Bureau of Indian Affairs

Western Region

DRAFT

Integrated Noxious Weed Management Plan

and

Programmatic Environmental Assessment for Weed Control Projects on Indian Lands*

*For the scope of this PEA, Indian land will also be used to include associated government land and rights-of-way. See discussion on the use of this term in Framework for Terms of Reference and Usage, after abstract.

Prepared by Bureau of Indian Affairs,
Western Regional Office
Division of Natural Resources
Phoenix, Arizona
May 2014

Abstract

The Bureau of Indian Affairs Noxious Weed Program annually provides funding for weed control objectives with nearly all funding going directly to individual tribes for noxious weed projects on their lands. This Draft Programmatic Environmental Assessment (PEA) evaluates noxious weed control projects within BIA Western Region funded by the BIA Noxious Weed Program and related cooperative projects with other internal and external entities. This includes, but is not limited to, cooperative projects with BIA Division of Forestry, Irrigation and Transportation, and tribal environmental, natural resources and land use planning departments. Cooperative projects may also take place with Cooperative Weed Management Areas (CWMA) and other federal, state and local entities.

The Integrated Noxious Weed Management Plan outlines the noxious weed control techniques to be carried out and describes control strategies for specific noxious weed species and management zones. The PEA evaluates potential impacts on the human and natural environment of one No-Action and two Action Alternatives for weed control projects on Indian lands within BIA Western Region. Alternative 1 (No-Action) indicates that no steps would be taken to reduce the spread of noxious weeds on Indian lands. The two Action Alternatives (Alternatives 2 & 3) include the use of Integrated Weed Management practices, but Alternative 3 excludes chemical or biological methods due to tribal preference or policy.

BIA Western Region and Western Region Tribes desire a cooperative and coordinated management process to actively monitor and control noxious weeds. The desired outcomes of the proposed action are healthy natural ecosystems to support tribal goals of protecting rangeland, agriculture, riparian systems, roads and forests for human health and safety, wildlife habitat, traditional cultural practices and economic and social well-being.

Framework for Terms of Reference and Usage

American Indian/Native American terminology-Although there is some cultural sensitivity with the usage of these terms, this PEA will use the term, American Indian. The terms, Indian landowner, Indian lands, American Indian Agriculture Resources Management Act (AIARMA) are all terms defined in the Code of Federal Regulations (CFR).

Best Management Practices-This term is used only in reference to fact sheets or information prepared by other agencies or authors, such as in Appendix E, Sec 8.5.4, Best Management Practices to Protect Groundwater from Pesticide Contamination, prepared by AZ Department of Environmental Quality.

Capitalization- The following is the protocol used in this PEA.

Animal and Plant Names

Common names-Words used to describe plant species are generally lower case. The exception to this is if the word used is the name of a person, group of persons or geographical location. (Example: Russian knapweed vs. spotted knapweed.)

Scientific names-The first name, the genus is capitalized, the second name, the species, is always lower case, even if it denotes a person or geographical place.

Tribe

This PEA will use the guidance from the Intertribal Council of Arizona http://itcaonline.com/wp-content/uploads/2011/03/TRIBES.pdf .

Always capitalize the word tribe when used in conjunction with a specific tribe or tribes. Also capitalize the word tribe or tribal if it refers to a specific tribe, tribal government or leader.

Reservation

Lowercase for generic meaning but uppercase for the name of a specific American Indian reservation.

Common and scientific plant names This PEA uses the common name for most weeds throughout the EA. There are a few exceptions. Scientific names are listed in Appendix K (Sec 8.12.4 BIA Western Region Noxious Weed list). Sometimes the common name is not adequate to describe the plant or the noxious weed may include several species of the same genus (Arundo is an example) so the scientific name is used.

Ecological Region (Ecoregion) Evaluation Since the evaluation area is over 12 million acres in Arizona, Nevada, Utah and parts of California, Oregon and Idaho, it takes in a variety of climates, water resources, geology, soil and vegetation patterns. Description of the Land and Living Resource factors for the Affected Environment section was completed using the Environmental Protection Agency (EPA) ecoregion approach. Level III ecoregions descriptions are used in this PEA. Ecological Region denotes areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. Ecoregion is an abbreviated and more commonly used form of the term, ecological region. Further description of this approach is in Section 3.1.

Land Ownership and Land Types-This PEA will be using the term "Indian land" to denote where weed control projects will take place. Noxious weed projects will be carried out on tribal trust, restricted tribal, allotted lands and government lands.

<u>Indian Land</u>
From 25 CFR 166.4 and 25 CFR 162.003 , Indian land means any tract in which any interest in the surface estate is owned by a tribe or individual Indian in trust or restricted status.

*For the scope of this PEA, Indian land will also be used to include associated government land and rights-of-way.

Noxious Weed/Invasive Species terminology-This PEA is evaluating the control of noxious weeds as opposed to invasive species. Noxious weeds are invasive plants defined by a legal entity. BIA Western Region has a Noxious Weed list of plants covered by the program with High, Medium and Low priority ratings. (Appendix K, Section 8.12.4) This list is based on the state Noxious Weed lists with input from tribes and BIA staff. No native plants are listed on the BIA Noxious Weed list. The terms invasive species or invasive plants are widely used in the literature and by many other programs and entities due to the broader context in which they can be used. Invasive plants (or weeds) are aggressive plants occurring in natural or disturbed environments as part of plant succession. They are often non-native but include some native species. This PEA uses those terms in that broader, scientific context but the actual plants targeted for control in this PEA are the noxious weeds, as defined by the BIA Noxious Weed program. Invasive species is even a broader term, taking in all invasive organisms including fish, mammals, birds, insects and plants.

Noxious Weed Treatment Guidelines-Is the term used to describe practices required or recommended by the BIA Noxious Weed Program. All Noxious Weed Treatment Guidelines are in Appendix O. Three checklists of treatment guidelines are in Section 8.15.3. Section 8.15.3.1, Noxious Weed Program Checklist, contains required practices that are part of the BIA Noxious Weed Program Criteria. Section 8.15.3.2 lists the criteria guidelines that are not required, but most grant applicants submit documentation that they carry out these practices in order to rate higher in the application process. Section 8.15.3.3, Checklist of Noxious Weed Treatment Guidelines, is a list of recommended practices.

Standard Operating Procedures (SOP) is a term used in this PEA only in conjunction with the BIA EMS system.

