I of the PEIS (BLM 2007a). Many of its	Laura Welp, WWP

	the Vegetation Treatment Programmatic EIS. It expands on the points brought up above, and contains important information that should be considered by the Monument during its development of this programmatic EA, It is appended	recommendations were incorporated in the PEIS as Prevention Measures, SOPs or Mitigation Measures, which are included in the EA Appendix B and will be followed under any Alternative.	

5.3 List of Preparers

5.4.1 BLM

Name	Title	Responsible for the Following Section(s) of this Document
Richard Madril	Assistant Monument Manager, Resources	Technical Coordination & Quality Control
Kevin Miller	Science Program Coordinator	Soils, Air, Water
Terry Tolbert	Wildlife	Terrestrial Wildlife, Threatened, Endangered, and Sensitive Animals
Sean Stewart	Lead Rangeland management Specialist	Range, Wild Horse and Burro
Allan Bate	Rangeland Management Specialist	Forestry, Fire
Jeffrey Beal	Outdoor Recreation Planner	Recreation
Amber Hughes	Botany	Botany
Raymond Brinkerhoff	Botany	Vegetation, Threatened, Endangered, and Sensitive Plants
Brett Pierson	Haz-Mat	Haz-Mat
Allysia Angus	Landscape Architect	Visuals
Lora Gale	Outdoor Recreation Planner	Wilderness Study Areas, Wild and Scenic Rivers
Katherine Farrell	Planning and Environmental Coordinator	NEPA Compliance, Quality Control
Sarah Schlanger	Associate Monument Manager	Review

6.0 REFERENCES, GLOSSARY AND ACRONYMS

6.1 References Cited

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Yvette Converse, pers. comm. Wildlife section

APPENDICES

APPENDIX A: INTERDISCIPLINARY TEAM CHECKLIST

Project Title: Programmatic Noxious Weed and Non-Native Invasive Plant Management

NEPA Number: DOI-BLM-UT-0300-2011-0009-EA

Project Leader: Amber Hughes

Determination: (Choose one of the following abbreviated options for the left column)
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 with potential for relevant impact that need to be analyzed in detail in the EA

RESOURCES AND ISSUES CONSIDERED (INCLUDES SUPPLEMENTAL AUTHORITIES APPENDIX 1 H-1790-1)

Determi-nation	Resource	Rationale for Determination*	Signature	Date
PI	Air Quality (Miller)	Mechanical treatments involving ground disturbance, and any treatment leaving exposed bare ground, will likely mobilize particulate matter depending on the soil type. Chemical applications have the potential for localized air toxic effects, depending on chemicals used. Other criteria pollutants resulting from emissions from vehicles or engines used in mechanical or other treatments would be minimal and quickly dispersed.	/s/ khmiller	04/30/2014
NP	Areas of Critical Environmental Concern (Beal/Gale)	No Areas of Critical Environmental Concern are designated within Grand Staircase-Escalante National Monument.	/s/ J. Beal	03/18/2014
NI	Biological Soil Crusts (Brinkerhoff)	The proposed action will not impact the overall health of the existing soil crusts. Most weed populations are in disturbed areas resulting in minimal disturbance to soil crusts.	/s/ R. Brinkerhoff	03/31/2014
NP	BLM Natural Areas (Beal)	No Natural Areas are designated in the Monument.	/s/ J. Beal	03/08/2014
NP	Cultural Resources (Zweifel)	Annual plans will be reviewed by the staff Archaeologist; if there is potential for cultural resource conflicts then inventory for such resources, followed by consultation with SHPO, will be performed as necessary.	/s/ M. Zweifel	3/3/2014
NI	Greenhouse Gas Emissions (Miller)	Greenhouse gas emissions from vehicles or engines used in mechanical treatments or chemical applications should be minimal, localized and quickly dispersed.	/s/ khmiller	04/30/2014
NI	Environmental Justice (Farrell)	The proposal would not have disproportionate effects on low income or minority communities. According to the EPA EJView Mapper, Garfield and Kane Counties have been categorized as having a minority population of 0-10% and a below poverty population of 0-10%. (Accessed at: http://epamap14.epa.gov/ejmap/ejmap.aspx?wherestr=Garfield%20County%2C%20UT on 2/6/2014.).	/s/ K. Farrell	5/5/14

Determi-nation	Resource	Rationale for Determination*	Signature	Date
NP	Farmlands (Prime or Unique) (Farrell)	Prime farmland is described as farmland with resources available to sustain high levels of production. In Utah, it normally requires irrigation to make prime farmland. In general, prime farmland has a dependable water supply, a favorable temperature and growing season, acceptable levels of acidity or alkalinity, an acceptable content of salt and sodium, and few or no rocks. Unique farmland in Utah is primarily in the form of orchards. Based on these definitions, no prime or unique farmlands exist within the Monument. (see NRCS 1997 Results - Cropland Utah accessed at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ut/technical/dma/nri/?cid=nrcs141p2_034092 on 2/6/2014.)	/s/ K. Farrell	5/5/14
PI	Fish and Wildlife Excluding USFW Designated Species (Tolbert/McQuivey)	Removal of vegetation, and application of, and exposure to, the chemicals used for weed control along with ground disturbing activities will impact wildlife and fish species. Effects to wildlife need to be assessed.	/s/ T. Tolbert	3/20/14
PI	Floodplains (Miller)	Mechanical treatments involving ground disturbance, and any treatment leaving exposed bare ground, will increase potential for floodplain erosion. Chemical applications have the potential for localized soil toxicity, localized toxic effects to non-target riparian species, persistence in floodplain soils and for larger-scale toxicity to aquatic organisms and adverse effects on water quality, depending on chemicals used.	/s/ khmiller	04/30/2014
PI	Fuels/Fire Management (Bate)	Fuels /and Fire Management would be impacted because of the increase fuel that would be generated from cutting Russian Olive and Tamarisk. Also the Fuels program on the Color Country District would need to be consulted before slash piles are burned.	/s/A. Bate	4/23/2014
NI	Geology / Mineral Resources/Energy Production (Titus)	Treatments, whatever the method used, would be temporary actions that would not affect valid existing claims, leases or energy corridors. Nothing proposed in the Proposed Action would impact scenic geologic features. No geological hazards would be anticipated as a result of the Proposed Action.	/s/ Alan Titus	2/28/2014
PI	Hydrologic Conditions (Miller)	Mechanical treatments involving ground disturbance, and any treatment leaving exposed bare ground, will increase potential for erosion with associated alteration of hydrology (especially runoff/infiltration). Denuded areas resulting from treatment will also alter hydrology by reducing plant uptake of water, thereby increasing runoff.	/s/ khmiller	04/30/2014
PI	Invasive Species/Noxious Weeds (EO 13112) (Brinkerhoff)	The proposed action is to control and hopefully eradicate weed species. The EA addresses the impacts of the weed treatments. Planning and mitigation will be used to prevent the spread of invasive and noxious weeds during treatment.	/s/ R. Brinkerhoff	03/31/2014
NI	Lands/Access (Beal)	This document and associated implementation of any projects would not impact Lands and Realty or access considerations within GSENM. This programmatic EA will support all future lands and realty actions on the Monument.	/s/ J. Beal	03/18/2014
PI	Livestock Grazing (Stewart)	Treatments, whatever the method used, would be temporary actions that have the potential to affect livestock grazing depending on location, timing, and method type.	/s/S. Stewart	04/23/2014
NP	Native American Religious Concerns (Zweifel)	Removal of invasive vegetation is generally supported by Native American groups. This project will be included in the annual GSENM/Native American consultations, but no adverse comments are anticipated.	/s/ M. Zweifel	3/3/2014
PI	Paleontology (Titus)	Mechanical treatments that involve ground disturbance are potentially destructive to paleontological resources. Any projects involving such methods would need paleontological surveys and possible on-the-ground inventory. Hand treatments and spraying would not significantly impact paleontological resources because they do not involve significant ground disturbance.	/s/ Alan Titus	2/28/2014

Determi-nation	Resource	Rationale for Determination*	Signature	Date
PI	Rangeland Health Standards (Stewart)	Treatments, whatever the method used, would have a positive effect on Rangeland Health Standards, specifically in relation to Standard 3: Desired Species by removing or curtailing competition from non-native or undesired species. Short term impacts of the proposed action to soil, riparian, and water quality would be outweighed by the overall benefits.	/s/S. Stewart	04/23/2014
PI	Recreation (Beal/Gale)	Weed treatment and the application of chemicals would have short term effects on recreation. This will be analyzed in the EA.	/s/ J. Beal	5/8/2014
NI	Socio-Economics (Farrell)	The proposed action is not likely to provide any noticeable impact to the local economy. The amount of use and activity generated by authorizing the proposed weed treatments are similar to ongoing treatments and are not likely to result in any noticeable change.	/s/ K. Farrell	5/5/14
PI	Soils (Miller)	Mechanical treatments involving ground disturbance, and any treatment leaving exposed bare ground, will increase potential for erosion. Chemical applications have the potential for localized soil toxicity, soil persistence and for toxicity from chemical residues in eroded soils, which may affect aquatic organisms in, and reduce water quality of, receiving waters, depending on chemicals used.	/s/ khmiller	04/30/2014
PI	Threatened, Endangered or Candidate Plant Species (Hughes)	An integrated weed control program could potentially affect sensitive plants if present in or near treatment areas. Treatment of noxious and invasive weeds poses a risk to special status plants as a result of herbicide drift from treatment areas and disturbance associated with manual treatments (i.e., soil compaction, ground disturbance, and accidental pulling of individuals).	/s/ A. Hughes	3/2/2013
PI	Threatened, Endangered or Candidate Animal Species (Tolbert/McQuivey)	Designated critical habitat for Mexican spotted owls and southwestern willow flycatchers exist on the Monument and treatments in these areas would require consulting with the USFWS to determine proper practices and timing. Treatments in known occupation areas of Mexican spotted owls would require special consideration to avoid harassment of owls.	/s/ T. Tolbert	3/20/14
PI	Wastes (hazardous or solid) (Pierson)	Use of herbicides for control of noxious weeds and other invasive plant species poses some potential risk of adverse impacts on human health and safety. Therefore all herbicides require compliance with labels and BLM guidelines.	/s/ B. Pierson	5/20/14
PI	Water Resources/Quality (drinking/surface/ground) (Miller)	Mechanical treatments involving ground disturbance, and any treatment leaving exposed bare ground, will increase potential for runoff and erosion, which may degrade water quality in receiving streams. Chemical treatments have the potential for toxicity to aquatic organisms, for persistence in sediments and for degrading water quality, depending on chemicals used. Chemical applications also have the potential for adverse effects to non-target aquatic plant species, potentially mobilizing sediments and adversely affecting water quality.	/s/ khmiller	04/30/2014
PI	Wetlands/Riparian Zones (Brinkerhoff)	The proposed action will help improve the riparian areas. Most of the riparian systems have invasive or noxious weeds in them which lessens the functionality of the entire system. Impacts and mitigation measures are analyzed in the document.	/s/ R. Brinkerhoff	03/31/2014

Determi-nation	Resource	Rationale for Determination*	Signature	Date
PI	Wild and Scenic Rivers (Beal/Gale)	The mainstem and tributaries of the Paria and Escalante Rivers are listed on the nationwide rivers inventory. They have been inventoried and found suitable for designation as WSR. The various segments have been tentatively classified as wild, scenic, and recreational. The identified outstandingly remarkable values (ORV) for both rivers include scenic, recreational, geological, riparian, and historic. The identified corridor width is approximately ¼ mile from mean high-water. The removal of exotic vegetation would benefit the restoration of native riparian vegetation and subsequently riparian habitat. This would benefit the riparian ORV as well as scenic and recreational ORV's by restoring greater ease of access for hiking and boating as well as added appreciation and enjoyment by presence of restored native view shed. The potential for erosion and loss of soils as well as use of chemicals or methods that could impact negatively native vegetation and organisms should be mitigated. Pending impact determination and adoption of stipulations to protect native ecosystems and prevent wide-spread erosion or soil loss, there are no long-term threats to suitability or ORV expected by this project. There are long-term benefits to treating and removing noxious trees and re-planting native vegetation that has the potential to restore the riparian health of both rivers and protect suitability for designation as WSR.	/s/L. Gale	05.01.14
PI	Wilderness/WSA (Beal/Gale)	Proposal to remove non-native vegetation meets the class of exception to non-impairment for protection and enhancement of wilderness characteristics. However, impacts to native ecosystems need to be assessed as these contribute to the wilderness characteristic of naturalness. Mitigations should include methods of removal and use of chemicals that are not impacting to native species or enduring within the watershed as well as methods to avoid wide-spread erosion will ensure protection of WSA wilderness characteristics. The use of mechanized equipment such as chain saws will create impacts to visitor experience and the soundscape in this area. Impacts are expected to be temporary and short-term. Public outreach or education could limit impacts by notifying hikers of work in progress and potential for noise in order to let them self-select to hike elsewhere. Pending impact determination and adoption of stipulations to protect native ecosystems and prevent wide-spread erosion or soil loss, there are no long-term threats to eligibility expected by this project.	/s/L. Gale	04/28/14
PI	Woodland/Forestry (Bate)	The proposed action to treat non-native invasive weeds specifically Tamarisk and Russian Olive trees would have a beneficial impact to native trees such as cottonwood and willows in riparian areas.	/s/A. Bate	4/23/2014
PI	Vegetation Excluding USFWS Designated Species (Brinkerhoff)	The proposed action will be removing or lowering the amount of invasive and noxious weeds. This will improve the habitat for the native species of vegetation.	/s/ R. Brinkerhoff	03/31/2014
PI	Visual Resources (Angus)	Removal of vegetation has the potential to alter the landscape character of any given area. Effects on visuals need to be assessed.	/s/AAngus	3/20/2014
NP	Wild Horses and Burros (Stewart)	There are no active Wild Horse and Burro Herd Management Areas within Grand Staircase-Escalante National Monument.	/s/S. Stewart	5/19/14

Determi-nation	Resource	Rationale for Determination*	Signature	Date
PI	Lands with Wilderness Characteristics (Beal/Gale)	Proposal to remove non-native vegetation meets the class of exception to non-impairment for protection and enhancement of wilderness characteristics. However, effects on native ecosystems need to be assessed as they contribute to the wilderness characteristic of naturalness. Adoption of mitigations or stipulations to include methods of removal and use of chemicals that are not impacting to native species or enduring within the watershed will ensure protection of wilderness characteristics. The use of mechanized equipment such as chain saws will create impacts to visitor experience and the soundscape in this area. Impacts are expected to be temporary and short-term. Public outreach or education could limit impacts by notifying hikers of work in progress and potential for noise in order to let them self-select to hike elsewhere. Pending impact determination, there are no long-term threats to LWC lands expected by this project.	/s/L. Gale	04/28/14

FINAL REVIEW

Reviewer Title	Signature	Date	Comments
Environmental Coordinator			
Authorized Officer			

APPENDIX B

Appendix B contains a list of design features, prevention measures, standard operating procedures, mitigation measures, and other protective measures that are included as part of the alternatives in the Grand Staircase-Escalante National Monument, Programmatic Noxious Weed and Invasive Plant Management Environmental Assessment.

In September 2007, the BLM issued a Record of Decision (ROD) for Vegetation Treatments using Herbicides on Bureau of Land Management Lands in 17 Western States, Programmatic Environmental Impact Statement. That ROD identified standard operating procedures (SOPs) that would be followed to ensure that risks to human health and environment are kept to a minimum. In addition to the SOPS, the ROD also identified mitigation measures to reduce potential adverse environmental effects. The BLM also identified prevention measures to minimize the amount of non-target vegetation that is disturbed during noxious weed and invasive plant treatments using herbicides. These SOPs, mitigation measures and prevention measures are repeated here.