Saltcedar/Tamarisk-These two common names for *Tamarix spp.* are often used interchangeably. For consistency in this document, saltcedar was replaced with tamarisk except when it was part of a title in a reference document. The numerous species of Tamarix are described in Section 5.4.12., along with management strategies.

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1 Introduction

1.1 *Background and Location*

The Bureau of Indian Affairs (BIA), Western Region, (WR) holds twelve and a half million acres in trust for tribes in the states of Arizona, Nevada, Utah, California and Idaho. Map 1.1 shows the reservations located within BIA WR. BIA WR Division of Natural Resources personnel have the responsibility to provide natural resource management assistance to forty seven tribes in the Region. The BIA Noxious Weed Program provides annual funding for weed control projects. Western Regional Office (WRO) Division of Natural Resources coordinates the Noxious Weed Program for tribes and 13 BIA Agencies and tribes within Western Region. In 2009, the BIA Range and Agriculture Program determined the need to evaluate and outline weed management goals within the Region and to develop an environmental assessment of weed management alternatives.

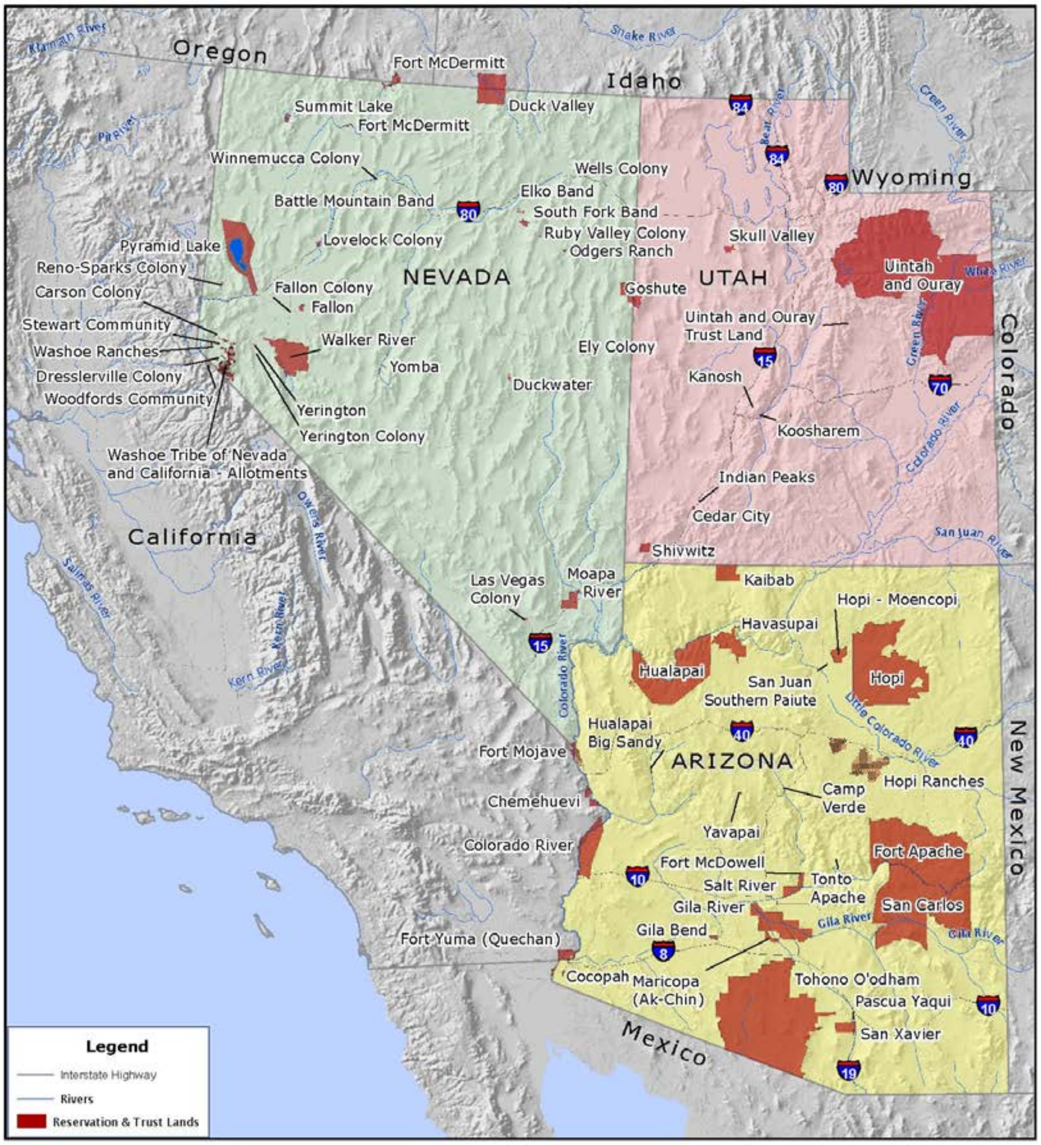
At least one million acres of Indian land are known to be infested with noxious weeds within BIA Western Region. Comprehensive vegetation inventories have not been completed, to date, and additional lands need to be monitored and assessed for invasive weeds. In addition to inventoried noxious weeds, there are large expanses of cheatgrass and other widespread invasive plants.

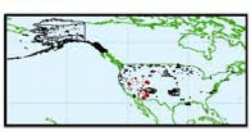
Damages to resources and economic costs of weed infestations have been well-documented in the literature. (Beck, 1994; Pimentel et al, 2005; Hole Weed Control, Undated; Klingman and Ashton as cited in Kelton & Price, 2009) Weedy plants interfere with the natural ecosystem and native wildlife habitat. They lower production for range cattle and farming enterprises. Disturbed weedy areas can be unsightly around housing, parks and schools. They encroach in riparian areas and hamper water flow and aesthetics. Many tribes are also concerned about the destruction of plants used for medicinal and healing purposes.

The BIA Noxious Weed program was initiated in December, 1988, in response to congressional directives for improved management on Indian lands. A BIA Task Force and 10-Year Management Plan was developed and put into the BIA Range and Agriculture Handbook.

The Acting Deputy Commissioner of Indian Affairs issued an Interim Policy in 1991 for the Noxious Weed Control Program. The Interim Policy directed the emphasis to on-the-ground accomplishments. Funds issued were to be used directly for weed control. The program has averaged a funding level of approximately two million dollars annually nation-wide. The funding is made available to tribes through Public Law (P.L.) 93-638 contracts or directly through BIA self-governance grants. Some of the funds are used for biological control research with workshops and insects provided to tribes. Program standards were set up by the BIA Central Office Agriculture and Range Program Leader with input from twelve Regional Noxious Weed coordinators. Oversight and assistance is provided by Regional and Agency field staff. Agency resource staff provides coordination and technical assistance with local tribes. Although the BIA Noxious Weed Program was originally designed to provide weed control funding to rangelands, changes to the program were made in 2008 to incorporate the importance of reducing weeds along roadways, trails and waterways.

Map 1.1 Western Region Reservations





The boundaries depicted on this map are for display purposes only. The legal title and existing legal maps, if any maps exist, are available from:

BIA Division of Land Titles and Records
P.O. Box 26567
Albuquerque, NM 87125
505 563-3262

American Indian Reservations
and Other Indian Trust Lands
Bureau of Indian Affairs Western Region
January 1, 2010

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The program encourages cooperation with other entities to augment the BIA funding. BIA Noxious Weed Program materials and guidelines are in Appendix K.

This Programmatic Environmental Assessment (PEA) will also cover projects carried out by the BIA Forestry Pest Management Program or Woodland Management grants. Several tribes combine both funding sources to improve woodland and riparian habitat. The BIA Forestry Pest Management Program was authorized in 1983. It assures that preventive measures are taken to reduce the hazard of pest damage and include a variety of forest management activities. The funding comes from the US Forest Service but requires the cooperation of the tribes and various levels of BIA to administer the program and funding. There are directives in the BIA Forestry Manual which apply to all Federal agencies participating in the management and protection of Indian forest lands. The appropriate Federal official must insure that program standards are met.

1.2 *Purpose and Need*

Chapter 39, 3701, 25 USC, American Indian Agriculture Resource Management, states that “the United States has a trust responsibility to protect, conserve, utilize and manage Indian agricultural lands…” In working with the Noxious Weed Program and obtaining feedback from tribes, the Western Regional Office, Natural Resource Division, determined that there was a need for assistance with environmental documentation for weed control projects. Tribes without staff or funding to complete an EA have been reluctant to apply for grants. Other tribes have older environmental documentation or were using categorical exclusions obtained years earlier.

The WRO Natural Resource Division determined a need for a cooperative and coordinated management process to implement tribally-driven management plans~~ ~~and~~ ~~incorporate methodical, science-based strategies to actively monitor and control noxious weeds. The programmatic environmental assessment process will identify common management strategies for particular weeds and groups of weeds in like management areas.

The planning process will bring together weed control stakeholders at the tribal, regional, state and local level. There are many entities carrying out weed control on Indian lands. Divisions within BIA, such as Transportation, Irrigation and Forestry, carry out weed control using their own methods and funding. This environmental process seeks to coordinate these efforts and pool resources and knowledge to work together instead of carrying out separate, isolated projects.

There are several federal agencies that provide weed control funding to tribes. Cost share from other federal, state and local agencies is vital for allowing the limited funding from BIA to go further in controlling weeds. Agencies with land adjacent to reservations, such as the Forest Service and Bureau of Land Management have consistent weed control budgets and a stake in controlling noxious weeds on nearby Indian lands. The other federal agencies have their own environmental documentation process. Inviting them to participate as reviewers will help foster communication and coordination for the multiple weed projects and funding occurring on or adjacent to Indian lands.

Coordinated Weed Management Areas (CWMA) for each state have been identified (See Appendix L) and brought into the assessment process at scoping meetings. The BIA Noxious Weed Program scoring procedure awards points to tribes who participate in a CWMA. Most importantly, the PEA process will give the participating tribes the ability to identify weed management goals to help bring about successful restoration and viable production of rangelands, riparian areas, road rights-of-way and tribal agriculture enterprises.

1.3 *Legal Authorities*

1.3.1 Authorities for BIA

In addition to the two BIA programs described above, other laws and authorities governing weed control on Indian land are listed below.

- Carlson-Foley Act of 1968 (PL 90-583) requires the control of noxious plants on land under the control or jurisdiction of the Federal Government;
- Federal Noxious Weed Act Of 1974 , 7 U.S.C. §§ 2801-2814, January 3, 1975, as amended 1988 and 1994, provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health;
- Federal Fire Prevention and Control Act of October 29, 1974 (88 Stat. 1535; 15 U.S.C. 2201);
- United States Department of Agriculture (U.S.D.A) and the Department of Interior Cooperative Agreement, March 28, 1983 authorizes the Forest Service to provide funding and technical assistance to the Bureau of Indian Affairs (BIA) for Forest Pest Management);
- Public Law 101-512; 1988 BIA launched a national noxious weed management programs on Indian trust lands;
- Public Law. 103-177; 1993 (25 USC, Chapter 39, 3701) the American Indian Agriculture Resource Management Act states that "the United States has a trust responsibility to protect, conserve, utilize and manage Indian agricultural lands;
- Presidential Documents, Executive Order 13112 of February 3, 1999, Invasive Species, Code of Federal Register Vol. 64, No. 25 (authorizes Federal agencies to facilitate and coordinate public education and the preparation of Invasive Species Management Plan);
- 25 CFR Section 170.7 (BIA has the authority to enter into agreements for the construction and maintenance of certain Indian reservation roads and bridges, especially where road projects serve non-Indian land as well as Indian land (Right-of-way vegetation management is a maintenance function);
- Southwest Strategy Initiative for the Arizona Wildland Invasive Plant Working Group, 2003;
- Public Law 108–412, 2004; Noxious Weed Control and Eradication Act;

- Memorandum of Understanding (MOU) between the Department of the Interior Bureau of Indian Affairs, U.S. Department of Agriculture Animal and Plant Health Inspection Service for the control of grasshoppers and Mormon crickets on BIA and tribally managed lands, 2004;
- Public Law 109-320, 2006; Salt cedar and Russian Olive Control Demonstration Act;
- Memorandum of Understanding (MOU) among Department of the Interior Bureau of Indian Affairs, U.S. Department of Agriculture Natural Resources Conservation Service, and USDA Farm Service Agency, December 06, 2006 (describes the common objectives for managing and conserving natural resources on Indian lands. It includes programs and treatments for invasive species management).