Appendix B-1: Prevention Measures

BLM Activity	Prevention Measures
Project Planning	• Incorporate prevention measures into project layout and design, alternative evaluation, and project decisions to prevent the introduction or spread of weeds. • Determine prevention and maintenance needs, including the use of herbicides, at the onset of project planning • Before ground-disturbing activities begin, inventory weed infestations and prioritize areas for treatment in project operating areas and along access routes. • Remove sources of weed seed and propagules to prevent the spread of existing weeds and new weed infestations. • Pre-treat high-risk sites for weed establishment and spread before implementing projects. • Post weed awareness messages and prevention practices at strategic locations such as trailheads, roads, boat launches, and public land kiosks. • Coordinate project activities with nearby herbicide applications to maximize the cost-effectiveness of weed treatments.
Project Development	• Minimize soil disturbance to the extent practical, consistent with project objectives. • Avoid creating soil conditions that promote weed

BLM Activity	Prevention Measures
	germination and establishment. • To prevent weed germination and establishment, retain native vegetation in and around project activity areas and keep soil disturbance to a minimum, consistent with project objectives. Locate and use weed-free project staging areas. Avoid or minimize all types of travel through weed-infested areas, or restrict travel to periods when the spread of seeds or propagules is least likely. • Prevent the introduction and spread of weeds caused by moving weed-infested sand, gravel, borrow, and fill material. • Inspect material sources on site, and ensure that they are weed-free before use and transport. • Treat weed-infested sources to eradicate weed seed and plant parts, and strip and stockpile contaminated material before any use of pit material. • Survey the area where material from treated weed-infested sources is used for at least 3 years after project completion to ensure that any weeds transported to the site are promptly detected and controlled. • Prevent weed establishment by not driving through weed-infested areas. • Inspect and document weed establishment at access roads, cleaning sites, and all disturbed areas; control infestations to prevent weed spread within the project area. • Avoid acquiring water for dust abatement where access to the water is through weed-infested sites. • Identify sites where equipment can be cleaned. Clean equipment before entering public lands. • Clean all equipment before leaving the project site if operating in areas infested with weeds. • Inspect and treat weeds that establish at equipment cleaning sites. • Ensure that rental equipment is free of weed seed. • Inspect, remove, and properly dispose of weed seed and plant parts found on workers' clothing and equipment. Proper disposal entails bagging the seeds and plant parts and incinerating them.
Revegetation	• Include weed prevention measures, including project inspection and documentation, in operation and reclamation plans.

BLM Activity	Prevention Measures
	• Retain bonds until reclamation requirements, including weed treatments, are completed, based on inspection and documentation. • To prevent conditions favoring weed establishment, reestablish vegetation on bare ground caused by project disturbance as soon as possible using either natural recovery or artificial techniques. • Maintain stockpiled, uninfested material in a weed-free condition. • Revegetate disturbed soil (except travel ways on surfaced projects) in a manner that optimizes plant establishment for each specific project site. For each project, define what constitutes disturbed soil and objectives for plant cover revegetation. Revegetation may include topsoil replacement, planting, seeding, fertilization, liming, and weed-free mulching, as necessary. • Where practical, stockpile weed-seed-free topsoil and replace it on disturbed areas (e.g., road embankments or landings). • Inspect seed and straw mulch to be used for site rehabilitation (for wattles, straw bales, dams, etc.) and certify that they are free of weed seed and propagules. • Inspect and document all limited term ground-disturbing operations in noxious weed infested areas for at least 3 growing seasons following completion of the project. • Use native material where appropriate and feasible. Use certified weed-free or weed-seed-free hay or straw where certified materials are required and/or are reasonably available. • Provide briefings that identify operational practices to reduce weed spread (for example, avoiding known weed infestation areas when locating fire lines). • Evaluate options, including closure, to regulate the flow of traffic on sites where desired vegetation needs to be established. Sites could include road and trail rights-of-way (ROW), and other areas of disturbed soils.

Appendix B-2: Standard Operating Procedures

Resource Element	Standard Operating Procedure
General	• Prepare operational and spill contingency plan in advance of treatment. • Conduct a pretreatment survey before applying herbicides. • Select herbicide that is least damaging to the environment while providing the desired results. • Select herbicide products carefully to minimize additional impacts from degradates, adjuvants, inert ingredients, and tank mixtures. • Apply the least amount of herbicide needed to achieve the desired result. • Follow herbicide product label for use and storage. • Have licensed applicators apply herbicides. • Use only USEPA-approved herbicides and follow product label directions and "advisory" statements. • Review, understand, and conform to the "Environmental Hazards" section on the herbicide product label. This section warns of known pesticide risks to the environment and provides practical ways to avoid harm to organisms or to the environment. • Consider surrounding land use before assigning aerial spraying as a treatment method and avoid aerial spraying near agricultural or densely populated areas. • Minimize the size of application area, when feasible. • Comply with herbicide-free buffer zones to ensure that drift will not affect crops or nearby residents/landowners. • Post treated areas and specify reentry or rest times, if appropriate. • Notify adjacent landowners prior to treatment. • Keep a copy of Material Safety Data Sheets (MSDSs) at work sites. MSDSs are available for review at http://www.cdms.net/. • Keep records of each application, including the active ingredient, formulation, application rate, date, time, and location. • Avoid accidental direct spray and spill conditions to minimize risks to resources. • Consider surrounding land uses before aerial spraying. • Avoid aerial spraying during periods of adverse weather conditions (snow or rain imminent, fog, or air turbulence). • Make helicopter applications at a target airspeed of 40 to

Resource Element	Standard Operating Procedure
	50 miles per hour (mph), and at about 30 to 45 feet above ground. • Take precautions to minimize drift by not applying herbicides when winds exceed >10 mph (>6 mph for aerial applications), or a serious rainfall event is imminent. • Use drift control agents and low volatile formulations. • Conduct pre-treatment surveys for sensitive habitat and special status species within or adjacent to proposed treatment areas. • Consider site characteristics, environmental conditions, and application equipment in order to minimize damage to non-target vegetation. • Use drift reduction agents, as appropriate, to reduce the drift hazard to non-target species. • Turn off applied treatments at the completion of spray runs and during turns to start another spray run. • Refer to the herbicide product label when planning revegetation to ensure that subsequent vegetation would not be injured following application of the herbicide. • Clean OHVs to remove seeds.
Air Quality	• Consider the effects of wind, humidity, temperature inversions, and heavy rainfall on herbicide effectiveness and risks. • Apply herbicides in favorable weather conditions to minimize drift. For example, do not treat when winds exceed 10 mph (>6 mph for aerial applications) or rainfall is imminent. • Use drift reduction agents, as appropriate, to reduce the drift hazard. • Select proper application equipment (e.g., spray equipment that produces 200- to 800-micron diameter droplets [spray droplets of 100 microns and less are most prone to drift]). • Select proper application methods (e.g., set maximum spray heights, use appropriate buffer distances between spray sites and non-target resources).
Soil	• Minimize treatments in areas where herbicide runoff is likely, such as steep slopes when heavy rainfall is expected. • Minimize use of herbicides that have high soil mobility, particularly in areas where soil properties increase the potential for mobility. • Do not apply granular herbicides on slopes of more than

Resource Element	Standard Operating Procedure
	15% where there is the possibility of runoff carrying the granules into non-target areas.
Water Resources	• Consider climate, soil type, slope, and vegetation type when developing herbicide treatment programs. • Select herbicide products to minimize impacts to water. This is especially important for application scenarios that involve risk from active ingredients in a particular herbicide, as predicted by risk assessments. • Use local historical weather data to choose the month of treatment. Considering the phenology of the target species, schedule treatments based on the condition of the water body and existing water quality conditions. • Plan to treat between weather fronts (calms) and at appropriate time of day to avoid high winds that increase water movements, and to avoid potential stormwater runoff and water turbidity. • Review hydrogeologic maps of proposed treatment areas. Note depths to groundwater and areas of shallow groundwater and areas of surface water and groundwater interaction. • Minimize treating areas with high risk for groundwater contamination. • Conduct mixing and loading operations in an area where an accidental spill would not contaminate an aquatic body. • Do not rinse spray tanks in or near water bodies. Do not broadcast pellets where there is danger of contaminating water supplies. • Maintain buffers between treatment areas and water bodies. Buffer widths should be developed based on herbicide- and site-specific criteria to minimize impacts to water bodies. • Minimize the potential effects to surface water quality and quantity by stabilizing terrestrial areas as quickly as possible following treatment.
Wetlands and Riparian Areas	• Use a selective herbicide and a wick or backpack sprayer. • Use appropriate herbicide-free buffer zones for herbicides not labeled for aquatic use based on risk assessment guidance, with minimum widths of 100 feet for aerial, 25 feet for vehicle, and 10 feet for hand spray applications.
Vegetation	• Refer to the herbicide label when planning revegetation to ensure that subsequent vegetation would not be injured following application of the herbicide.

Resource Element	Standard Operating Procedure
	• Use native or sterile species for revegetation and restoration projects to compete with invasive species until desired vegetation establishes. • Use weed-free feed for horses and pack animals. Use weed-free straw and mulch for revegetation and other activities. • Identify and implement any temporary domestic livestock grazing and/or supplemental feeding restrictions needed to enhance desirable vegetation recovery following treatment. Consider adjustments in the existing grazing permit, to maintain desirable vegetation on the treatment site.
Pollinators	• Complete vegetation treatments seasonally before pollinator foraging plants bloom. • Time vegetation treatments to take place when foraging pollinators are least active both seasonally and daily. • Design vegetation treatment projects so that nectar and pollen sources for important pollinators and resources are treated in patches rather than in one single treatment. • Minimize herbicide application rates. Use typical rather than maximum rates where there are important pollinator resources. • Maintain herbicide free buffer zones around patches of important pollinator nectar and pollen sources. • Maintain herbicide free buffer zones around patches of important pollinator nesting habitat and hibernacula. • Make special note of pollinators that have single host plant species, and minimize herbicide spraying on those plants (if invasive species) and in their habitats
Fish and Other Aquatic Organisms	• Use appropriate buffer zones based on label and risk assessment guidance. • Minimize treatments near fish-bearing water bodies during periods when fish are in life stages most sensitive to the herbicide(s) used, and use spot rather than broadcast or aerial treatments. • Use appropriate application equipment/method near water bodies if the potential for off-site drift exists. • For treatment of aquatic vegetation, 1) treat only that portion of the aquatic system necessary to achieve acceptable vegetation management, 2) use the appropriate application method to minimize the potential for injury to desirable vegetation and aquatic organisms, and 3) follow

Resource Element	Standard Operating Procedure
	water use restrictions presented on the herbicide label.
Wildlife	• Use herbicides of low toxicity to wildlife, where feasible. • Use spot applications or low-boom broadcast operations where possible to limit the probability of contaminating non-target food and water sources, especially non-target vegetation over areas larger than the treatment area. • Use timing restrictions (e.g., do not treat during critical wildlife breeding or staging periods) to minimize impacts to wildlife.
Threatened, Endangered, and Sensitive Species	• Survey for special status species before treating an area. Consider effects to special status species when designing herbicide treatment programs. • Use a selective herbicide and a wick or backpack sprayer to minimize risks to special status plants. • Avoid treating vegetation during time-sensitive periods (e.g., nesting and migration, sensitive life stages) for special status species in area to be treated.
Livestock	• Whenever possible and whenever needed, schedule treatments when livestock are not present in the treatment area. Design treatments to take advantage of normal livestock grazing rest periods, when possible. • As directed by the herbicide product label, remove livestock from treatment sites prior to herbicide application, where applicable. • Use herbicides of low toxicity to livestock, where feasible. • Take into account the different types of application equipment and methods, where possible, to reduce the probability of contamination of non-target food and water sources. • Avoid use of diquat in riparian pasture while pasture is being used by livestock. • Notify permittees of the herbicide treatment project to improve coordination and avoid potential conflicts and safety concerns during implementation of the treatment. • Notify permittees of livestock grazing, feeding, or slaughter restrictions, if necessary. • Provide alternative forage sites for livestock, if possible.
Cultural resources and Paleontological Resources	• Follow standard procedures for compliance with Section 106 of the National Historic Preservation Act as implemented through the Programmatic Agreement among the Bureau of Land Management, the Advisory Council on Historic Preservation, and the National

Resource Element	Standard Operating Procedure
	Conference of State Historic Preservation Officers Regarding the Manner in Which BLM Will Meet Its Responsibilities Under the National Historic Preservation Act and state protocols or 36 Code of Federal Regulations Part 800, including necessary consultations with State Historic Preservation Officers and interested tribes. • Follow BLM Handbook H-8270-1 (General Procedural Guidance for Paleontological Resource Management) to determine known Condition I and Condition 2 paleontological areas, or collect information through inventory to establish Condition 1 and Condition 2 areas, determine resource types at risk from the proposed treatment, and develop appropriate measures to minimize or mitigate adverse impacts. • Consult with tribes to locate any areas of vegetation that are of significance to the tribe and that might be affected by herbicide treatments. • Work with tribes to minimize impacts to these resources. • Follow guidance under Human Health and Safety in areas that may be visited by Native peoples after treatments.
Visual Resources	• Minimize the use of broadcast foliar applications in sensitive watersheds to avoid creating large areas of browned vegetation. • Consider the surrounding land use before assigning aerial spraying as an application method. • Minimize off-site drift and mobility of herbicides (e.g., do not treat when winds exceed 10 mph; minimize treatment in areas where herbicide runoff is likely; establish appropriate buffer widths between treatment areas and residences) to contain visual changes to the intended treatment area. • If the area is a Class I or II visual resource, ensure that the change to the characteristic landscape is low and does not attract attention (Class I), or if seen, does not attract the attention of the casual viewer (Class II). • Lessen visual impacts by: 1) designing projects to blend in with topographic forms; 2) leaving some low-growing trees or planting some low-growing tree seedlings adjacent to the treatment area to screen short-term effects; and 3) revegetating the site following treatment. • When restoring treated areas, design activities to repeat the form, line, color, and texture of the natural landscape

Resource Element	Standard Operating Procedure
	character conditions to meet established Visual Resource Management (VRM) objectives.
Wilderness and Other Special Areas	• Encourage backcountry pack and saddle stock users to feed their livestock only weed-free feed for several days before entering a wilderness area. • Encourage stock users to tie and/or hold stock in such a way as to minimize soil disturbance and loss of native vegetation. • Revegetate disturbed sites with native species if there is no reasonable expectation of natural regeneration. • Provide educational materials at trailheads and other wilderness entry points to educate the public on the need to prevent the spread of weeds. • Use the "minimum tool" to treat noxious and invasive vegetation, relying primarily on the use of ground-based tools, including backpack pumps, hand sprayers, and pumps mounted on pack and saddle stock. • Use chemicals only when they are the minimum method necessary to control weeds that are spreading within the wilderness or threaten lands outside the wilderness. • Give preference to herbicides that have the least impact on non-target species and the wilderness environment. • Implement herbicide treatments during periods of low human use, where feasible. • Address wilderness and special areas in management plans. • Maintain adequate buffers for Wild and Scenic Rivers (¼ mile on either side of river).
Recreation	• Schedule treatments to avoid peak recreational use times, while taking into account the optimum management period for the targeted species. • Notify the public of treatment methods, hazards, times, and nearby alternative recreation areas. • Adhere to entry restrictions identified on the herbicide product label for public and worker access. • Post signs noting exclusion areas and the duration of exclusion, if necessary. • Use herbicides during periods of low human use, where feasible
Social and Economic Values	• Consider surrounding land use before selecting aerial spraying as a method, and avoid aerial spraying near agricultural or densely-populated areas.

Resource Element	Standard Operating Procedure
	• Post treated areas and specify reentry or rest times, if appropriate. • Notify grazing permittees of livestock feeding restrictions in treated areas, if necessary, as per herbicide product label instructions. • Notify the public of the project to improve coordination and avoid potential conflicts and safety concerns during implementation of the treatment. • Control public access until potential treatment hazards no longer exist, per herbicide product label instructions. • Observe restricted entry intervals specified by the herbicide product label. • Notify local emergency personnel of proposed treatments. • Use spot applications or low-boom broadcast applications where possible to limit the probability of contaminating non-target food and water sources, especially vegetation over areas larger than the treatment area. • Consult with Native American tribes to locate any areas of vegetation that are of significance to the tribes and Native groups and that might be affected by herbicide treatments. • To the degree possible within the law, hire local contractors and workers to assist with herbicide application projects and purchase materials and supplies, including chemicals, for herbicide treatment projects through local suppliers. • To minimize fears based on lack of information, provide public educational information on the need for vegetation treatments and the use of herbicides in an integrated pest management program for projects proposing local use of herbicides.
Rights-of-way	• Coordinate vegetation management activities where joint or multiple use of a ROW exists. • Notify other public land users within or adjacent to the ROW proposed for treatment. • Use only herbicides that are approved for use in ROW areas.
Human health and Safety	• Establish a buffer between treatment areas and human residences based on guidance given in the HHRA, with a minimum buffer of ¼ mile for aerial applications and 100 feet for ground applications, unless a written waiver is granted. • Use protective equipment as directed by the herbicide

Resource Element	Standard Operating Procedure
	product label. • Post treated areas with appropriate signs at common public access areas. • Observe restricted entry intervals specified by the herbicide product label. • Provide public notification in newspapers or other media where the potential exists for public exposure. • Have a copy of MSDSs at work site. • Notify local emergency personnel of proposed treatments. • Contain and clean up spills and request help as needed. • Secure containers during transport. • Follow label directions for use and storage. • Dispose of unwanted herbicides promptly and correctly.

Appendix B-3: Vegetation Treatment Standard Operating Procedures and Guidelines[5]

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
Guidance Documents	BLM handbooks H-9211-1 (*Fire Management Activity Planning Procedures*) and H-9214-1 (*Prescribed Fire Management*), and manuals 1112 (*Safety*), 9210 (*Fire Management*), 9211 (*Fire Planning*), 9214 (*Prescribed Fire*), and 9215 (*Fire Training and Qualifications*).	BLM Handbook H-5000-1 (*Public Domain Forest Management*), and manuals 1112 (*Safety*) and 9015 (*Integrated Weed Management*).	BLM *Domain Forest Management*, and manuals 1112 (*Safety*), and 9015 (*Integrated Weed Management*).	BLM manuals 1112 (*Safety*), 4100 (*Grazing Administration*), 9014 (*Use of Biological Control Agents on Public Lands*), and 9015 (*Integrated Weed Management)* and Handbook H-4400-1 (*Rangeland Health Standards*).	BLM Handbook H-9011-1 (*Chemical Pest Control*), and manuals 1112 (*Safety*), 9011 (*Chemical Pest Control*), 9015 (*Integrated Weed Management)*, and 9220 (*Integrated Pest Management*).
General	• Prepare fire management plan. • Use trained personnel with adequate equipment. • Minimize frequent burning in arid environments. • Avoid burning herbicide-treated vegetation for at least 6 months.	• Ensure that power cutting tools have approved spark arresters. • Ensure that crews have proper fire-suppression tools during the fire season. • Wash vehicles and equipment before leaving weed infested areas to avoid infecting weed-free areas. • Keep equipment in good operating condition.	• Ensure that crews have proper fire-suppression tools during fire season. • Minimize soil disturbance, which may encourage new weeds to develop.	• Use only biological control agents that have been tested and approved to ensure they are host specific. • If using domestic animals, select sites with weeds that are palatable and non-toxic to the animals. • Manage the intensity and duration of containment by domestic animals to minimize overutilization of desirable plant species. • Utilize domestic animals to contain the target species in the treatment areas	• Prepare a spill contingency plan in advance of treatment. • Select herbicides that are least dangerous to the environment while providing the desired results. • Minimize the size of treatment areas, where feasible. • Use the least amount of herbicide necessary to achieve the desired result. • Follow product label for use and storage. • Have a licensed applicator

[5] TABLE 2-5 from Programmatic Environmental Report (BLM 2007b)

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
				prior to weed seed set. Or if seed set has occurred, do not move the domestic animals to uninfested areas for a period of 7 days.	apply herbicides. • Keep records of each application, including the active ingredient, formulation, application rate, date, time, and location. • Dispose of unwanted herbicides promptly and correctly.
Land Use	• Carefully plan fires in the WUI to avoid or minimize loss of structures and property. • Notify nearby residents and landowners who could be affected by smoke intrusions or other fire effects.	• Collaborate on project development with nearby landowners and agencies.	• Collaborate on project development with nearby landowners and agencies.	• Notify nearby residents and landowners who could be affected by biological control agents.	• Consider surrounding land uses before aerial spraying. • Comply with herbicide-free buffer zones to ensure that drift will not affect crops or nearby residents and landowners. • Post treated areas and specify reentry times, if appropriate.
Air Quality See Manual 7000 (*Soil, Water, and Air Management*).	• Have clear smoke management objectives. • Evaluate weather conditions, including wind speed and atmospheric stability, to predict effects of burn and impacts from smoke. • Burn when weather conditions favor rapid combustion and dispersion. • Burn under favorable moisture conditions. • Use backfires, when applicable.	• Maintain equipment in optimal working order. • Conduct treatment activities during the wetter seasons. • Use heavy equipment under adequate soil moisture conditions to minimize soil erosion. • Minimize vehicle speeds on unpaved roads. • Minimize dust impacts to the extent practicable.	• Maintain equipment in optimal working order. • Conduct treatment activities during the wetter seasons. • Minimize vehicle speeds on unpaved roads. • Minimize dust impacts to the extent practicable.		• Consider effects of wind, humidity, temperature inversions, and heavy rainfall on herbicide effectiveness and risks. • Apply herbicides in favorable weather conditions to minimize drift. For example, do not treat when winds exceed 10 mph (6 mph for aerial applications) or rainfall is imminent. • Apply herbicides consistent with label directions.

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
	• Burn small vegetation blocks, when appropriate. • Manage smoke to prevent air quality violations and minimize impacts to smoke-sensitive areas. • Coordinate with air pollution and fire control officials, and obtain all applicable smoke management permits, to ensure that burn plans comply with federal, state, and local regulations.				• Use drift reduction agents, as appropriate, to reduce the drift hazard. • Select proper application equipment (e.g., equipment that produces • 200- to 800-micron diameter droplets). • Select proper application methods and use appropriate buffer distances between spray sites and non-target resources.
Soil Resources See Manual 7000 (*Soil, Water, and Air Management*).	• Assess the susceptibility of the treatment site to soil damage and erosion prior to treatment. • Prescribe broadcast and other burns that are consistent with soil management activities. • Plan burns so as to minimize damage to soil resources. • Conduct burns when moisture content of large fuels, surface organic matter, and soil is high to limit the amount of heat penetration into lower soil surfaces and protect surface organic matter. • Time treatments to encourage rapid recovery	• Assess the susceptibility of the treatment site to soil damage and erosion prior to treatment. • Time treatments to avoid intense rainstorms. • Time treatments to encourage rapid recovery of vegetation. • Further facilitate revegetation by seeding or planting following treatment. • Use equipment that minimizes soil disturbance and compaction. • Minimize use of heavy equipment on slopes >20%. • Conduct treatments when the ground is sufficiently dry to support heavy	• Assess the susceptibility of the treatment site to soil damage and erosion prior to treatment. • Time treatments to avoid intense rainstorms. • Time treatments to encourage rapid recovery of vegetation. • Further facilitate revegetation by seeding or planting following treatment. • Minimize soil disturbance and compaction. • Minimize disturbance to biological soil crusts (e.g., by timing treatments when crusts are moist). • Reinoculate biological crust organisms to aid in their	• Assess the susceptibility of the treatment site to soil damage and erosion prior to treatment. • Minimize use of domestic animals if removal of vegetation may cause significant soil erosion or impact biological soil crusts. • Closely monitor timing and intensity of biological control with domestic animals. • Avoid grazing on wet soil to minimize compaction and shearing.	• Assess the susceptibility of the treatment site to soil damage and erosion prior to treatment. • Minimize treating areas where herbicide runoff is likely, such as steep slopes when heavy rainfall is expected. • Minimize the use of herbicides that have high soil mobility, particularly in areas where soil properties increase the potential for mobility. • Time treatments to encourage rapid recovery of desirable vegetation. • Further facilitate revegetation by seeding or planting following

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
	of vegetation. • Further facilitate revegetation by seeding or planting following treatment. • When appropriate, reseed following burning to re-introduce species, or to convert a site to a less flammable plant association, rather than to specifically minimize erosion.	equipment. • Implement erosion control measures in areas where heavy equipment use occurs. • Minimize disturbances to biological soil crusts (e.g., by timing treatments when crusts are moist). • Reinoculate biological crust organisms to aid in their recovery, if possible. • Conduct mechanical treatments along topographic contours to minimize runoff and erosion. • When appropriate, leave plant debris on site to retain moisture, supply nutrients, and reduce erosion. • Consider chaining when soils are frozen and plants are brittle to minimize soil disturbance.	recovery, if possible. • When appropriate, leave plant debris on site to retain moisture, supply nutrients, and reduce erosion. • Prevent oil and gas spills to minimize damage to soil.		treatment.
Water Resources See Manual 7000 (*Soil, Water, and Air Management*).	• Prescribe burns that are consistent with water management objectives. • Plan burns to minimize negative impacts to water resources. • Minimize burning on hillslopes, or revegetate hillslopes shortly after burning. • Maintain a vegetated	• Minimize removal of desirable vegetation near residential and domestic water sources. • Do not wash equipment or vehicles in water bodies. • Maintain minimum 25- foot wide vegetated buffer near streams and wetlands.	• Maintain vegetated buffer near residential and domestic water sources. • Minimize removal of desirable vegetation near residential and domestic water sources. • Minimize removal of desirable vegetation near water bodies.	• Minimize use of domestic animals near residential or domestic water sources. • Minimize use of domestic animals adjacent to water bodies if trampling or other activities are likely to cause soil erosion or impact water quality.	• Consider climate, soil type, slope, and vegetation type when developing herbicide treatment programs. • Do not rinse spray tanks in or near water bodies. • Do not broadcast herbicide pellets where there is danger of contaminating water supplies. • Minimize treating areas

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
	buffer between treatment areas and water bodies.				with a high risk for groundwater contamination. • Maintain buffers between the treatment area and water bodies. Buffer widths should be developed based on herbicide- and site-specific criteria to minimize impacts to water bodies.
Wetlands and Riparian Areas	• Following treatment, reseed or replant with native vegetation if the native plant community cannot recover and occupy the site sufficiently.	• Manage riparian areas to provide adequate shade, sediment control, bank stability, and recruitment of wood into stream channels. • Following treatment, reseed or replant with native vegetation if the native plant community cannot recover and occupy the site sufficiently.	• Following treatment, reseed or replant with native vegetation if the native plant community cannot recover and occupy the site sufficiently	• Manage animals to prevent overgrazing and minimize damage to wetlands. • Following treatment, reseed or replant with native vegetation if the native plant community cannot recover and occupy the site sufficiently.	• Use appropriate herbicide-free buffer zone for herbicides not labeled for aquatic use based on risk assessment guidance, with minimum widths of 100 feet for aerial, 25 feet for vehicle, and 10 feet for hand spray applications • Following treatment, reseed or replant with native vegetation if the native plant community cannot recover and occupy the site sufficiently.
Vegetation See Handbook H-4410-1 (*National Range Handbook*), and manuals 5000 (*Forest Management*) and 9015 (*Integrated Weed Management*).	• Keep fires as small as possible to meet the treatment objectives. • Conduct low intensity burns to minimize adverse impacts to large vegetation. • Limit area cleared for fire breaks and clearings to reduce potential for weed	• Power wash vehicles and equipment to prevent the introduction and spread of weed and exotic species. • Remove damaged trees and treat woody residue to limit subsequent mortality by bark beetles. • Use plant stock or seed from the same seed zone	• Remove damaged trees and treat woody residue to limit subsequent mortality by bark beetles. • Identify and implement any temporary domestic livestock grazing and/or supplemental feeding restrictions needed to enhance desirable	• Use domestic animals at the time they are most likely to damage invasive species. • Manage animals to prevent overgrazing and minimize damage to sensitive areas. • Identify and implement any temporary domestic livestock grazing and/or	• Use drift reduction agents, as appropriate, to reduce the drift hazard to non-target species. • Use the appropriate application rate to treat weeds and other noxious vegetation to minimize effects to non-target vegetation.

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
	infestations. • Where appropriate, use mechanical treatments to prepare forests for the reintroduction of fire. • Identify and implement any temporary domestic livestock grazing and/or supplemental feeding restrictions needed to enhance desirable vegetation recovery following treatment. • Consider adjustments in the existing grazing permit, including the application of state or regional grazing administration guidelines, needed to maintain desirable vegetation on the treatment site. • Use plant stock or seed from the same seed zone and from sites of similar elevation when conducting revegetation activities.	and from sites of similar elevation when conducting revegetation activities. • Use lighter chains with 40 to 60 pound links where the objective is to minimize disturbance to the understory species. • As appropriate, use two chainings to reduce tree competition and prepare the seedbed. Carry out the second chaining at the most advantageous time for seeding (late fall or early winter, in most cases). • Do not chain in areas where annual rainfall is less than 6-9 inches, especially if downy brome is present. • Identify and implement any temporary domestic livestock grazing and/or supplemental feeding restrictions needed to enhance desirable vegetation recovery following treatment. • Consider adjustments in the existing grazing permit, including the application of state or regional grazing administration guidelines, needed to maintain desirable vegetation on the treatment site.	vegetation recovery following treatment. • Consider adjustments in the existing grazing permit, including the application of state or regional grazing administration guidelines, needed to maintain desirable vegetation on the treatment site. • Use plant stock or seed from the same seed zone and from sites of similar elevation when conducting revegetation activities.	supplemental feeding restrictions needed to enhance desirable vegetation recovery following treatment. • Consider adjustments in the existing grazing permit, including the application of state or regional grazing administration guidelines, needed to maintain desirable vegetation on the treatment site. • Use plant stock or seed from the same seed zone and from sites of similar elevation when conducting revegetation activities.	• Conduct pre-treatment surveys for sensitive habitat and species of concern within and adjacent to proposed treatment areas. • Identify and implement any temporary domestic livestock grazing and/or supplemental feeding restrictions needed to enhance desirable vegetation recovery following treatment. • Consider adjustments in the existing grazing permit, including the application of state or regional grazing policies and administration guidelines, needed to maintain desirable vegetation on the treatment site. • Use plant stock or seed from the same seed zone and from sites of similar elevation when conducting revegetation activities.

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
Fish and Other Aquatic Resources See Manual 6500 (*Wildlife and Fisheries Management*).	• Maintain vegetated buffers near fish-bearing streams to minimize soil erosion and soil runoff into streams. • Minimize treatments near fish-bearing streams during periods when fish are in sensitive life stages (e.g., embryo).	• Minimize treatments adjacent to fish-bearing waters. • Do not wash vehicles in streams or wetlands. • Refuel and service equipment at least 100 feet from water bodies to reduce the chance for pollutants to enter water. • Maintain adequate vegetated buffer between treatment area and water body to reduce the potential for sediments and other pollutants to enter the water body.	• Refuel and service equipment at least 100 feet from water bodies to reduce the chance for pollutants to enter water. • Minimize removal of desirable vegetation near fish-bearing streams and wetlands.	• Limit access of domestic animals to streams and other water bodies to minimize sediments entering water and potential for damage to fish habitat.	• Use appropriate buffer zones based on label and risk assessment guidance. • Minimize treatments near fish-bearing streams during periods when fish are in life stages most sensitive to the herbicide(s) used. • Use spot, rather than aerial treatments, near water bodies. • Use herbicides that are least toxic to fish and still effective.
Wildlife Resources See Manual 6500 (*Wildlife and Fisheries Management)*	• Minimize treatments during nesting and other important periods for birds and other wildlife. • Minimize treatments of important forage areas immediately prior to important use period(s), unless the burn is designed to stimulate forage growth.	• Minimize treatments during nesting and other important periods for birds and other wildlife. • Retain wildlife trees and other unique habitat features where practical. • Design chaining treatments to provide a mosaic of treated and non-treated sites. No more than 50% of an area should be chained at one time. Provide natural travel lanes, resting and thermal cover areas, snags, and corridors (>30 feet wide) connecting non-chained areas. Size of clearing should not exceed	• Minimize treatments during nesting and other important periods for birds and other wildlife. • Retain wildlife trees and other unique habitat features where practical.	• Minimize the use of livestock grazing as a vegetation control measure where and/or when it could impact nesting and/or other important periods for birds and other wildlife. • Consider and minimize potential adverse impacts to wildlife habitat and minimize the use of livestock grazing as a vegetation control measure where it is likely to result in removal or physical damage to vegetation that provides a critical source of food or cover for wildlife.	• Minimize treatments during nesting and other important periods for wildlife. • Use herbicides of low toxicity to wildlife, where feasible. • Conduct pre-treatment surveys for sensitive habitat and wildlife species of concern. • Avoid using glyphosate formulations that include R-11 in the future, and either avoid using any formulations with POEA, or seek to use the formulation with the lowest amount of POEA available, to reduce