1.3.2 Authorities for Tribes

Other laws and authorities governing weed control by tribes on Indian land are:

- 1968-Indian Civil Rights Act-allowed for the Bill of Rights in Indian Country;
- Indian Self-Determination and Education Assistance Act (PL 93-638) of 1975, as amended, allows the use of contracts where tribes assume responsibility for administration of programs;
- National Indian Forest Resources Management Act (P. L. 101-630 November 28, 1990);
- Tribal Self-Governance Act of 1994 (P.L. 103-413);
- San Juan Watershed Woody-Invasive Initiative May 2006. (This partnership includes four states and four native tribes to facilitate coordination among partners across political boundaries including BIA Navajo Region);
- On a project or program basis, tribes support invasive species management with tribal council resolutions.

1.4 *Relevant Environmental Analysis and Planning Documents*

Prior to this document, no BIA Region-wide noxious weed management plans or environmental assessments have been developed in BIA Western Region. However, individual tribes have completed weed management plans and either programmatic or project environmental assessments. They are:

1) Duckwater Shoshone Tribe Noxious Weed Management EA, 2006.
2) Lower Truckee River Cooperative Weed Management Area (CWMA) Strategic Plan, 2006.
3) Noxious Weed Plan for the Washoe Tribe of Nevada and California, 2000.
4) Noxious Weed Management Plan and EA for the Uintah and Ouray Reservation, October 2000. Noxious Weed Management Plan, updated 2006 and 2009.
5) Programmatic Environmental Assessment for the Management of Noxious and Invasive Weeds on the Hopi Reservation and the Moenkopi District, Navajo and Coconino Counties, Arizona (September 2009).
6) Pyramid Lake Paiute Tribe Integrated Purple Loosestrife Management Environmental Assessment, May 2005.

7) Salt River Pima-Maricopa Indian Community, Lower Verde River Tamarisk Removal Project Environmental Assessment, July 2008.

8) San Carlos Apache Tribe, Grassland and Woodland Restoration Project Programmatic Environmental Assessment, December 2004.

9) South Fork Indian Reservation Noxious Weed Treatment Projects Environmental Assessment, November 2010.

2 Alternatives

2.1 *Introduction to Alternatives*

Western Region tribes provided input into the alternatives and most wanted to see a variety of weed management strategies available to them using the methods of Integrated Weed Management. A no action alternative will also be evaluated. Some tribes have formal or informal policies that limit or prohibit the use of chemical and biological control methods and this alternatives will also evaluated. Other alternatives were considered but not pursued.

2.2 *Alternative 1-No Action*

This alternative would mean not implementing any weed control strategies on Indian lands. There would be no spraying or mechanical removal of noxious weeds. Fire would not be used as a tool to manage Indian lands. Restoration or reseeding of disturbed areas would not occur. The No Action alternative would mean that no response of any kind would be taken to control noxious weed infestations.

2.3 *Alternative 2-Integrated Weed Management*

This alternative would evaluate and make use of all Integrated Weed Management (IWM) techniques (fire, mechanical, chemical, cultural and biological control) to manage noxious weeds. These techniques are described in the Integrated Noxious Weed Management Plan in Section 5. It would include monitoring of invasive plant species and implementing plant restoration programs. This alternative could potentially employ all of the methods for control outlined in the Integrated Weed Management Plan in Section 5.

2.4 *Alternative 3-Integrated Weed Management without Chemical or Biological treatments -*

Use of Integrated Weed Management (IWM) techniques would be limited to cultural, fire and mechanical methods to manage noxious weeds; plant monitoring and restoration programs would still occur.

Under this alternative, chemical herbicides and biological control using insect pathogens would not be used. Organic weed control methods, including cultural, physical, fire and mechanical methods (as described in Sec 5.1, the Integrated Weed Management Plan) would be evaluated.

2.5 *Alternatives Considered but Eliminated from Further Analysis*

Managing weeds as a biomass fuel was brought up as an alternative. Although this alternative may be useful in some circumstances, it has a number of drawbacks that would keep it from being considered as a viable alternative. This alternative would involve intensive management of an invasive species. It encourages monocultures which can upset the natural balance of the ecosystem. When one species is dominant, the diversity of the ecosystem is affected and numerous niches for plant and animal species are eliminated.

This procedure has not yet been found to be economically or ecologically feasible. It also does not address the huge variety of weed problems on reservations within the BIA Western Region and would be possible only for a few reservations containing the particular grass species. Tribes are not set up for the harvesting procedures and the costs and limited distribution of this plant would eliminate this alternative from further analysis.

Research into this alternative is in its infancy and several species of *Arundo spp*. (giant reed), *Phragmites spp.* (common reed) and *Panicum virgatum* (switchgrass) have been identified for further study. Traits that make these grasses potentially valuable as a crop could enhance invasiveness (defined here as the ability to re-sprout from below ground and efficient and rapid growth rates). Balancing costs and benefits is a key challenge. Safety must be established by agronomic and ecological analyses. (*Raghu, 2006)*

2.6 *Noxious Weed Treatment Guidelines to be used with the two action alternatives (Alternatives 2 and 3).*

Some of treatment guidelines in this environmental document are only recommended but others are required as part of the grant process or incorporated into the scoring mechanism for projects. Complete tables of Noxious Weed Treatment Guidelines are assembled in Appendix O, Sections 8.15.1 through 8.15.4.

Checklists of required and recommended treatment guidelines are in Section 8.15.3. These checklists will be distributed to grant recipients in 2014 and will be in place for 2015 project submittals.

BIA has required Noxious Weed Treatment Guidelines according to the Noxious Weed Program Criteria, such as requiring pesticide applicators to be licensed and banning the use of Restricted Use Pesticides unless EPA certification process is in place and adhered to by tribe. These required practices are listed in Section 8.15.3.1. Section 8.15.3.2 lists practices that are part of the of BIA Noxious Weed Program Rating Criteria, which nearly all applicants do, such as participate in Cooperative Weed Management Areas or support of weed control measures through tribal resolution or tribal management policy. Inventory, monitoring and revegetation projects are also part of the grant rating criteria and have been increasing in the last several years, due to increased awareness and funding. Some management practices have not been required or documented, but BIA would like to encourage these practices through education and program guidelines. These practices are listed in Appendix O, Sec 8.15.3.3. Funding incentives or disincentives will be used to encourage specific practices, such as replanting, or to discourage other practices such as removal of native species, ground disturbance or other ill-informed management practices that increase weeds and cause other negative environmental effects.