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
		100 yards at its widest point.			risks to amphibians. • Minimize use of herbicides near wetlands and riparian areas with amphibians.
Threatened and Endangered Species See Manual 6840 (*Special Status Species*) and *Vegetation Treatments Using Herbicides on BLM Lands in 17 Western States Programmatic Biological Assessment.*	• Survey for special status species of concern if project may impact federally- and state-listed species. • Minimize direct impacts to species of concern, unless studies show that species will benefit from fire.	• Minimize use of ground-disturbing equipment near special status species of concern. • Survey for species of concern if project could impact these species. • Use temporary roads when long-term access is not required.	• Survey for special status species of concern if project could impact these species.	• Survey for special status species of concern if project could impact these species.	• Survey for special status species before treating an area.
Livestock See Handbook H-4120-1 (*Grazing Management*).	• Notify permittees of proposed treatments and identify any needed livestock grazing, feeding, or slaughter restrictions. • Design treatments to take advantage of normal livestock grazing rest periods, when possible, and minimize impacts to livestock grazing permits. • Provide alternative forage sites for livestock, if possible. • Notify permittees of the project to improve coordination and avoid	• Notify permittees of proposed treatments and identify any needed livestock grazing, feeding, or slaughter restrictions. • Design treatments to take advantage of normal livestock grazing rest periods, when possible, and minimize impacts to livestock grazing permits. • Provide alternative forage sites for livestock, if possible. • Notify permittees of the project to improve coordination and avoid	• Notify permittees of proposed treatments and identify any needed livestock grazing, feeding, or slaughter restrictions. • Design treatments to take advantage of normal livestock grazing rest periods, when possible, and minimize impacts to livestock grazing permits. • Provide alternative forage sites for livestock, if possible. • Notify permittees of the project to improve coordination and avoid	• Notify permittees of proposed treatments and identify any needed livestock grazing, feeding, or slaughter restrictions. • Design treatments to take advantage of normal livestock grazing rest periods, when possible, and minimize impacts to livestock grazing permits. • Provide alternative forage sites for livestock, if possible. • Notify permittees of the project to improve coordination and avoid	• Notify permittees of proposed treatments and identify any needed livestock grazing, feeding, or slaughter restrictions. • Design treatments to take advantage of normal livestock grazing rest periods, when possible, and minimize impacts to livestock grazing permits. • Provide alternative forage sites for livestock, if possible. • Use herbicides of low toxicity to livestock, where feasible. • As directed by the herbicide label, remove livestock from

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
	potential conflicts and safety concerns during implementation of the treatment.	potential conflicts and safety concerns during implementation of the treatment.	potential conflicts and safety concerns during implementation of the treatment.	potential conflicts and safety concerns during implementation of the treatment.	treatment sites prior to herbicide application, where applicable. • Take into account the different types of application equipment and methods, where possible, to reduce the probability of contamination of non- target food and water sources. • Notify permittees of the project to improve coordination and avoid potential conflicts and safety concerns during implementation of the treatment.
Paleontological and Cultural Resources See handbooks H-8120-1 (*Guidelines for Conducting Tribal Consultation*) and H-8270-1 (*General Procedural Guidance for Paleontological Resource Management*), and manuals 8100 (*The Foundations for Managing Cultural Resources*), 8120 (*Tribal Consultation Under Cultural Resource Authorities*),	• Follow standard procedures for compliance with Section 106 of the National Historic Preservation Act as implemented through the National Programmatic Agreement and state protocols or 36 CFR Part 800, including necessary consultations with the State Historic Preservation Officers and affected tribes. • Follow BLM Handbook H-8270-1 to determine known Condition 1 and Condition 2 paleontological areas, or collect information through	• Follow standard procedures for compliance with Section 106 of the National Historic Preservation Act as implemented through the National Programmatic Agreement and state protocols or 36 CFR Part 800, including necessary consultations with the State Historic Preservation Officers and interested tribes. • Follow BLM Handbook H-8270-1 to determine known Condition 1 and Condition 2 paleontological areas, or collect information through	• Follow standard procedures for compliance with Section 106 of the National Historic Preservation Act as implemented through the National Programmatic Agreement and state protocols or 36 CFR Part 800, including necessary consultations with the State Historic Preservation Officers and interested tribes. • Follow BLM Handbook H-8270-1 to determine known Condition 1 and Condition 2 paleontological areas, or collect information through	• Follow standard procedures for compliance with Section 106 of the National Historic Preservation Act as implemented through the National Programmatic Agreement and state protocols or 36 CFR Part 800, including necessary consultations with the State Historic Preservation Officers and interested tribes. • Follow BLM Handbook H-8270-1 to determine known Condition 1 and Condition 2 paleontological areas, or collect information through	• Follow standard procedures for compliance with Section 106 of the National Historic Preservation Act as implemented through the National Programmatic Agreement and state protocols or 36 CFR Part 800, including necessary consultations with the State Historic Preservation Officers and interested tribes. • Follow BLM Handbook H-8270-1 to determine known Condition 1 and Condition 2 paleontological areas, or collect information through

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
and 8270 (*Paleontological Resource Management*). See also: *Programmatic Agreement among the Bureau of Land Management, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers Regarding the Manner in Which BLM Will Meet Its Responsibilities Under the National Historic Preservation Act (1997)*.	inventory to establish Condition 1 and Condition 2 areas, determine resource types at risk from the proposed treatment, and develop appropriate measures to minimize or mitigate adverse impacts. • Identify cultural resource types at risk from fire use and design inventories that are sufficient to locate these resources. Provide measures to minimize impacts. • Identify opportunities to meet tribal cultural use plant objectives for projects on public lands. • Monitor significant paleontological and cultural resources for potential looting of materials where they have been exposed by fire.	inventory to establish Condition 1 and Condition 2 areas, determine resource types at risk from the proposed treatment, and develop appropriate measures to minimize or mitigate adverse impacts. • Identify cultural resource types at risk from mechanical treatments and design inventories that are sufficient to locate these resources. Provide measures to minimize impacts. • Identify opportunities to meet tribal cultural use plant objectives for projects on public lands. • Consult with tribes to locate any areas of vegetation that are of significance to the tribe and that might be affected, adversely or beneficially, by mechanical treatments.	inventory to establish Condition 1 and Condition 2 areas, determine resource types at risk from the proposed treatment, and develop appropriate measures to minimize or mitigate adverse impacts. • Identify cultural resource types at risk from manual treatments and design inventories that are sufficient to locate these resources. Provide measures to minimize impacts. • Identify opportunities to meet tribal cultural use plant objectives for projects on public lands. • Consult with tribes to locate any areas of vegetation that are of significance to the tribe and that might be affected, adversely or beneficially, by manual treatments.	inventory to establish Condition 1 and Condition 2 areas, determine resource types at risk from the proposed treatment, and develop appropriate measures to minimize or mitigate adverse impacts. • Identify opportunities to meet tribal cultural use plant objectives for projects on public lands. • Consult with tribes to locate any areas of vegetation that are of significance to the tribe and that might be affected, adversely or beneficially, by biological treatments.	inventory to establish Condition 1 and Condition 2 areas, determine resource types at risk from the proposed treatment, and develop appropriate measures to minimize or mitigate adverse impacts. • Identify opportunities to meet tribal cultural use plant objectives for projects on public lands. • Consult with tribes to locate any areas of vegetation that are of significance to the tribe and that might be affected, adversely or beneficially, by herbicide treatments.
Visual Resources See handbooks H-8410-1 (*Visual Resource Inventory*) and H-8431-1 (*Visual Resource Contrast Rating*), and Manual 8400 (*Visual Resource*	• Minimize use of fire in sensitive watersheds to reduce the creation of large areas of browned vegetation. • Consider the surrounding land use before assigning fire as a treatment method. • At areas such as visual	• Minimize dust drift, especially near recreational or other public use areas. • Minimize loss of desirable vegetation near high public use areas. • At areas such as visual overlooks, leave sufficient vegetation in place, where	• Minimize dust drift, especially near recreational or other public use areas. • Minimize loss of desirable vegetation near high public use areas. • At areas such as visual overlooks, leave sufficient vegetation in place, where	• At areas such as visual overlooks, leave sufficient vegetation in place, where possible, to screen views of vegetation treatments. • Lessen visual effects in Class I and Class II visual resource areas. • Design activities to repeat	• At areas such as visual overlooks, leave sufficient vegetation in place, where possible, to screen views of vegetation treatments. • Minimize use of broadcast foliar applications in sensitive watersheds to avoid creating large areas of browned

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
Management).	overlooks, leave sufficient vegetation in place, where possible, to screen views of vegetation treatments. • Avoid use of fire near agricultural or densely populated areas, where feasible. • Lessen visual effects in Class I and Class II visual resource areas. • Design activities to repeat the form, line, color, texture of the natural landscape conditions to meet established Visual Resource Management (VRM) objectives.	possible, to screen views of vegetation treatments. • Minimize earthwork and locate away from prominent topographic features. • Revegetate treated sites. • Lessen visual effects in Class I and Class II visual resource areas. • Design activities to repeat the form, line, color, and texture of the natural landscape character conditions to meet established VRM objectives.	possible, to screen views of vegetation treatments. • Lessen visual effects in Class I and Class II visual resource areas. • Design activities to repeat the form, line, color, and texture of the natural landscape character conditions to meet established VRM objectives.	the form, line, color, and texture of the natural landscape character conditions to meet established VRM objectives.	vegetation. • Consider the surrounding land use before assigning aerial spraying as an application method. • Avoid aerial spraying near agricultural or densely populated areas, where feasible. • Minimize off-site drift and mobility of herbicides (e.g., do not treat when winds exceed 10 mph; avoid treating areas where herbicide runoff is likely; establish appropriate buffer widths between treatment areas and residences). • Lessen visual effects in Class I and Class II visual resource areas. • When restoring treated areas, design activities to repeat the form, line, color, and texture of the natural landscape character conditions to meet established VRM objectives.
Wilderness and Other Special Areas See handbooks H-8550-1 (*Management of Wilderness Study Areas (WSAs)*), and H-8560-1 (*Management of Designated*	• Minimize soil-disturbing activities during fire control or prescribed fire activities. • Revegetate sites with native species if there is no reasonable expectation of natural regeneration. • Maintain adequate buffers for Wild and Scenic Rivers.	• Use the least intrusive methods possible to achieve objectives, and use non-motorized equipment in wilderness and off existing routes in wilderness study areas, and where possible in other areas.	• Use the least intrusive methods possible to achieve objectives, and use non-motorized equipment in wilderness and off existing routes in wilderness study areas, and where possible in other areas.	• Use the least intrusive methods possible to achieve objectives, and use non-motorized equipment in wilderness and off existing routes in wilderness study areas, and where possible in other areas.	• Revegetate disturbed sites with native species if there is no reasonable expectation of natural regeneration. • Use chemicals only when they are the minimum method necessary to control weeds that are

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
Wilderness Study Areas), and Manual 8351 (*Wild and Scenic Rivers*).		• If mechanized equipment is required, use the minimum amount of equipment needed. • Time the work for weekdays or off-season. • Require shut down of work before evening if work is located near campsites. • If aircraft are used, plan flight paths to minimize impacts on visitors and wildlife. • Revegetate sites with native species if there is no reasonable expectation of natural regeneration. • Maintain adequate buffers for Wild and Scenic Rivers.	• Revegetate sites with native species if there is no reasonable expectation of natural regeneration. • Maintain adequate buffers for Wild and Scenic Rivers.	• Maintain adequate buffers for Wild and Scenic Rivers.	spreading within the wilderness or threaten lands adjacent to the wilderness. • Give preference to herbicides that have the least effect on non-target species and the wilderness environment. • Implement herbicide treatments during periods of low human use, where feasible. • Maintain adequate buffers for Wild and Scenic Rivers.
Recreation See Handbook H-1601-1 (*Land Use Planning Handbook*).	• Control public access to potential burn areas. • Schedule treatments to avoid peak recreational use times, unless treatments must be timed during peak times to maximize effectiveness. • Notify the public of treatment methods, hazards, times, and nearby alternative recreation areas.	• Control public access until potential treatment hazards no longer exist. • Schedule treatments to avoid peak recreational use times, unless treatments must be timed during peak times to maximize effectiveness. • Notify the public of treatment methods, hazards, times, and nearby alternative recreation areas.	• Control public access until potential treatment hazards no longer exist. • Schedule treatments to avoid peak recreational use times, unless treatments must be timed during peak times to maximize effectiveness. • Notify the public of treatment methods, hazards, times, and nearby alternative recreation areas.	• Control public access in areas with control agents to ensure that agents are effective. • Schedule treatments to avoid peak recreational use times, unless treatments must be timed during peak times to maximize effectiveness. • Notify the public of treatment methods, hazards, times, and nearby alternative recreation areas.	• Adhere to entry restrictions identified on the herbicide label for public and worker access. • Post signs noting exclusion areas and their duration. • Schedule treatments to avoid peak recreational use times, unless treatments must be timed during peak times to maximize effectiveness. • Notify the public of treatment methods, hazards, times, and nearby alternative recreation areas.

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
Social and Economic Values	• Post treatment areas. • Notify adjacent landowners, grazing permittees, the public, and emergency personnel of treatments. • Control public access to treatment areas. • Consult with Native American tribes and Alaska Natives whose health and economies might be affected by the project. • To the extent feasible, hire local contractors and purchase supplies locally.	• Post treatment areas. • Notify adjacent landowners, grazing permittees, the public, and emergency personnel of treatments. • Control public access to treatment areas. • Consult with Native American tribes and Alaska Natives whose health and economies might be affected by the project. • To the extent feasible, hire local contractors and purchase supplies locally.	• Post treatment areas. • Notify adjacent landowners, grazing permittees, the public, and emergency personnel of treatments. • Control public access to treatment areas. • Consult with Native American tribes and Alaska Natives whose health and economies might be affected by the project. • To the extent feasible, hire local contractors and purchase supplies locally.	• Post treatment areas. • Notify adjacent landowners, grazing permittees, the public, and emergency personnel of treatments. • Control public access to treatment areas. • Consult with Native American tribes and Alaska Natives whose health and economies might be affected by the project. • To the extent feasible, hire local contractors and purchase supplies locally.	• Observe restricted entry intervals given on herbicide labels. • Post treated areas and specify reentry or rest times, if appropriate. • Notify adjacent landowners, grazing permittees, the public, and emergency personnel of treatments. • Control public access until potential treatment hazards no longer exist. • Consult with Native American tribes and Alaska Natives whose health and economies might be affected by the project. • To the degree possible within the law, hire local contractors and purchase supplies locally.
Rights-of-way	• Coordinate vegetation management activities where joint or multiple use of a ROW exists. • Notify other public land users within or adjacent to the ROW proposed for treatment. • Manage burns under powerlines so as to avoid negative impacts to the powerline.	• Coordinate vegetation management activities where joint or multiple use of a ROW exists. • Notify other public land users within or adjacent to the ROW proposed for treatment. • Apply appropriate safety measures when operating equipment within utility ROW corridors. • Minimize exposed soil	• Coordinate vegetation management activities where joint or multiple use of a ROW exists. • Notify other public land users within or adjacent to the ROW proposed for treatment. • Always use appropriate safety equipment and operating procedures. • Utilize methods for disposal of vegetation that	• Coordinate vegetation management activities where joint or multiple use of a ROW exists. • Notify other public land users within or adjacent to the ROW proposed for treatment.	• Coordinate vegetation management activities where joint or multiple use of a ROW exists. • Notify other public land users within or adjacent to the ROW proposed for treatment. • Use only herbicides that are approved for use in ROW areas. • Take precautions to minimize drift by not

Resource Element	Treatment Method				
	Fire Use	Mechanical	Manual	Biological	Chemical
		areas during treatment. • Keep operations within prescribed ROW.	prevent spreading or reinfestation of unwanted vegetation.		applying herbicides when winds exceed > 10 mph (6 mph for aerial applications) or a serious rainfall event is imminent. • Use drift control agents and low volatile formulations.
Human Health and Safety	• Use some form of pretreatment, such as mechanical or manual treatment, in areas where fire cannot be safely introduced because of hazardous fuel buildup. • Wear appropriate safety equipment and clothing, and use equipment that is properly maintained. • Notify nearby residents who could be affected by smoke. • Maintain adequate safety buffers between treatment area and residences/ structures. • Burn vegetation debris off ROWs to ensure that smoke does not provide a conductive path from the transmission line or electrical equipment to the ground.	• Wear appropriate safety equipment and clothing, and use equipment that is properly maintained. • Cut all brush and tree stumps flat, where possible, to eliminate sharp points that could injure a worker or the public. • Ensure that only qualified personnel cut trees near powerlines.	• Wear appropriate safety equipment and clothing, and use equipment that is properly maintained. • Cut all brush and tree stumps flat, where possible, to eliminate sharp points that could injure a worker or the public.	• Wear appropriate safety equipment and clothing, and use equipment that is properly maintained.	• Use protective equipment as directed by the herbicide label. • Maintain adequate buffer widths between treatment area and residences, municipal water supplies, and recreation areas. • Post treated areas with appropriate signs at common public access areas. • Provide public notification in newspapers or other media where the potential exists for public exposure. • Have a copy of Material Safety Data Sheets at work sites. • Notify local emergency personnel of proposed treatments. • Contain and clean up spills and request help as needed. • Secure containers during transport.