3 Affected Environment

The affected environment for this PEA consists of all the reservations within the jurisdictional boundary of the BIA Western Region. The first section will evaluate the components of each Ecological Region (Ecoregion) as defined by EPA (See Glossary and Section 3.1 below.) within the BIA Western Region. Water quality, cultural resources, socio-economic conditions, resource use patterns including range and agriculture, and other values will be described for Western Region, as a whole in sections 3.2 to 3.10.

3.1 *Ecological Region Descriptions-Including Land and Living Resources*

Ecological regions (ecoregions) denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. They are designed to serve as a framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. These regions are used for structuring and implementing ecosystem management strategies across federal and state agencies, and nongovernment organizations responsible for resource management within the same geographical areas. The ecoregions were identified through the analysis of patterns of biotic and abiotic phenomena comprising the land and living resources of the affected environment, including geology, physiography, vegetation, climate, soils, land use, wildlife, endangered species and hydrology. The relative importance of each characteristic varies from one ecoregion to another. A Roman numeral hierarchical scheme has been adopted for different levels for ecoregions. (Environmental Protection Agency, 2010)

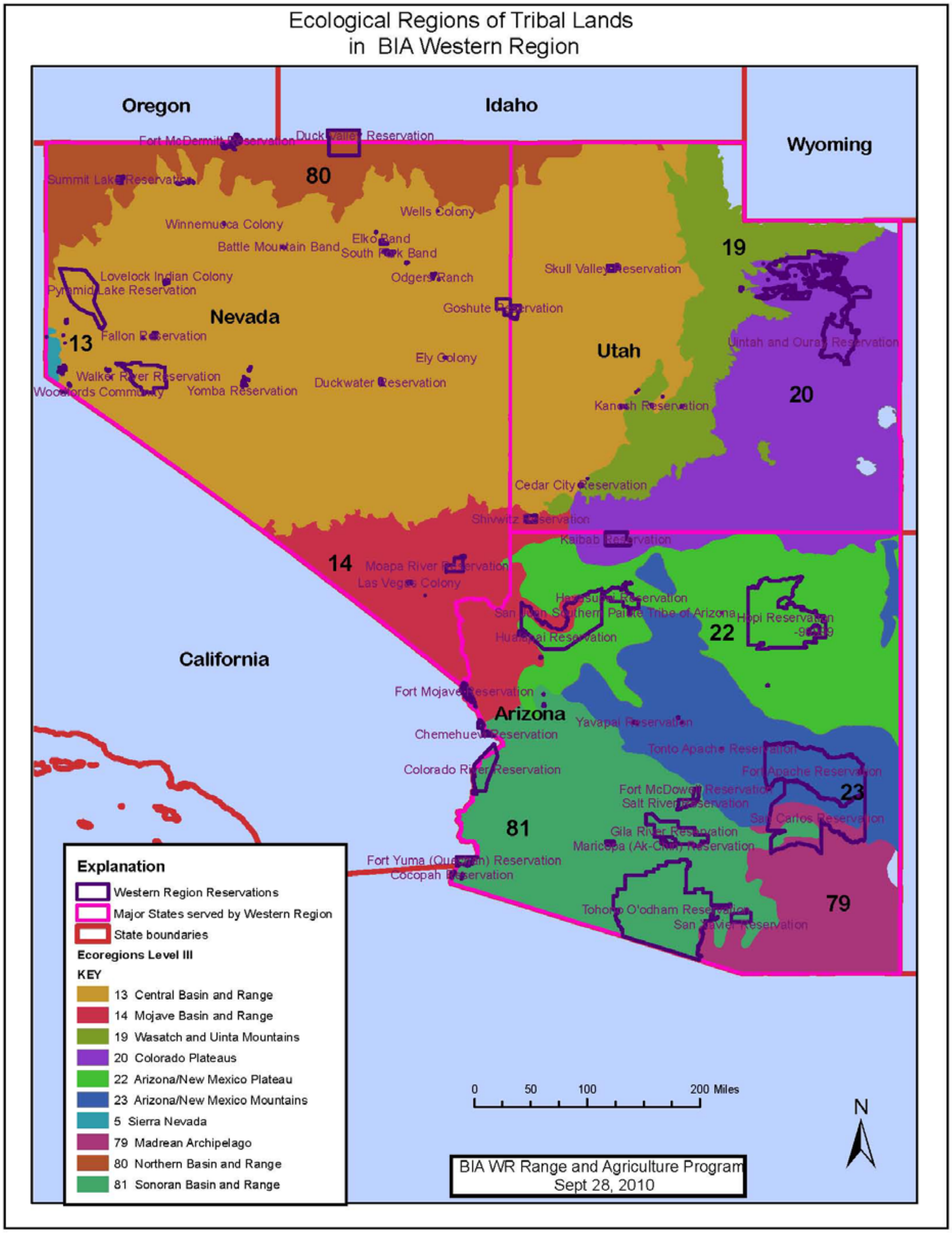
Soil data at this scale is very general; for more specific information about soils in a project area, detailed soil surveys are available from Web Soil Survey. http://websoilsurvey.nrcs.usda.gov

For this PEA evaluation, Level III ecoregions will be used. Level III divides the continental United States into 104 regions. Ten of these ecoregions are within the boundary of BIA Western Region. Map 3-1 shows the ten Level III ecoregions that comprise the reservations within BIA Western Region.

The following elements will be described in Section 3.1:

1) Location and Climate
   a) Names and acres of tribes/reservations within each ecoregion;
   b) Climate
2) Land Resources
   a) Soils, Topography and Geologic setting
3) Living Resources
   a) Vegetation (including noxious weeds);
   b) Wildlife
   c) Endangered and Threatened Species
4) Water Resources (hydrology) with-additional descriptions in Section 3.2.
5) Land Use and Human Activities are included in this section, with-additional descriptions in Section 3.2, 3.4 and 3.5.

Map 3.1 Ecoregions in BIA Western Region



3.1.1 5 Sierra Nevada

3.1.1.1 **Location and Climate**

The Sierra Nevada consists of a high north-south mountain range of eastern California with a small extension into far western Nevada near Lake Tahoe. Small acreages of the Washoe tribal ranches are located in this region.