Appendix B-4: Mitigation Measures

Resource	Mitigation Measures
Water Resources and Quality	• Establish appropriate (herbicide-specific) buffer zones to downstream water bodies, habitats, and species/populations of interest (see Appendix C of PEIS, Table C-16). • Areas with potential for groundwater for domestic or municipal water use shall be evaluated through the appropriate, validated USEPA model(s) to estimate vulnerability to potential groundwater contamination, and appropriate mitigation measures shall be developed if such an area requires the application of herbicides and cannot otherwise be treated with nonchemical methods.
Wetland and Riparian Areas	• See mitigation for Water Resources and Quality and Vegetation.
Vegetation	• Minimize the use of terrestrial herbicides (especially bromacil, diuron, and sulfometuron methyl) in watersheds with down gradient ponds and streams if potential impacts to aquatic plants are identified. • Establish appropriate (herbicide-specific) buffer zones (see Tables 4-12 and 4-14 in Chapter 4 of the Final PEIS) around downstream water bodies, habitats, and species/populations of interest. Consult the ecological risk assessments (ERAs) prepared for the PEIS for more specific information on appropriate buffer distances under different soil, moisture, vegetation, and application scenarios. • Limit the aerial application of chlorsulfuron and metsulfuron methyl to areas with difficult land access, where no other means of application are possible. Do not apply sulfometuron methyl aerially. • To protect special status plant species, implement all conservation measures for plants presented in the Vegetation Treatments on Bureau of Land Management Lands in 17 Western States Programmatic Biological Assessment.
Fish and Other Aquatic Organisms	• Limit the use of diquat in water bodies that have native fish and aquatic resources. • Limit the use of terrestrial herbicides (especially diuron) in watersheds with characteristics suitable for potential surface runoff that have fish-bearing streams during periods when fish are in life stages most sensitive to the

Resource	Mitigation Measures
	herbicide(s) used. • To protect special status fish and other aquatic organisms, implement all conservation measures for aquatic animals presented in the Vegetation Treatments on Bureau of Land Management Lands in 17 Western States Programmatic Biological Assessment. • Establish appropriate herbicide-specific buffer zones for water bodies, habitats, or fish or other aquatic species of interest (see Final PEIS Appendix C, Table C-16, and recommendations in individual ERAs). • Consider the proximity of application areas to salmonid habitat and the possible effects of herbicides on riparian and aquatic vegetation. Maintain appropriate buffer zones around salmonid-bearing streams (see Appendix C, Table C-16, of the Final PEIS, and recommendations in the individual ERAs). • Avoid using the adjuvant R-11® in aquatic environments, and either avoid using glyphosate formulations containing polyoxyethyleneamine (POEA), or seek to use formulations with the least amount of POEA, to reduce risks to aquatic organisms in aquatic environments. • At the local level, consider effects to special status fish and other aquatic organisms when designing treatment programs.
Wildlife	• To minimize risks to terrestrial wildlife, do not exceed the typical application rate for applications of dicamba, diuron, glyphosate, hexazinone, tebuthiuron, or triclopyr, where feasible. • Minimize the size of application areas, where practical, when applying 2,4-D, bromacil, diuron, and Overdrive® to limit impacts to wildlife, particularly through contamination of food items. • Where practical, limit glyphosate and hexazinone to spot applications in rangeland and wildlife habitat areas to avoid contamination of wildlife food items. • Avoid using the adjuvant R-11® in aquatic environments and either avoid using glyphosate formulations containing POEA, or seek to use formulations with the least amount of POEA, to reduce risks to amphibians. • Do not apply bromacil or diuron in rangelands, and use appropriate buffer zones (see Tables 4-12 and 4-14 in Chapter 4 of the Final PEIS) to limit contamination of off-

Resource	Mitigation Measures
	site vegetation, which may serve as forage for wildlife. • Do not aerially apply diquat directly to wetlands or riparian areas. • To protect special status wildlife species, implement all conservation measures for terrestrial animals presented in the Vegetation Treatments on Bureau of Land Management Lands in 17 Western States Programmatic Biological Assessment.
Livestock	• Minimize potential risks to livestock by applying diuron, glyphosate, hexazinone, tebuthiuron, and triclopyr at the typical application rate, where feasible. • Do not apply 2,4-D, bromacil, dicamba, diuron, Overdrive®, picloram, or triclopyr across large application areas, where feasible, to limit impacts to livestock, particularly through the contamination of food items. • Where feasible, limit glyphosate and hexazinone to spot applications in rangeland. • Do not aerially apply diquat directly to wetlands or riparian areas used by livestock. • Do not apply bromacil or diuron in rangelands, and use appropriate buffer zones (see Tables 4-12 and 4-14 in Chapter 4 of the Final PEIS) to limit contamination of off-site rangeland vegetation.
Paleontological and Cultural Resources	• Do not exceed the typical application rate when applying 2,4-D, bromacil, diquat, diuron, fluridone, hexazinone, tebuthiuron, and triclopyr in known traditional use areas. • Avoid applying bromacil or tebuthiuron aerially in known traditional use areas. • Limit diquat applications to areas away from high residential and traditional use areas to reduce risks to Native Americans and Alaska Natives.
Wilderness and other Special Areas	• Mitigation measures that may apply to wilderness and other special area resources are associated with human and ecological health and recreation (see mitigation measures for Vegetation, Fish and Other Aquatic Resources, Wildlife Resources, Recreation, and Human Health and Safety).
Recreation	• Mitigation measures that may apply to recreational resources are associated with human and ecological health (see mitigation measures for Vegetation, Fish and Other Aquatic Resources, Wildlife Resources, and Human Health and Safety).

Resource	Mitigation Measures
Human Health and Safety	• Use the typical application rate, where feasible, when applying 2,4-D, bromacil, diquat, diuron, fluridone, hexazinone, tebuthiuron, and triclopyr to reduce risk to occupational and public receptors. • Avoid applying bromacil and diuron aerially. Do not apply sulfometuron methyl aerially. • Limit application of chlorsulfuron via ground broadcast applications at the maximum application rate. • Limit diquat application to ATV, truck spraying, and boat applications to reduce risks to occupational receptors; limit diquat applications to areas away from high residential and subsistence use to reduce risks to public receptors. • Evaluate diuron applications on a site-by-site basis to avoid risks to humans. There appear to be few scenarios where diuron can be applied without risk to occupational receptors. • Do not apply hexazinone with an over-the-shoulder broadcast applicator.

Conservation Measures for Plants (BLM 2007d)

As dictated in BLM Manual 6840 (Special Status Species Management), local BLM offices are required to develop and implement management plans and programs that will conserve listed species and their habitats. In addition, NEPA documentation related to treatment activities (i.e., projects) will be prepared that identify any TEP plant species or their critical habitat that are present in the proposed treatment areas, and that list the measures that will be taken to protect them.

Many local BLM offices already have management plans in place that ensure the protection of these plant species during activities on public land. However, a discussion of these existing plans is outside the scope of this programmatic BA. The following general guidance applies to all management plans developed at the local level.

Required steps include the following:

- A survey of all proposed action areas within potential habitat by a botanically qualified biologist, botanist, or ecologist to determine the presence/absence of the species.
- Establishment of site-specific no activity buffers by a qualified botanist, biologist, or ecologist in areas of occupied habitat within the proposed project area. To protect occupied habitat, treatment activities would not occur within these buffers.
- Collection of baseline information on the existing condition of TEP plant species and their habitats in the proposed project area.
- Establishment of pre-treatment monitoring programs to track the size and vigor of TEP populations and the state of their habitats. These monitoring programs would help in anticipating the future effects of vegetation treatments on TEP plant species.
- Assessment of the need for site revegetation post treatment to minimize the opportunity for noxious weed invasion and establishment.

At a minimum, the following must be included in all management plans:

- Given the high risk for damage to TEP plants and their habitat from burning, mechanical treatments, and use of domestic animals to contain weeds, none of these treatment methods should be utilized within 330 feet of sensitive plant populations UNLESS the treatments are specifically designed to maintain or improve the existing population.
- Off-highway use of motorized vehicles associated with treatments should be avoided in suitable or occupied habitat.
- Biological control agents (except for domestic animals) that affect target plants in the same genus as TEP species must not be used to control target species occurring within the dispersal distance of the agent.

- Prior to use of biological control agents that affect target plants in the same family as TEP species, the specificity of the agent with respect to factors such as physiology and morphology should be evaluated, and a determination as to risks to the TEP species made.
- Post-treatment monitoring should be conducted to determine the effectiveness of the project.

In addition, the following guidance must be considered in all management plans in which herbicide treatments are proposed to minimize or avoid risks to TEP species. The exact conservation measures to be included in management plans would depend on the herbicide that would be used, the desired mode of application, and the conditions of the site. Given the potential for off-site drift and surface runoff, populations of TEP species on lands not administered by the BLM would need to be considered if they are located near proposed herbicide treatment sites.

- Herbicide treatments should not be conducted in areas where TEP plant species may be subject to direct spray by herbicides during treatments.
- Applicators should review, understand, and conform to the "Environmental Hazards" section on herbicide labels (this section warns of known pesticide risks and provides practical ways to avoid harm to organisms or the environment).
- To avoid negative effects to TEP plant species from off-site drift, surface runoff, and/or wind erosion, suitable buffer zones should be established between treatment sites and populations (confirmed or suspected) of TEP plant species, and site-specific precautions should be taken (refer to the guidance provided below).
- Follow all instructions and Standard Operating Procedures (SOPs) to avoid spill and direct spray scenarios into aquatic habitats that support TEP plant species.
- Follow all BLM operating procedures for avoiding herbicide treatments during climatic conditions that would increase the likelihood of spray drift or surface runoff.

The following conservation measures refer to sites where broadcast spraying of herbicides, either by ground or aerial methods, is desired. Manual spot treatment of undesirable vegetation can occur within the listed buffer zones if it is determined by local biologists that this method of herbicide application would not pose risks to TEP plant species in the vicinity. Additional precautions during spot treatments of vegetation within habitats where TEP plant species occur should be considered while planning local treatment programs, and should be included as conservation measures in local-level NEPA documentation.

The buffer distances provided below are conservative estimates, based on the information provided by ERAs, and are designed to provide protection to TEP plants. Some ERAs used regression analysis to predict the smallest buffer distance to ensure no risks to TEP plants. In most cases, where regression analyses were not

performed, suggested buffers extend out to the first modeled distance from the application site for which no risks were predicted. In some instances the jump between modeled distances was quite large (e.g., 100 feet to 900 feet). Regression analyses could be completed at the local level using the interactive spreadsheets developed for the ERAs, using information in ERAs and for local site conditions (e.g., soil type, annual precipitation, vegetation type, and treatment method), to calculate more precise, and possibly smaller buffers for some herbicides.

2,4-D

- Because the risks associated with this herbicide were not assessed, do not spray within ½ mile of terrestrial plant species or aquatic habitats where TEP aquatic plant species occur.
- Do not use aquatic formulations in aquatic habitats where TEP aquatic plant species occur.
- Assess local site conditions when evaluating the risks from surface water runoff to TEP plants located within ½ mile down gradient from the treatment area.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Bromacil

- Do not apply within 1,200 feet of terrestrial TEP plant species.
- If using a low boom at the typical application rate, do not apply within 100 feet of an aquatic habitat in which

TEP plant species occur.

- If using a low boom at the maximum application rate or a high boom, do not apply within 900 feet of an aquatic habitat in which TEP plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Chlorsulfuron

- Do not apply by ground methods within 1,200 feet of terrestrial TEP species.
- Do not apply by aerial methods within 1,500 feet of terrestrial TEP species.
- Do not apply by ground methods within 25 feet of aquatic habitats where TEP plant species occur.
- Do not apply by aerial methods at the maximum application rate within 300 feet of aquatic habitats where

TEP plant species occur.

- Do not apply by aerial methods at the typical application rate within 100 feet of aquatic habitats where TEP
  plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Clopyralid

- Since the risks associated with using a high boom are unknown, use only a low boom during ground applications of this herbicide within ½ mile of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.
- Do not apply by ground methods at the typical application rate within 900 of terrestrial TEP species.
- Do not apply by ground methods at the typical application rate within ½ mile of terrestrial TEP species.
- Do not apply by aerial methods within ½ mile of terrestrial TEP species.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Dicamba

- If using a low boom at the typical application rate, do not apply within 1,050 feet of terrestrial TEP plant species.
- If using a low boom at the maximum application rate, do not apply within 1,050 feet of terrestrial TEP plant species.
- If using a high boom, do not apply within 1,050 feet of terrestrial TEP plant species.
- Do not apply within 25 feet of aquatic habitats where TEP plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Diflufenzopyr

- If using a low boom at the typical application rate, do not apply within 100 feet of terrestrial TEP plant species.
- If using a high boom, or a low boom at the maximum application rate, do not apply within 900 feet of terrestrial TEP plant species.
- If using a high boom, do not apply within 500 feet of terrestrial TEP plant species.
- Do not apply within 25 feet of aquatic habitats where TEP plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Diquat

- Do not use in aquatic habitats where TEP aquatic plant species occur.
- Do not apply by ground methods within 1,000 feet of terrestrial TEP species at the maximum application rate.
- Do not apply by ground methods within 900 feet of terrestrial TEP species at the typical application rate.
- Do not apply by aerial methods within 1,200 feet of terrestrial TEP species.

Diuron

- Do not apply within 1,100 feet of terrestrial TEP species.

- If using a low boom at the typical application rate, do not apply within 900 feet of aquatic habitats where

TEP aquatic plant species occur.

- If using a high boom, or a low boom at the maximum application rate, do not apply within 1,1000 feet of aquatic habitats where TEP aquatic plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Fluridone

- Since effects on terrestrial TEP plant species are unknown, do not apply within ½ mile of terrestrial TEP species.

Glyphosate

- Since the risks associated with using a high boom are unknown, use only a low boom during ground applications of this herbicide within ½ mile of terrestrial TEP plant species.
- Do not apply by ground methods at the typical application rate within 50 feet of terrestrial TEP plant species.
- Do not apply by ground methods at the maximum application rate within 300 feet of terrestrial TEP plant species.
- Do not apply by aerial methods within 300 feet of terrestrial TEP plant species.

Hexazinone

- Since the risks associated with using a high boom or an aerial application are unknown, only apply this herbicide by ground methods using a low boom within ½ mile of terrestrial TEP plant species and aquatic habitats that support aquatic TEP species.
- Do not apply by ground methods at the typical application rate within 300 feet of terrestrial TEP plant species or aquatic habitats that support aquatic TEP plant species.
- Do not apply by ground methods at the maximum application rate within 900 feet of terrestrial TEP plant species or aquatic habitats that support aquatic TEP plant species.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Imazapic

- Do not apply by ground methods within 25 feet of terrestrial TEP species or aquatic habitats where TEP plant species occur.
- Do not apply by helicopter at the typical application rate within 25 feet of terrestrial TEP plant species.
- Do not apply by helicopter at the maximum application rate, or by plane at the typical application rate, within 300 feet of terrestrial TEP plant species.

- Do not apply by plane at the maximum application rate within 900 feet of terrestrial TEP species.
- Do not apply by aerial methods at the maximum application rate within 300 feet of aquatic TEP species.
- Do not apply by aerial methods at the typical application rate within 100 feet of aquatic TEP species.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Imazapyr

- Since the risks associated with using a high boom are unknown, use only a low boom for ground applications of this herbicide within ½ mile of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.
- Do not apply at the typical application rate, by ground or aerial methods, within 900 feet of terrestrial TEP
  plant species or aquatic habitats in which aquatic TEP species occur.
- Do not apply at the maximum application rate, by ground or aerial methods, within ½ mile of terrestrial TEP
  plant species or aquatic habitats in which aquatic TEP species occur.
- Do not use aquatic formulations in aquatic habitats where TEP aquatic plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Metsulfuron Methyl

- Since the risks associated with using a high boom are unknown, use only a low boom for ground applications of this herbicide within ½ mile of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.
- Do not apply at the typical application rate, by ground or aerial methods, within 900 feet of terrestrial TEP plant species or aquatic habitats in which aquatic TEP species occur.
- Do not apply at the maximum application rate, by ground or aerial methods, within ½ mile of terrestrial TEP
  plant species or aquatic habitats in which aquatic TEP species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Overdrive®

- If using a low boom at the typical application rate, do not apply within 100 feet of terrestrial TEP plant species.
- If using a low boom at the maximum application rate, do not apply within 900 feet of terrestrial TEP plant species.