Table 3.1 Western Region Reservations in Sierra Nevada

Reservations in Sierra Nevada	Acres
Woodfords Community (Part of Washoe Tribe)	338
Woodfords Public Domain Allotment	267
Washoe Ranches	112
Total Acres of Indian Land in Sierra Nevada	**717**

The ecoregion has a severe to mild mid-latitude climate with Mediterranean characteristics. It has mild to hot dry summers and cool-to-cold, wet winters. The mean annual temperature ranges from -37° F at high elevations to 63°F at low elevations in the southwest portion of the region. The frost-free period ranges from 30 to 320 days. The mean annual precipitation is 42 inches, ranging from 5.3 inches in the eastern lowlands to over 98 inches on high elevation peaks.

3.1.1.2 **Land Resources**

Soils, Topography and Geologic setting: The Sierra Nevada is a deeply dissected block fault that rises sharply from the arid, basin and range ecoregions on the east and slopes gently toward the Central California Valley to the west. It has hilly to steep mountain relief. The eastern portion has been strongly glaciated and contains higher elevations than the Klamath Mountains to the northwest. Elevations range from about 1312 feet to 14,435 feet on Mt. Whitney, the highest point in the lower 48 United States. The central and southern parts of the region are underlain primarily by granite. There are some areas of metamorphic and volcanic rocks in the north. Alfisols, Entisols, Inceptisols, Mollisols, and Ultisols soil orders occur. There are mesic, frigid, and cryic soil temperature regimes, and mostly xeric and udic soil moisture regimes.

3.1.1.3 **Living Resources**

Vegetation: Dominant vegetation is diverse temperate coniferous forest. The vegetation grades from chaparral and oak woodland to ponderosa pine at the lower elevations on the west side, and lodgepole pine on the east side, to mixed conifer forests of ponderosa pine, sugar pine, Douglas-fir, and white fir. Giant sequoias occur in some areas, the most massive trees on Earth. At higher elevations, white fir and red fir forests dominate and in the subalpine zone, lodgepole pine, Jeffrey pine, western white pine, limber pine, and aspen occur. Alpine conditions exist at the highest elevations.

Predominant Noxious Weeds of the Sierra Nevada: The most significant weed on reservations located within the Sierra Nevada is yellow star thistle. Diffuse knapweed is also a problem, along with and bull and Canada thistle.

Wildlife: Black bear, black-tailed deer, mule deer, Sierra Nevada bighorn sheep, cougar, coyote, bobcat, red fox, badger, ringtail, yellow-bellied marmot, crow, stellar jay, golden trout, Yosemite toad, Kern salamander.

Endangered and Threatened Species: Lahontan cutthroat trout, greater sage-grouse, cui-ui, Tahoe yellow cress, and mountain yellow-legged frog.

3.1.1.4 Water Resources/Hydrology

There are many high-gradient perennial streams and rivers and numerous alpine lakes and several reservoirs. Rainfall and snowpack provide water for adjacent low elevation ecoregions.

3.1.1.5 Land Use/Human Activities

Recreation and tourism, forestry, rural residential businesses, ranching and woodland grazing and mining occur in this region. The higher elevations of this region are on public lands with national forests,

3.1.2 13 Central Basin And Range

3.1.2.1 Location and Climate

The region occupies a large portion of Nevada and western Utah, with small extensions into California and southern Idaho. This ecoregion covers the largest geographical area within the three major states covered by Western Region and contains the highest number of tribes. Except for a few, most of these tribes do not have a very large land base. Table 3.2 lists the reservations with approximate acreage within this zone.

Table 3.2 WR Reservations in Central Basin and Range

Reservations in Central Basin and Range	Acres
Battle Mountain Band	691
Duckwater Shoshone	3855
Elko Band	192.8
Ely Shoshone	3797
Fallon Shoshone	8223
Goshute Reservation	113,269
Lovelock Colony	20
Odgers Ranch and Ruby Valley PD	3538
Pinenut Public Domain	62,075
Public Domain Washoe	60835
PITU-Cedar Band (partial)	527
PITU Kanosh Band (partial)	1653
PITU-Koosharem (partial)	514
PITU-Indian Peaks (partial)	55
PITU-Shivwits (partial)	140
Fort McDermitt (partial)	3404
Pyramid Lake Paiute	477,216
Reno-Sparks Colony	1827
South Fork Band	14,000
Skull Valley, UT	17,444
Walker River Paiute	324,000
Washoe Tribe of Nevada	5453
Wells Colony	81
Winnemucca Colony	340
Yerington	1654
Yomba	4718
Total Acres of Indian Land	**1,109,521.8**

The ecoregion has a dry, mid-latitude desert climate, marked by hot summers and mild winters. It has a hotter and drier climate than and Northern Basin and Range ecoregions to the north. The mean annual temperatures (MAT) range from 35°F on high mountains to 57°F in southern lowland areas. The frost-free period ranges from about 15 days at cold, high elevations to 200 days in warmer areas. The mean annual precipitation ranges from .2 inches in the lower drier areas to over 39 inches in the wetter high mountains. Most rainfall occurs during thunderstorms in the warm season. The light precipitation in winter is mostly in the form of snow.

3.1.2.2 Land Resources

Soils, Topography and Geologic setting: North-south trending mountain ranges are separated by broad xeric basins and valleys. The basins may have playas, salt flats, low terraces, sand dunes, or scattered low hills, and are often bordered by long gently sloping alluvial fans. Most of the mountains are uplifted fault blocks with steep side slopes. Elevations range from 3347 feet to more than 13,000 feet. Aridisols and Entisols are common, with some Mollisols in higher elevations. Soil temperature regimes are mostly mesic and frigid, with aridic to xeric soil moisture regimes. Some saline-sodic soils occur.

3.1.2.3 Living Resources

Vegetation: Basins are covered by Great Basin sagebrush or saltbush-greasewood vegetation. The region has fewer cool season grasses than Northern Basin and Range. Shadscale, winterfat, black sagebrush, Wyoming big sagebrush, ephedra, rabbitbrush, Indian ricegrass, and squirreltail are typical. Greasewood, Nuttall saltbush, seepweed, and alkali sacaton occur in more saline areas. Lower mountains have singleleaf pinyon, Utah juniper, sagebrush, bitterbrush, serviceberry, snowberry, and bluebunch wheatgrass. High mountains may contain Douglas-fir, white fir, limber pine, whitebark pine, or aspen.