- If using a high boom, do not apply within 900 feet of terrestrial TEP plant species.
- Do not apply within 25 feet of aquatic habitats where TEP plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Picloram

- Do not apply by ground or aerial methods, at any application rate, within ½ mile of terrestrial TEP plant species.
- Assess local site conditions when evaluating the risks from surface water runoff to TEP plants located within ½ mile down gradient from the treatment area.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Sulfometuron Methyl

- Do not apply by ground or aerial methods within 1,500 feet of terrestrial TEP species.
- Do not apply by ground methods within 900 feet of aquatic habitats where TEP plant species occur, or by aerial methods within 1,500 feet of aquatic habitats where TEP plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Tebuthiuron

- If using a low boom at the typical application rate, do not apply within 25 feet of terrestrial TEP plant species.
- If using a low boom at the maximum application rate or a high boom at the typical application rate, do not apply within 50 feet of terrestrial TEP plant species.
- If using a high boom at the maximum application rate, do not apply within 900 feet of terrestrial TEP plant species.
- Do not apply within 25 feet of aquatic habitats where TEP plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Triclopyr Acid

- Since the risks associated with using a high boom are unknown, use only a low boom during ground applications of this herbicide within ½ mile of terrestrial TEP plant species.
- Since the risks associated with using a high boom are unknown, use only a low boom during ground applications at the maximum application rate of this herbicide within ½ mile of aquatic habitats in which TEP plant species occur.
- Do not apply by ground methods at the typical application rate within 300 feet of terrestrial TEP plant species.

- Do not apply by aerial methods at the typical application rate within 500 feet of terrestrial TEP plant species.
- Do not apply by ground or aerial methods at the maximum application rate within ½ mile of terrestrial TEP
  plant species or aquatic habitats in which TEP plant species occur.
- If applying to aquatic habitats in which aquatic TEP plant species occur, do not exceed the targeted water concentration on the product label.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

Triclopyr BEE

- Since the risks associated with using a high boom are unknown, use only a low boom for ground applications of this herbicide within ½ mile of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.
- Do not apply by ground methods at the typical application rate within 300 feet of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.
- Do not apply by aerial methods at the typical application rate within 500 feet of terrestrial TEP plant species or aquatic habitats in which TEP plant species occur.
- Do not apply by ground or aerial methods at the maximum application rate within ½ mile of terrestrial TEP

plant species or aquatic habitats in which TEP plant species occur.

- Do not use aquatic formulations in aquatic habitats where TEP aquatic plant species occur.
- In areas where wind erosion is likely, do not apply within ½ mile of TEP plant species.

The information provided in Table 4-4 provides a general guideline as to the types of habitats in which treatments (particularly fire) may be utilized to improve growing conditions for TEP plant species. However, at the local level, the BLM must make a further determination as to the suitability of vegetation treatments for the populations of TEP species that are managed by local offices. The following information should be considered: the timing of the treatment in relation to the phenology of the TEP plant species; the intensity of the treatment; the duration of the treatment; and the tolerance of the TEP species to the particular type of treatment to be used. When information about species tolerance is unavailable or is inconclusive, local offices must assume a negative effect to plant populations, and protect those populations from direct exposure to the treatment in question.

Treatment plans must also address the presence of and expected impacts on noxious weeds on the project site. These plans must be coordinated with BLM weed experts and/or appropriate county weed supervisors to minimize the spread of weeds.

In order to prevent the spread of noxious weeds and other unwanted vegetation in occupied or suitable habitat, the following precautions should be taken:

- Cleared areas that are prone to downy brome or other noxious weed invasions should be seeded with an appropriate seed mixture to reduce the probability of noxious weeds or other undesirable plants becoming established on the site.
- Where seeding is warranted, bare sites should be seeded as soon as appropriate after treatment, and at a time of year when it is likely to be successful.
- In suitable habitat for TEP species, non-native species should not be used for revegetation.
- Certified noxious weed seed free seed must be used in suitable habitat, and preference should be given to seeding appropriate plant species when rehabilitation is appropriate.
- Straw and hay bales used for erosion control in suitable habitat must be certified weed- and seed-free.
- Vehicles and heavy equipment used during treatment activities should be washed prior to arriving at a new location to avoid the transfer of noxious weeds.

When BAs are drafted at the local level for treatment programs, additional conservation measures may be added to this list. Where BLM plans that consider the effects of vegetation treatments on TEP plant species already exist, these plans should be consulted, and incorporated (e.g., any guidance or conservation measures they provide) into local level BAs for vegetation treatments.

Conservation Measures for Aquatic Animals (BLM 2007d)

Many local BLM offices already have management plans in place that ensure the protection of these species, and have completed formal or informal consultations on similar treatment activities. These consultations have identified protection zones alongside aquatic habitats that support these species. The conservation measures discussed below are probable steps required of the BLM to ensure that vegetation treatments would minimize impacts to TEP species. These conservation measures are intended as broad guidance at the programmatic level; further analysis of treatment programs and species habitats at the local level is required to better reduce potential impacts from proposed vegetation treatments. Completion of consultation at the local level will fine-tune conservation measures associated with treatment activities and ensure consistency of the treatments with ESA requirements.

The aquatic TEP species considered in this programmatic BA occur in varied habitats, over a large geographic area. The conservation measures guidance presented below is intended to apply broadly to aquatic species and habitats over the entire region covered by this BA, based on the common features found in nearly all aquatic and riparian habitats. Some species with alternate or unusual habitat requirements may require additional conservation measures to ensure a Not Likely to Adversely Affect determination at the local level. Such additional conservation measure are outside the scope of this BA, and will be completed at the local level.

Some local BLM plans have delineated protected riparian areas, or portions of watersheds where riparian- dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines (USDA Forest Service 1995). These protected riparian areas include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems by 1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams; 2) providing root strength for channel stability; 3) shading the stream; and 4) protecting water quality. Examples of protected riparian areas are the BLM's Riparian Reserves of the Pacific Northwest and the Interior Columbia Basin, as described in the Aquatic Conservation Strategy (USDA Forest Service and USDI BLM 1994). The term "riparian areas," as used in the conservation measures guidance below, refers to riparian protected areas, wherever such designations apply. However, since not all local BLM plans have made such designations, "riparian areas," when the above-mentioned use is not applicable, generally refers to: 1) for streams, the stream channel and the extent of the 100-year floodplain; and 2) for wetlands, ponds, and lakes, and other aquatic habitats, the area extending to the edges of the riparian vegetation, provided it is no less than the minimum buffer distance for a given site established by local BLM biologists.

Conservation Measures for Site Access and Fueling/Equipment Maintenance
For treatments occurring in watersheds with TEP species or designated or undesignated critical habitat (i.e., unoccupied habitat critical to species recovery):

- Where feasible, access work site only on existing roads, and limit all travel on roads when damage to the road surface will result or is occurring.
- Where TEP aquatic species occur, consider ground-disturbing activities on a case by case basis, and implement SOPs to ensure minimal erosion or impact to the aquatic habitat.
- Within riparian areas, do not use vehicle equipment off of established roads.
- Outside of riparian areas, allow driving off of established roads only on slopes of 20% or less.
- Except in emergencies, land helicopters outside of riparian areas.
- Within 150 feet of wetlands or riparian areas, do not fuel/refuel equipment, store fuel, or perform equipment maintenance (locate all fueling and fuel storage areas, as well as service landings outside of protected riparian areas).

- Prior to helicopter fueling operations prepare a transportation, storage, and emergency spill plan and obtain the appropriate approvals; for other heavy equipment fueling operations use a slip-tank not greater than 250 gallons; Prepare spill containment and cleanup provisions for maintenance operations.
- Do not conduct biomass removal (harvest) activities that will alter the timing, magnitude, duration, and spatial distribution of peak, high, and low flows outside the range of natural variability.

Conservation Measures Related to Revegetation Treatments

- Outside riparian areas, avoid hydro-mulching within buffer zones established at the local level. This precaution will limit adding sediments and nutrients and increasing water turbidity.
- Within riparian areas, engage in consultation at the local level to ensure that revegetation activities incorporate knowledge of site-specific conditions and project design.

Conservation Measures Related to Herbicide Treatments

The complexity of this action within riparian areas requires local consultation, which will be based on herbicide risk assessments.

Possible Conservation Measures:

- Maintain equipment used for transportation, storage, or application of chemicals in a leak proof condition.
- Do not store or mix herbicides, or conduct post-application cleaning within riparian areas.
- Ensure that trained personnel monitor weather conditions at spray times during application.
- Strictly enforce all herbicide labels.
- Do not broadcast spray within 100 feet of open water when wind velocity exceeds 5 mph.
- Do not broadcast spray when wind velocity exceeds 10 mph.
- Do not spray if precipitation is occurring or is imminent (within 24 hours).
- Do not spray if air turbulence is sufficient to affect the normal spray pattern.
- Do not broadcast spray herbicides in riparian areas that provide habitat for TEP aquatic species. Appropriate buffer distances should be determined at the local level to ensure that overhanging vegetation that provides habitat for TEP species is not removed from the site. Buffer distances provided as conservation measures in the assessment of effects to plants (Chapter 4 of this BA) and fish and aquatic invertebrates should be consulted as guidance (Table 5-5). (Note: the Forest Service did not determine appropriate buffer distances for TEP fish and aquatic invertebrates when evaluating herbicides in Forest Service ERAs; buffer distances were only determined for non-TEP species.)
- Do not use diquat, fluridone, terrestrial formulations of glyphosate, or triclopyr BEE, to treat aquatic vegetation in habitats where aquatic TEP species occur or may potentially occur.

- Avoid using glyphosate formulations that include R-11 in the future, and either avoid using any formulations with POEA, or seek to use the formulation with the lowest amount of POEA available, to reduce risks to aquatic organisms.
- Follow all instructions and SOPs to avoid spill and direct spray scenarios into aquatic habitats. Special care should be followed when transporting and applying 2,4-D, bromacil, clopyralid, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, tebuthiuron, and triclopyr.
- Do not broadcast spray diuron, glyphosate, picloram, or triclopyr BEE in upland habitats adjacent to aquatic habitats that support (or may potentially support) aquatic TEP species under conditions that would likely result in off-site drift.
- In watersheds that support TEP species or their habitat, do not apply bromacil, diuron, tebuthiuron, or triclopyr BEE in upland habitats within ½ mile upslope of aquatic habitats that support aquatic TEP species under conditions that would likely result in surface runoff.

Numerous conservation measures were developed from information provided in ERAs. The measures listed below would apply to TEP fish and other aquatic species at the programmatic level in all 17 western states. However, local BLM field offices could use interactive spreadsheets and other information contained in the ERAs to develop more site-specific conservation measures and management plans based on local conditions (soil type, rainfall, vegetation type, and herbicide treatment method). It is possible that conservation measures would be less restrictive than those listed below if local site conditions were evaluated using the ERAs when developing project-level conservation measures.

TABLE 5-5
Buffer Distances to Minimize Risks to Threatened, Endangered, and Proposed Fish and Aquatic Invertebrates from Off-site Drift of BLM-Evaluated Herbicides from Broadcast and Aerial Treatments

Application Scenario	BROM[1]	CHLR	DICA	DIFLU	DIQT	DIUR	FLUR	IMAZ	OVER	SULF	TEBU
Minimum Buffer Distance (feet) from TEP Fish and Aquatic Invertebrates											
Typical Application Rate											
Aerial	NA	0	NA	NA	NA	NA	NA	0	NA	0	NA
Low boom	0	0	0	0	NA	0	NA	0	0	0	0
High boom	0	0	0	0	NA	100	NA	0	0	0	0
Maximum Application Rate											
Aerial	NA	0	NA	NA	NA	NA	NA	0	NA	0	NA
Low boom	0	0	0	0	NA	100	NA	0	0	0	0
High boom	0	0	0	0	NA	900	NA	0	0	0	0

[1] BROM = Bromacil; CHLR = Chlorsulfuron; DICA = Dicamba; DIFLU = Diflufenzopyr; DIQT = Diquat; DIUR - Diuron; FLUR = Fluridone; IMAZ = Imazapic; OVER = Overdrive®; SULFM = Sulfometuron methyl; and TEBU = Tebuthiuron.
Boom height = The Tier I ground application model allows selection of a low (20 in) or a high (50 in) boom height.
NA = Not applicable.
Sources: Ecological risk assessments for herbicides (Syracuse Environmental Research Associates, Inc. 2001; ENSR 2005a-

Conservation Measures Related to Non-herbicide Treatments

Conservation Measures Related to Prescribed Fire

Within riparian areas, in watersheds with TEP species or their habitats:

- Conduct prescribed burning only when long-term maintenance of the riparian area is the primary objective, and where low intensity fires can be maintained.
- Do not construct black lines, except by non-mechanized methods.
- Utilize/create only the following firelines: natural barriers; hand-built lines parallel to the stream channel and outside of buffer zones established at the local level; or hand built lines perpendicular to the stream channel with waterbars and the same distance requirement.
- Do not ignite fires using aerial methods.
- In forested riparian areas, keep fires to low severity levels to ensure that excessive vegetation removal does not occur.
- Do not camp, unless allowed by local consultation.
- Have a fisheries biologist determine whether pumping activity can occur in streams with TEP species.
- During water drafting/pumping, maintain a continuous surface flow of the stream that does not alter original wetted stream width.
- Do not alter dams or channels in order to pump in streams occupied by TEP species.
- Do not allow helicopter dipping from waters occupied by TEP species, except in lakes outside of the spawning period.
- Consult with a local fisheries biologist prior to helicopter dipping in order to avoid entrainment and harassment of TEP species.

Conservation Measures Related to Mechanical Treatments

Note: these measures apply only to treatments occurring in watersheds that support TEP species or in unoccupied habitat critical to species recovery (including but not limited to critical habitat, as designated by USFWS).

Outside riparian areas in watersheds with TEP species or designated or undesignated critical habitat (i.e., unoccupied habitat critical to species recovery):

- Conduct soil-disturbing treatments only on slopes of 20% or less, where feasible.
- Do not conduct log hauling activities on native surface roads prone to erosion, where feasible.

Within riparian areas in these watersheds, more protective measures will be required to avoid negatively affecting TEP species or their habitat:

- Do not use vehicles or heavy equipment, except when crossing at established crossings.
- Do not remove large woody debris or snags during mechanical treatment activities.
- Do not conduct ground disturbing activities (e.g., disking, drilling, chaining, and plowing).

- Ensure that all mowing follows guidance to avoid negative effects to streambanks and riparian vegetation and major effects to streamside shade.
- Do not use equipment in perennial channels or in intermittent channels with water, except at crossings that already exist.
- Leave suitable quantities (to be determined at the local level) of excess vegetation and slash on site.
- Do not apply fertilizers or seed mixtures that contain chemicals by aerial methods.
- Do not apply fertilizer within 25 feet of streams and supersaturated soils; apply fertilizer following labeling instructions.
- Do not apply fertilizer in desert habitats.
- Do not completely remove trees and shrubs.

Conservation Measures Related to Biological Control Treatments using Livestock
For treatments occurring in watersheds that support TEP species or in critical habitat:

- Where terrain permits, locate stock handling facilities, camp facilities, and improvements at least 300 feet from lakes, streams, and springs.
- Educate stock handlers about at-risk fish species and how to minimize negative effects to the species and their associated habitat.
- Employ appropriate dispersion techniques to range management, including judicial placement of salt blocks, troughs, and fencing, to prevent damage to riparian areas but increase weed control.
- Equip each watering trough with a float valve.

Within riparian areas of these watersheds, more protective measures are required.

- Do not conduct weed treatments involving domestic animals, except where it is determined that these treatments will not damage the riparian system, or will provide long-term benefits to riparian and adjacent aquatic habitats.
- Do not locate troughs, storage tanks, or guzzlers near streams with TEP species, unless their placement will enhance weed-control effectiveness without damaging the riparian system.

Local BLM offices should design conservation measures for treatment plans using the above conservation measures as guidance, but altering it as needed based on local conditions and the habitat needs of the particular TEP aquatic species that could be affected by the treatments. Locally-focused conservation measures would be necessary to reduce or avoid potential impacts such that a Not Likely to Adversely Affect determination would be reached during the local-level NEPA process. BLM offices that are responsible for the protection of Northwest salmonids are directed to the guidance document: Criteria for At-Risk Salmonids: National Fire Plan Activities, Version 2.1 (National Fire Plan Technical Team 2002), which contains detailed instructions for developing suitable conservation measures for these TEP species in conjunction with vegetation treatment programs, and from which many of the above-listed conservation measures were taken.

Conservation Measures for Terrestrial Animals (BLM 2007d)

Butterflies and Moths

Many local BLM offices already have management plans in place that ensure the protection of these species during activities on public lands. The following conservation measures are the minimum steps required of the BLM to ensure that treatment methods would be unlikely to negatively affect TEP species.

Each local BLM office is required to draw up management plans related to treatment activities that identify any TEP butterfly or moth species or their critical habitat that are present in the proposed treatment areas, as well as the measures that will be taken to protect these species.

Management plans should, at a minimum, follow this general guidance:

- Use an integrated pest management approach when designing programs for managing pest outbreaks.
- Survey treatment areas for TEP butterflies/moths and their host/nectar plants (suitable habitat) at the appropriate times of year.
- Minimize the disturbance area with a pre-treatment survey to determine the best access routes. Areas with butterfly/moth host plants and/or nectar plants should be avoided.
- Minimize mechanical treatments and OHV activities on sites that support host and/or nectar plants.
- Carry out vegetation removal in small areas, creating openings of 5 acres or less in size.
- Avoid burning all of a species' habitat in any 1 year. Limit area burned in butterfly/moth habitat in such a manner that the unburned units are of sufficient size to provide a refuge for the population until the burned unit is suitable for recolonization. Burn only a small portion of the habitat at any one time, and stagger timing so that there is a minimum 2-year recovery period before an adjacent parcel is burned.
- Where feasible, mow or wet around patches of larval host plants within the burn unit to reduce impacts to larvae.
- In TEP butterfly/moth habitat, burn while butterflies and/or moths of concern are in the larval stage, when the organisms would receive some thermal protection.
- Wash equipment before it is brought into the treatment area.
- Use a seed mix that contains host and/or nectar plant seeds for road/site reclamation.
- To protect host and nectar plants from herbicide treatments, follow recommended buffer zones and other conservation measures for TEP plants species when conducting herbicide treatments in areas where populations of host and nectar plants occur.

- Do not broadcast spray herbicides in habitats occupied by TEP butterflies or moths; do not broadcast spray herbicides in areas adjacent to TEP butterfly/moth habitat under conditions when spray drift onto the habitat is likely.
- Do not use 2,4-D in TEP butterfly/moth habitat.
- When conducting herbicide treatments in or near habitat used by TEP butterflies or moths, avoid use of the following herbicides, where feasible: bromacil, clopyralid, diquat, diuron, glyphosate, hexazinone, imazapyr, picloram, tebuthiuron, and triclopyr.
- If conducting manual spot applications of diquat, diuron, glyphosate, hexazinone, tebuthiuron, or triclopyr to vegetation in TEP butterfly or moth habitat, utilize the typical, rather than the maximum, application rate.

Amphibians and Reptiles

Many local BLM offices already have management plans in place that ensure the protection of these species during activities on public lands. In addition, the following conservation measures are the minimum steps required of the BLM to ensure that treatment methods would be unlikely to negatively affect TEP species.

Conservation measures:

- Survey all areas that may support TEP amphibians and/or reptiles prior to treatments.
- Conduct burns during periods when the animals are in aquatic habitats or are hibernating in burrows.
- For species with extremely limited habitat, such as the desert slender salamander, avoid prescribed burning in known habitat.
- Do not use water from aquatic habitats that support TEP amphibians and/or reptiles for fire abatement.
- Install sediment traps upstream of aquatic habitats to minimize the amount of ash and sediment entering aquatic habitats that support TEP species.
- Do not conduct prescribed burns in desert tortoise habitat.
- In habitats where aquatic herpetofauna occur, implement all conservation measures identified for aquatic organisms in Chapter 4.
- Within riparian areas, wetlands, and aquatic habitats, conduct herbicide treatments only with herbicides that are approved for use in those areas.
- Do not broadcast spray herbicides in riparian areas or wetlands that provide habitat for TEP herpetofauna.
- Do not use diquat, fluridone, glyphosate, or triclopyr BEE to treat aquatic vegetation in habitats where TEP amphibians occur or may potentially occur.
- In desert tortoise habitat, conduct herbicide treatments during the period when desert tortoises are less active.
- To the greatest extent possible, avoid desert tortoise burrows during herbicide treatments.

- When conducting herbicide treatments in upland areas adjacent to aquatic or wetland habitats that support TEP herpetofauna, do not broadcast spray during conditions under which off-site drift is likely.
- In watersheds where TEP amphibians occur, do not apply bromacil, diuron, or triclopyr BEE in upland habitats upslope of aquatic habitats that support (or may potentially support) TEP amphibians under conditions that would likely result in surface runoff.
- Follow all instructions and SOPs to avoid spill and direct spray scenarios into aquatic habitats that support TEP herpetofauna.
- Do not use 2,4-D in terrestrial habitats occupied by TEP herpetofauna; do not broadcast spray 2,4-D within ¼ mile of terrestrial habitat occupied by TEP herpetofauna.
- When conducting herbicide treatments in or near terrestrial habitat occupied by TEP herpetofauna, avoid using the following herbicides, where feasible: clopyralid, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, and triclopyr.
- When conducting herbicide treatments in upland habitats occupied by TEP herpetofauna, do not broadcast spray 2,4-D, clopyralid, glyphosate, hexazinone, picloram or triclopyr; do not broadcast spray these herbicides in areas adjacent to habitats occupied by TEP herpetofauna under conditions when spray drift onto the habitat is likely.
- If conducting manual spot applications of glyphosate, hexazinone, or triclopyr to vegetation in upland habitats occupied by TEP herpetofauna, utilize the typical, rather than the maximum, application rate.
- If spraying imazapyr or metsulfuron methyl in or adjacent to upland habitats occupied by TEP herpetofauna, apply at the typical, rather than the maximum, application rate.
- If conducting herbicide treatments in or near upland habitats occupied by TEP herpetofauna, consult Table 6-3 on a species by species basis to determine additional conservation measures that should be enacted to avoid negative effects via ingestion of contaminated prey.

Riparian Species: Least Bell's Vireo, Inyo California Towhee, and Southwestern Willow Flycatcher

To minimize or avoid negative effects to the least Bell's vireo, Inyo California towhee, and southwestern willow flycatcher, the BLM would be required to implement the following programmatic-level conservation measures in habitats utilized by these three species.

- Conduct surveys prior to vegetation treatments within potential or suitable habitat.
- Where surveys detect birds, do not burn, broadcast spray herbicides, use domestic animals to control weeds, or conduct mechanical treatments.
- Do not conduct vegetation treatments within ½ mile (or further if deemed necessary to prevent smoke from inundating the nest area) of known nest sites

or unsurveyed suitable habitat during the breeding season (as determined by a qualified wildlife biologist).

- Adjust spatial and temporal scales of treatments to that not all suitable habitat is affected in any given year.
- Following treatments, replant or reseed treated areas with native species, if needed.
- Closely follow all application instructions and use restrictions on herbicide labels; in wetland habitats use only those herbicides that are approved for use in wetlands.
- Do not use 2,4-D in least Bell's vireo, Inyo California towhee, or southwestern willow flycatcher habitats; do not broadcast spray 2,4-D within ¼ mile of least Bell's vireo, Inyo California towhee, or southwestern willow flycatcher habitat.
- Where feasible, avoid use of the following herbicides in least Bell's vireo, Inyo California towhee, and southwestern willow flycatcher habitat: bromacil, clopyralid, diquat, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, tebuthiuron, and triclopyr.
- Do not broadcast spray clopyralid, diquat, diuron, glyphosate, hexazinone, picloram, or triclopyr in least Bell's vireo or southwestern willow flycatcher habitat; do not broadcast spray these herbicides in areas adjacent to least Bell's vireo or southwestern willow flycatcher habitat under conditions when spray drift onto the habitat is likely.
- Do not broadcast spray clopyralid, diquat, glyphosate, hexazinone, picloram, or triclopyr in Inyo California towhee habitat; do not broadcast spray these herbicides in areas adjacent to Inyo California towhee habitat under conditions when spray drift onto the habitat is likely.
- If broadcast spraying imazapyr or metsulfuron methyl in or adjacent to least Bell's vireo or southwestern willow flycatcher habitat, apply at the typical, rather than the maximum, application rate.
- If broadcast spraying bromacil, diuron, imazapyr, metsulfuron methyl, or tebuthiuron in or adjacent to Inyo California towhee habitat, apply at the typical, rather than the maximum, application rate.
- If conducting manual spot applications of glyphosate, hexazinone, or triclopyr to vegetation in least Bell's vireo, Inyo California towhee, or southwestern willow flycatcher habitat, utilize the typical, rather than the maximum, application rate.

Additional, project-specific conservation measures would be developed at the local level to ensure protection of these species during treatment activities.

California Condor

In order to avoid or minimize negative effects to the California condor, the BLM would be required to implement the programmatic level conservation measures listed below.

- In areas where effects to breeding California condors may occur, do not burn until nesting is completed (Dodd 1986).

- Restrict human activity within 1.5 miles of California condor nest sites (Snyder et al. 1986).
- Do not use 2,4-D in California condor habitats; do not broadcast spray 2,4-D within ¼ mile of California condor habitat.
- Where feasible, avoid use of the following herbicides in California condor habitat: bromacil, clopyralid, diquat, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, and triclopyr.
- Do not broadcast spray clopyralid, diuron, glyphosate, hexazinone, picloram, or triclopyr in California condor habitat; do not broadcast spray these herbicides in areas adjacent to California condor habitat under conditions when spray drift onto the habitat is likely.
- If broadcast spraying bromacil, diquat, imazapyr, or metsulfuron methyl in or adjacent to California condor habitat, apply at the typical, rather than the maximum, application rate.
- If conducting manual spot applications of glyphosate, hexazinone, or triclopyr to vegetation in California condor habitat, utilize the typical, rather than the maximum, application rate.

Additional conservation measures would be developed at the project level, as appropriate.

Mature-forest Nesters: Marbled Murrelet, Northern Spotted Owl, and Mexican Spotted Owl

The following programmatic-level conservation measures are the minimum steps required of the BLM to ensure that treatment methods would be unlikely to negatively affect the marbled murrelet, northern spotted owl, or Mexican spotted owl.

- Survey for marbled murrelets, northern spotted owls, and Mexican spotted owls (and their nests) on suitable proposed treatment areas, prior to developing treatment plans.
- Delineate a 100-acre buffer around nests prior to mechanical treatments or prescribed burns.
- Do not allow human disturbance within ¼ mile of nest sites during the nesting period (as determined by a local biologist).
- Ensure that nest sites are at least 1 mile from downwind smoke effects during the nesting period.
- Protect and retain the structural components of known or suspected nest sites during treatments; evaluate each nest site prior to treatment and protect it in the most appropriate manner.
- Maintain sufficient dead and down material during treatments to support spotted owl prey species (minimums would depend on forest types, and should be determined by a wildlife biologist).
- Do not conduct treatments that alter forest structure in old-growth stands.
- Do not use 2,4-D in marbled murrelet, northern spotted owl, or Mexican spotted owl habitats; do not broadcast spray 2,4-D within ¼ mile of marbled murrelet, northern spotted owl, or Mexican spotted owl habitat.

- Where feasible, avoid use of the following herbicides in northern spotted owl and Mexican spotted owl habitat: bromacil, clopyralid, diquat, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, and triclopyr.
- Where feasible, avoid use of the following herbicides in marbled murrelet habitat: clopyralid, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, and triclopyr.
- Do not broadcast spray clopyralid, glyphosate, hexazinone, picloram, or triclopyr in marbled murrelet, northern spotted owl, or Mexican spotted owl habitat; do not broadcast spray these herbicides in areas adjacent to marbled murrelet, northern spotted owl, or Mexican spotted owl habitat under conditions when spray drift onto the habitat is likely.
- Do not broadcast spray diuron in Mexican or northern spotted owl habitat; do not broadcast spray these herbicides in areas adjacent to Mexican or northern spotted owl habitat under conditions when spray drift onto the habitat is likely.
- If broadcast spraying imazapyr or metsulfuron methyl in or adjacent to marbled murrelet, northern spotted owl, or Mexican spotted owl habitat, apply at the typical, rather than the maximum, application rate.
- If broadcast spraying bromacil or diquat in or adjacent to Mexican or northern spotted owl habitat, apply at the typical, rather than the maximum, application rate.
- If conducting manual spot applications of glyphosate, hexazinone, or triclopyr to vegetation in marbled murrelet, northern spotted owl, or Mexican spotted owl habitat, utilize the typical, rather than the maximum, application rate.
- Follow all instructions and SOPs to avoid spill and direct spray scenarios into aquatic habitats, particularly marine habitats where murrelets forage for prey.

Additional conservation measures would be developed, as necessary, at the project level to fine-tune protection of these species.

Bald Eagle

The following programmatic level conservation measures are the minimum steps required of the BLM to ensure that treatment methods would not negatively affect the bald eagle or its habitat. Additional, site-specific conservation measures would also be developed at the local level, as appropriate.

- Do not allow human disturbance within a suitable buffer distance of known bald eagle nest sites during the breeding season (as determined by a qualified wildlife biologist). For active bald eagle nests in open country, buffer distances should be 1 mile. In other habitats, with a shorter line-of-site distance, buffer distances may be reduced, based on consultation with the USFWS.
- Do not allow ground disturbing activities within ½ mile of active roost sites year round,
- Avoid human disturbance within 1 mile of a winter roost during the wintering period (as determined by a qualified wildlife biologist).
- Complete treatment activities that must occur within 1 mile of a winter roost within the hours of 9 a.m. to 3 p.m., during the winter roosting period.

- Do not allow helicopter/aircraft activity within 1 mile of bald eagle nest sites or winter roost sites during the breeding or roosting period.
- Conduct prescribed burn activities in a manner that ensures that nest and winter roost sites are greater than 1 mile from downwind smoke effects.
- Do not cut trees within ¼ mile of any known nest trees.
- Do not use 2,4-D in bald eagle habitats; do not broadcast spray 2,4-D within ¼ mile of bald eagle habitat.
- Where feasible, avoid use of the following herbicides in bald eagle habitat: bromacil, clopyralid, diquat, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, and triclopyr.
- Do not broadcast spray clopyralid, diuron, glyphosate, hexazinone, picloram, or triclopyr in bald eagle habitat; do not broadcast spray these herbicides in areas adjacent to bald eagle habitat under conditions when spray drift onto the habitat is likely.
- If broadcast spraying bromacil, diquat, imazapyr, or metsulfuron methyl in or adjacent to bald eagle habitat, apply at the typical, rather than the maximum, application rate.
- If conducting manual spot applications of glyphosate, hexazinone, or triclopyr to vegetation in bald eagle habitat, utilize the typical, rather than the maximum, application rate.

Bats: Lesser Long-nosed Bat and Mexican Long-nosed Bat

In order to prevent or minimize the potential effects to lesser and Mexican long-nosed bats from vegetation treatments, the following conservation measures should be followed:

- Prior to treatments, survey all potentially suitable habitat for the presence of bats or their nectar plants.
- At the local level, incorporate protection of lesser and Mexican long-nosed bats into management plans developed for proposed treatment programs.
- Instruct all field personnel on the identification of bat nectar plants and the importance of their protection.
- Protect nectar plants from modification by treatment activities to the greatest extent possible. Do not remove nectar plants during treatments. Avoid driving over plants, piling slash on top of plants, burning, and using domestic animals to control weeds.
- Do not burn within a mile upwind of known bat roosts.
- To protect nectar plants and roost trees from herbicide treatments, follow recommended buffer zones and other conservation measures for TEP plant species in areas where populations of nectar plants and roost trees occur.
- Do not use 2,4-D, diquat, or diuron, in lesser or Mexican long-nosed bat habitats; do not broadcast spray these herbicides within ¼ mile of lesser or Mexican long-nosed bat habitat.

- Where feasible, avoid use of the following herbicides in lesser and Mexican long-nosed bat habitat: bromacil, clopyralid, fluridone, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, tebuthiuron, and triclopyr.
- Do not broadcast spray clopyralid, glyphosate, hexazinone, picloram, or triclopyr in lesser or Mexican long-nosed bat habitat; do not broadcast spray these herbicides in areas adjacent to lesser or Mexican long-nosed bat habitat under conditions when spray drift onto the habitat is likely.
- If broadcast spraying bromacil, imazapyr, or metsulfuron methyl, or tebuthiuron in or near lesser or Mexican long-nosed bat habitat, apply at the typical, rather than the maximum, application rate.
- If conducting manual spot applications of bromacil, diuron, glyphosate, hexazinone, tebuthiuron, or triclopyr to vegetation in lesser or Mexican long-nosed bat habitat, utilize the typical, rather than the maximum, application rate.
- If conducting spot treatments of herbicides in lesser or Mexican long-nosed bat habitats, avoid potential roost sites.

In addition, local BLM offices would be required to prepare site-specific conservation measures to protect these species prior to conducting treatments.