Predominant Noxious Weeds of the Central Basin and Range: Bull and Canada thistle, cheatgrass, hoary cress, knapweeds, kochia, medusahead, perennial pepperweed, puncture vine, Russian olive and tamarisk are continual problems within this region.

Wildlife: Mule deer, pronghorn, bighorn sheep, coyote, bobcat, black-tail jackrabbit, bald eagle, sage sparrow, endemic desert fish species such as Lahontan cutthroat trout, White River springfish, Pahranagat roundtail chub, Monitor Valley speckled dace, and Independence Valley tui chub.

Endangered and Threatened Species: Lahontan cutthroat trout, ciu-ui, Greater sage-grouse, Devil’s Hole pupfish, Railroad Valley springfish, southwestern willow flycatcher, Least chub, Yellow-billed cuckoo, Ute ladies'-tresses, Pahrump poolfish, Carson wandering skipper and Utah prairie dog.

3.1.2.4 Water Resources/Hydrology

The Central Basin and Range ecoregion is internally drained. Sinks and playa lakes occur in the basins. Streams are mostly intermittent and ephemeral. There are some perennial streams flowing from mountainous areas within or adjacent to the region. Some large lakes occur near the margins and adjacent mountainous ecoregions, including Great Salt Lake, Utah Lake, Mono Lake, Pyramid Lake, and Walker Lake. Springs are important in some areas.

3.1.2.5 Land Use/Human Activities

The area is used for ranching and livestock grazing, mining for gold, silver, and mercury, wildlife habitat, recreation. Much of it is public rangelands and national forests, military lands, and Indian lands. Human populations are concentrated along the margins of this region. Larger cities include Carson City, Reno, Sparks, Ely, Salt Lake City, Ogden, and Provo.

3.1.3 14 Mojave Basin And Range

3.1.3.1 Location and Climate

Southeastern California, southern Nevada, southwest Utah, and northwest Arizona

Table 3.3 WR Reservations in Mojave Basin and Range

Reservations in Mojave Basin and Range *	Acres
Chemehuevi (partially located)	4559
Fort Mojave Indian Reservation	33,005
Hualapai Reservation (partial)	258,000
Las Vegas Paiute Reservation	3952
Moapa Band of Paiutes	70,575
Shivwits Indian Reservation (majority)	28,340
Total Acres of Indian Land in Mojave Basin and Range	**398,431**
**These figures are approximate. In some cases, trust acres did not match GIS analysis.*	

The ecoregion has a dry, subtropical desert climate, marked by hot summers and warm winters. The mean annual temperature is approximately 41°F at high elevations and 75°F in the lowest basins. The frost-free period ranges from 150 days in colder areas to 350 days in the warmer valleys The mean annual precipitation is 6.6 inches and ranges from 2 inches to over 35 inches on the wetter high peaks. Snow occurrence is uncommon at low elevations.

3.1.3.2 Land Resources

Soils, Topography and Geologic setting: This ecoregion contains scattered north-south trending mountains which are generally lower than those of the Central Basin and Range. Broad basins, valleys, and old lakebeds occur between the ranges, with long alluvial fans. Elevations range from 275 feet below sea level in Death Valley, to more than 10,827 feet on the highest mountain peaks. Deep Quaternary alluvial deposits are on valley floors and alluvial fans. Some complex geology is present with intrusive granitic and other igneous rocks, recent volcanic, metamorphic, and sedimentary rocks including some carbonates. Aridisols and Entisols with a thermic and hyperthermic soil temperature regime and aridic soil moisture regime.

3.1.3.3 Living Resources

<u>Vegetation</u>: Sparse desert vegetation, predominantly creosote bush, as compared to the mostly saltbush-greasewood and Great Basin sagebrush of the Central Basin and Range to the north, or the creosote bush-bur sage and palo verde, cactus shrub and saguaro cactus in the Sonoran Desert to the

south. In the Mojave, creosote bush, white bursage, Joshua-tree and other yuccas, and blackbrush are typical. On alkali flats, saltbush, saltgrass, alkali sacaton, and iodinebush are found. On mountains, sagebrush, juniper, and singleleaf pinyon occur. At high elevations, some ponderosa pine, white fir, limber pine, and some bristlecone pine. A century ago, overgrazing in open rangelands in the western states introduced Eurasian annuals which naturalized and displaced native plants. Different fire regimens, climatic shifts, and human commercial actions, such as vehicular transportation, were other contributing factors.

Predominant Noxious Weeds in the Mojave Basin and Range: Fountain grass, giant reed, tamarisk, tree of heaven, halogeton, Dalmatian toadflax, red brome, Russian thistle and Sahara mustard are known to have negative impacts in the Mojave Basin.

Wildlife: Desert bighorn sheep, pronghorn, coyote, kit fox, black-tail jackrabbit, desert cottontail rabbit, greater roadrunner, Gambel's quail, mourning dove, desert tortoise, rattlesnake.

Endangered and Threatened Species: Bonytail chub, Desert tortoise (Mojave population), Yuma Clapper rail, Moapa dace, southwestern willow flycatcher, razorback sucker, California red-legged frog, Colorado pikeminnow, relict leopard frog, Least Bell's vireo, Las Vegas buckwheat, Pahrump poolfish, Razorback chub, woundfin, Virgin River, Chub, Shivwits milkvetch and Holmgren milkvetch.

3.1.3.4 Water Resources/Hydrology

Surface water is scarce, mostly intermittent and ephemeral streams. The Colorado River crosses the eastern portion of the region. There are some springs, seeps, and ponds.

3.1.3.5 Land Use/Human Activities

Adjacent lands to reservations are mostly federally-owned, including national parks, military reservations and BLM lands. Grazing is limited due to lack of water and forage for livestock but managed grazing does occur on the Hualapai and Shivwits Reservations. Wild burros graze the Chemehuevi range. There is mining of silver, gold, talc, boron, and borate minerals. Recreation and tourism are the largest industries. Heavy use of off-road vehicles and motorcycles in some areas has caused severe wind and water erosion problems. Larger towns and cities include Bullhead City, Kingman, Las Vegas, and St. George.

3.1.4 19 Wasatch and Uinta Mountains

3.1.4.1 Location and Climate

This area includes the Uinta Mountains, Wasatch Range, and Wasatch Plateau. The region stretches from southeastern Idaho and southwestern Wyoming through the length of Utah. It takes in the northern portion of the Uintah and Ouray Reservation and land parcels of the Cedar, Kanosh, and Koosharem Bands of the Paiute Indian Tribe of Utah (PITU). The remaining land of these four bands is in the Central Basin and Range ecoregion.