Grassland Ground-Burrowing Mammals: Kangaroo Rats, Utah Prairie Dog, and Black-footed Ferret

The following programmatic-level conservation measures would be required to ensure that the proposed vegetation treatments did not negatively affect listed kangaroo rat species, the Utah prairie dog, or the black-footed ferret, or their habitats:

- Prior to conducting vegetation treatments, survey areas scheduled to receive treatments for listed kangaroo rats, Utah prairie dogs, and black-footed ferrets.
- Incorporate these species and their habitat into management plans developed for treatment activities.
- Avoid vegetation treatments during drought conditions.
- Where possible, perform treatments during the hibernation period.
- Do not use 2,4-D in listed kangaroo rat, Utah prairie dog, or black-footed ferret habitats; do not broadcast spray 2,4-D within ¼ mile of listed kangaroo rat, Utah prairie dog, or black-footed ferret habitat.
- Do not use diquat or diuron in listed kangaroo rat or Utah prairie dog habitats; do not broadcast spray these herbicides within ¼ mile of listed kangaroo rat or Utah prairie dog habitat.

Additional conservation measures for kangaroo rats and the Utah prairie dog:

- Where feasible, avoid use of the following herbicides in listed kangaroo rat and Utah prairie dog habitat: bromacil, clopyralid, fluridone, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, tebuthiuron, and triclopyr.
- Do not broadcast spray clopyralid, glyphosate, hexazinone, picloram, or triclopyr in listed kangaroo rat or Utah prairie dog habitat; do not broadcast

spray these herbicides in areas adjacent to listed kangaroo rat or Utah prairie dog habitat under conditions when spray drift onto the habitat is likely.

- If broadcast spraying bromacil, imazapyr, fluridone, metsulfuron methyl, or tebuthiuron in or near listed kangaroo rat or Utah prairie dog habitat, apply at the typical, rather than the maximum, application rate.
- If conducting manual spot applications of bromacil, glyphosate, hexazinone, tebuthiuron, or triclopyr to vegetation in listed kangaroo rat or Utah prairie dog habitat, utilize the typical, rather than the maximum, application rate.

Additional conservation measures for the black-footed ferret:

- Where feasible, avoid use of the following herbicides in black-footed ferret habitat: bromacil, clopyralid, diquat, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, and triclopyr.
- Do not broadcast spray clopyralid, diuron, glyphosate, hexazinone, picloram, or triclopyr in black-footed ferret habitat; do not broadcast spray these herbicides in areas adjacent to black-footed ferret habitat under conditions when spray drift onto the habitat is likely.
- If broadcast spraying bromacil, diquat, imazapyr, or metsulfuron methyl in or near black-footed ferret habitat, apply at the typical, rather than the maximum, application rate.
- If conducting manual spot applications of glyphosate, hexazinone, or triclopyr to vegetation in black-footed ferret habitat, utilize the typical, rather than the maximum, application rate.

Individual projects would be subject to review at the local level, during which additional conservation measures could be identified as necessary to protect these species.

Bighorn Sheep

The following programmatic-level conservation measures are the minimum steps required of the BLM to ensure that bighorn sheep and their habitats would not be impacted by vegetation treatment activities. Additional project-specific conservation measures would be identified at the local level, as appropriate.

- Prior to treatment activities, survey suitable habitat for evidence of use by bighorn sheep.
- Do not use domestic animals as a vegetation treatment in bighorn sheep habitat.
- When planning vegetation treatments, minimize the creation of linear openings that could result in permanent travel ways for competitors and humans.
- Obliterate any linear openings constructed within bighorn sheep habitat in order to deter future uses by humans and competitive species.
- Where feasible, time vegetation treatments such that they do not coincide with seasonal use of the treatment area by bighorn sheep.
- Do not broadcast spray herbicides in key bighorn sheep foraging habitats.
- Do not use 2,4-D in bighorn sheep habitat; do not broadcast spray 2,4-D within ¼ mile of bighorn sheep habitat.

- Where feasible, avoid use of the following herbicides in bighorn sheep habitat: bromacil, clopyralid, diquat, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, Overdrive®, picloram, and tebuthiuron, and triclopyr.
- Do not broadcast spray bromacil, clopyralid, diquat, diuron, glyphosate, hexazinone, Overdrive®, picloram, or triclopyr in bighorn sheep habitat; do not broadcast spray these herbicides in areas adjacent to bighorn sheep habitat under conditions when spray drift onto the habitat is likely.
- If broadcast spraying imazapyr, metsulfuron methyl, or tebuthiuron in or near bighorn sheep habitat, apply at the typical, rather than the maximum, application rate.
- If conducting manual spot applications of glyphosate, hexazinone, imazapyr, metsulfuron methyl, tebuthiuron, or triclopyr to vegetation in bighorn sheep habitat, utilize the typical, rather than the maximum, application rate.

APPENDIX C NON-NATIVE PLANT SPECIES FOR GSENM

Family	Species	Common Name
Po [Gramineae]	Aegilops cylindrica	Jointed goatgrass
Po [Gramineae]	*Agropyron cristatum*	Crested wheatgrass
Po [Gramineae]	*Agrostis stolonifera*	Redtop bentgrass
Po [Gramineae]	*Alopecurus pratensis*	Meadow foxtail
Amaranth	*Amaranthus albus*	Pale amaranth
Amaranth	*Amaranthus retroflexus*	Redroot pigweed
Aster [Compositae)	*Arctium minus*	Burdock
Chenopodi	*Atriplex rosea*	Tumbling orach
Po [Gramineae]	*Avena fatua var. sativa*	Common oat
Chenopodi	*Bassia hyssopifolia*	Bassia
Chenopodi	*Bassia prostrata*	Prostrate summer-cypress
Chenopodi	*Bassia scoparia*	Summer-cypress
Po [Gramineae]	*Bothriochloa ischaemum*	Yellow bluestem
Po [Gramineae]	*Bromus hordeaceus*	Soft chess
Po [Gramineae]	*Bromus inermis*	Smooth brome
Po [Gramineae]	*Bromus japonicus*	Japanese chess
Po [Gramineae]	*Bromus rubens*	Red brome
Po [Gramineae]	*Bromus tectorum*	Cheatgrass
Brassic [Cruciferae]	*Capsella bursa-pastoris*	Shepherd's purse
Brassic [Cruciferae]	*Cardaria draba*	Whitetop
Aster [Compositae)	*Centaurea repens*	Russian knapweed [Hardheads]
Chenopodi	*Chenopodium album var. album*	Lambsquarter
Brassic [Cruciferae]	*Chorispora tenella*	Musk-mustard
Aster [Compositae)	*Cichorium intybus*	Chicory
Aster [Compositae)	*Cirsium vulgare*	Bull thistle
Api [Umbelliferae]	*Conium maculatum*	Poison-hemlock
Brassic [Cruciferae]	*Conringia orientalis*	Hare's ear mustard
Convolvul	*Convolvulus arvensis*	Bindweed
Po [Gramineae]	*Cynodon dactylon*	Bermuda-grass
Po [Gramineae]	*Dactylis glomerata*	Orchard grass
Brassic [Cruciferae]	*Descurainia sophia*	Flixweed
Brassic [Cruciferae]	*Draba verna*	Spring draba
Po [Gramineae]	*Echinochloa crus-galli*	Barnyard grass
Elaeagn	*Elaeagnus angustifolia*	Russian olive
Po [Gramineae]	*Elymus hispidus var. hispidus*	Intermediate wheatgrass
Po [Gramineae]	*Elymus junceus*	Russian wildrye
Po [Gramineae]	*Elymus repens*	Quackgrass

Family	Species	Common Name
Po [Gramineae]	*Eragrostis cilianensis*	Stinkgrass
Gerani	*Erodium cicutarium*	Storksbill
Brassic [Cruciferae]	*Erysimum repandum*	Spreading wallflower
Po [Gramineae]	*Festuca arundinacea*	Tall fescue
Po [Gramineae]	*Festuca pratensis*	Meadow fescue
Chenopodi	*Halogeton glomeratus*	Halogeton
Po [Gramineae]	*Hordeum marinum*	Mediterranean barley
Po [Gramineae]	*Hordeum murinum*	Rabbit barley
Aster [Compositae)	*Lactuca serriola*	Prickly lettuce
Boragin	*Lappula squarrosa*	European stickseed
Brassic [Cruciferae]	*Lepidium perfoliatum*	Peppergrass
Scrophulari	*Linaria dalmatica*	Dalmatian toadflax
Brassic [Cruciferae]	*Malcolmia africana*	African mustard
Malv	*Malva neglecta*	Cheeseweed
Lami [Labiatae]	*Marrubium vulgare*	Horehound
Fab [Leguminosae]	*Medicago lupulina*	Black medick
Fab [Leguminosae]	*Medicago sativa*	Alfalfa
Fab [Leguminosae]	*Melilotus alba*	White sweet-clover
Fab [Leguminosae]	*Melilotus officinalis*	Yellow sweet-clover
Lami [Labiatae]	*Mentha piperita*	Peppermint
Brassic [Cruciferae]	*Nasturtium officinale*	Water-cress
Aster [Compositae)	*Onopordum acanthium*	Scotch thistle
Po [Gramineae]	*Phleum pratense*	Timothy
Plantagin	*Plantago lanceolata*	English plantain
Plantagin	*Plantago major*	Broadleaf plantain
Po [Gramineae]	*Poa pratensis*	Kentucky bluegrass
Po [Gramineae]	*Poa trivialis*	Rough-stalked bluegrass
Polygon	*Polygonum aviculare*	Knotweed
Polygon	*Polygonum lapathifolium*	Willow-weed
Polygon	*Polygonum persicaria*	Ladysthumb
Po [Gramineae]	*Polypogon interruptus*	Ditch polypogon
Po [Gramineae]	*Polypogon monspeliensis*	Rabbitfoot grass
Po [Gramineae]	*Polypogon semiverticillatus*	Water polypogon
Po [Gramineae]	*Puccinellia distans*	Weeping alkaligrass
Ranuncul	*Ranunculus testiculatus*	Bur buttercup
Polygon	*Rumex crispus*	Curled dock
Chenopodi	*Salsola tragus*	Russian-thistle

Family	Species	Common Name
Ros	*Sanguisorba minor*	Burnet
Po [Gramineae]	*Schismus arabicus*	Arabian grass
Po [Gramineae]	*Secale cereale*	Cultivated rye
Po [Gramineae]	*Setaria viridis*	Green bristlegrass
Brassic [Cruciferae]	*Sisymbrium altissiumum*	Tumbling mustard
Solan	*Solanum nigrum*	Black nightshade
Aster [Compositae)	*Sonchus asper*	Spiny sow-thistle
Aster [Compositae)	*Sonchus uliginosus*	Meadow sow-thistle
Po [Gramineae]	*Sorghum halepense*	Johnson grass [Millet]
Tamaric	*Tamarix chinensis*	Salt-cedar [Tamarisk]
Tamaric	*Tamarix parviflora*	Small-flowered tamarisk
Aster [Compositae)	*Taraxacum officinale*	Common dandelion
Aster [Compositae)	*Tragopogon dubius*	Yellow salsify
Zygophyll	*Tribulus terrestris*	Puncture vine
Fab [Leguminosae]	*Trifolium fragiferum*	Strawberry clover
Fab [Leguminosae]	*Trifolium pratense*	Red clover
Fab [Leguminosae]	*Trifolium repens*	White clover
Po [Gramineae]	*Triticum aestivum*	Wheat
Ulm	*Ulmus pumila*	Siberian elm
Scrophulari	*Verbascum thapsus*	Woolly mullein
Scrophulari	*Veronica anagallis-aquatica*	Water speedwell
Aster [Compositae)	*Helianthus pumilus*	Little sunflower
Brassic [Cruciferae]	*Lepidium virginicum var. pubescens*	Virginiacress
Portulac	*Portulaca oleracea*	Purslane

APPENDIX D ESCALANTE RIVER WATERSHED MONITORING METHODS

MONITORING METHODS AND ADAPTIVE MANAGEMENT

A series of monitoring protocols have been included ranging from fairly simple and inexpensive to complex and logistically difficult. Depending on the site, the goals of the particular project, and various logistics and access constraints, a subset of specific monitoring protocols can be chosen from the list below. This list is broken down into photo point monitoring, riparian ecosystem condition assessments, vegetation monitoring, wildlife, hydrology and geomorphology, and tamarisk leaf beetle monitoring. The simplest method, photo point monitoring, will be used in all control areas, as it is quick, simple and can potentially monitor both vegetation and geomorphology in a qualitative sense. The methods have been adopted from the Tamarisk Coalition unpublished methods, Coles-Ritchie (2008), Scott and Reynolds (2007), Brasher (2010), and Stacey et al. (2010). These methods are also those that have been adopted by the Dolores River Restoration Partnership and Action Plan (D-RAP).

The monitoring methods will be used to conduct both pre-treatment baseline sampling, and post-treatment effects and success of restoration, either passive or in some cases active. Past work will be integrated into the database for monitoring, including primarily a series of before and after photographic points. In the five year plan, additional monitoring methods will be incorporated into the control of RO. Each treatment project will include an analysis of the appropriate monitoring methods to be used to determine overall success, as well as needed statistical power. An MS Excel spreadsheet database will be developed to input all control and monitoring data. This database will be structured so that it can be easily imported into the main GIS database for mapping and analysis.

Monitoring methods are often used to determine the success or failure of specific management actions. For example, by using transect vegetation data collected both before and after RO removal, the response of native and other exotic species can be tracked over time. However, there is a tendency to simply collect monitoring data and then shelf it, without using it to inform management. Adaptive management approaches (see Susskind et al. 2010; Maris and Béchet 2010) emphasize the need to have clear goals, well designed monitoring methods, and data collection that can be used to inform management actions, thus allowing for more flexible responses to changing conditions compared with traditional management methods (Susskind et al. 2010). This approach requires clearly stated and achievable goals, and also a need for developing alternative scenario planning depending on what the results of monitoring show. In the WICP, one of the clearest examples of using adaptive management is in testing the assumption of passive restoration. Monitoring results should be able to detect whether native species are responding positively to RO control, and also if more active restoration will be needed. Given statistically robust data with sufficient power,

if passive restoration is shown to not work, active restoration at the site may be required. Thus, it is important to develop a set of monitoring criteria and guidelines to be used to examine the success or failure of each year's control and monitoring work, and that can be used to suggest alternative approaches or methods. An adaptive management component will be developed as part of the project to guide overall efforts to restore the Escalante River watershed.

1. Permanent Photo Points

Establish permanent photo points for repeat photography of vegetation/stream features and changes over time. Record location with GPS, provide sketch map showing site and how to get to it, provide information on bearing of photo, camera type, height, picture size, etc. Attachment E shows some historical photo monitoring of the Calf Creek-Escalante River confluence over time.

2. Vegetation Monitoring

For most riparian sites, linear dimensionless transects can be used. Starting from a random point, place cross-channel transects ca. every 20-30 meters, up to 15-20 in an area. This number will provide sufficient data and power to make inferences about effects of control methods and restoration. If the site is structurally or compositionally heterogeneous, it should be stratified, then the number of transects are assigned roughly proportional to the size of each stratification unit. Position the first transect randomly, then place the remaining transects systematically at predetermined intervals. Place the beginning of each transect in the upland/riparian transition zone, and extend it across the stream to the transition zone on the other side. Along each transect, place a pole (2-3 m) at each 1.0 or 0.5 meter mark, and record substrate, live plant hits by species. Estimate for overhead canopy hits for taller species. At every meter read canopy coverage using either a densitometer or a spherical densiometer. Dead wood hits can also be recorded if needed.

3. Wildlife - Birds

VCP (variable circular plot) point counts will be used along 1-km transects, with 5 stations positioned 250 meters apart. At each station, all birds seen or heard will be recorded for 7 minutes along with distance from the observer. In order to relate vegetation composition and structure to bird data, at each station a circular 0.1 hectare plot will be delineated, and plant species abundances (canopy cover) and height recorded using a simple plot sampling (releve) approach.

4. Geomorphology and Hydrology

A. Cross-channel transect with transit/laser level for elevations: along vegetation transects/belts record at 0.5 meter intervals ground elevation using a transit

instrument on a tripod or on smaller streams a laser level with a 2-meter rod (see 2 RSRA method). This will provide a cross-channel profile of the site.

B. Cross-channel transect with transit/laser level for hydrology: along vegetation transects/belts record at 0.5 meter intervals water depth using a transit instrument on a tripod or on smaller streams a laser level with a 2-meter rod. This will provide a cross-channel profile of the wetted areas of the stream reach, including the thalweg.