The ecoregion has a mid-latitude humid continental climate. Winters can be severe, and summers warm to hot, with no pronounced dry season. The mean annual temperature ranges from approximately 35.6 °F in the High Uintas to 46.4°F in low valleys. The frost-free period ranges from less than 40 days to nearly 200 days. The mean annual precipitation is 23.7 inches, ranging from 5.9 inches in dry valleys to more than 55 inches on the wettest high peaks. Some mountain peaks and canyons receive large amounts of powder snowfall. Avalanches are common in some northern areas.

Table 3.4 WR Reservations in Wasatch and Uinta Mountains

Reservations in the Wasatch and Uinta Mountains	**Acres**
Uintah and Ouray Reservation (partial)	30814
PITU Cedar Band (partial)	1617
PITU-Kanosh (partial)	484
PITU-Koosharem (partial)	760
PITU-Indian Peaks (partial)	370
Total Acres of Indian Land in the Wasatch and Uinta Mountains	34045

3.1.4.2 Land Resources

Soils, Topography and Geologic setting: This region contains a core area of high, precipitous mountains with narrow crests and valleys flanked in some areas by dissected plateaus and open high mountains. In the south there are rolling mountains and faulted plateaus. The highest areas in the east-west trending Uinta Mountains are extensively glaciated, with glacial features such as horns, moraines, cirques, and U-shaped valleys. Elevations range from 4790 feet to 13,527 feet. A complex mix of geology occurs, with Tertiary and Mesozoic sedimentary and igneous rocks and some Precambrian igneous and metamorphic rocks. Mollisols, Alfisols, and Inceptisols are typical soil orders with mesic, frigid, and cryic soil temperature regimes, and udic, aridic, and xeric soil moisture regimes.

3.1.4.3 Living Resources

Vegetation: The banding pattern of vegetation due to elevation is similar to that of the Southern Rockies except that aspen, chaparral, and juniper-pinyon and oak are more common at middle elevations. There is much less lodgepole pine than in the Middle Rockies. In valleys, there are sagebrush, grasses, some pinyon and Utah juniper. Foothills are pinyon-juniper woodland and sagebrush and in the north, some maple and Gambel oak scrub. Mid-elevations have ponderosa pine. Douglas-fir, aspen, subalpine fir, Englemann spruce, limber pine are at higher elevations.

Predominant Noxious Weeds of Wasatch and Uinta Mountains: cheatgrass, Dyer's woad, Johnson grass, knapweeds, leafy spurge, Canada thistle, musk thistle, Scotch thistle, Russian olive, houndstongue are problem weeds in this region.
*Invading Species Of Concern (Watch list)***:** black henbane, camelthorn, Dalmatian toadflax, goatsrue jointed goatgrass, poison hemlock, purple loosestrife , purple starthistle, St. John’s wort, silverleaf nightshade, squarrose knapweed

Wildlife: Black bear, elk, cougar, coyote, bobcat, red-tailed hawk, golden eagle, mountain bluebird, pinyon jay, cutthroat trout, Utah mountains kingsnake, Utah tiger salamander.

Endangered and Threatened Species: Bonytail chub, Razorback chub, Colorado pike minnow, Greater sage-grouse, Mexican spotted owl, Uinta Basin hookless cactus, Pariette cactus, and Utah prairie dog.

3.1.4.4 Water Resources/Hydrology

Many perennial and intermittent streams occur. Glacial lakes occur at high elevations. Runoff from deep snowpack is a major source of summer water for lower, more arid ecoregions (10.1.5, 10.1.6).

3.1.4.5 Land Use/Human Activities

Forestry, ranching and livestock grazing, and recreation are the main activities with increasing residential development. Some agriculture occurs in the lower valleys. Large areas are public national forest land. Larger towns include Park City, Heber City, and Panguitch.

3.1.5 20 Colorado Plateau

3.1.5.1 Location and Climate

The Colorado Plateau is bordered by the Southern Rocky Mountains on the east, the Wasatch Range to the west and the Grand Canyon and the Arizona and New Mexico Mountains on the south. The region occupies most of eastern and southern Utah, western Colorado, and small portions of northern Arizona and northwestern New Mexico. It contains most of the Uintah and Ouray Reservation on its northern end and the Kaibab Paiute Reservation on the southern edge of the region.

Table 3.5 WR Reservations in Colorado Plateau

Reservations in Colorado Plateaus	**Acres**
Uintah and Ouray (partial)	976,544
Kaibab Paiute	120,800
Total Acres of Indian land in the Colorado Plateau	1,097344

The ecoregion has a dry, mid-latitude steppe climate. It is marked by hot summers with low humidity, and cool to cold dry winters. The mean annual temperature ranges from approximately 41°F at high elevations in the north to 59°F in southern deep canyons along the Colorado River. The southern part of the ecoregion has a summer monsoonal precipitation pattern. The frost-free period ranges from 50 days to more than 220 days. The mean annual precipitation is 11.7 inches, ranging from 5.1 inches in arid canyons to more than 31 inches at high elevations.

3.1.5.2 Land Resources

Soils, Topography and Geologic setting: The Colorado Plateau is an uplifted, eroded, and deeply dissected tableland. Its benches, mesas, buttes, salt valleys, cliffs, and canyons are formed in and underlain by thick layers of sedimentary rock. The region is higher than the Wyoming Basin to the north but also contains large low lying areas in river canyons. The uplifted, eroded, and deeply dissected tableland of sedimentary rock contains benches, mesas, buttes, cliffs, canyons, and salt valleys. Elevations range from about 2953 feet to over 9800 feet. Entisols and Aridisols are typical soil orders, with mostly mesic and frigid soil temperature regimes and aridic and ustic soil moisture regimes.

3.1.5.3 Living Resources

Vegetation: Uplands and high valleys have Wyoming big sagebrush, black sagebrush, pinyon-juniper woodlands. At higher elevations there are areas of Gambel oak, mountain mahogany, aspen, and Douglas-fir. The Kaibab Reservation within this ecoregion consists of low elevation basins and canyons vegetated with galleta, Indian ricegrass, blue grama, squirreltail, shadscale, fourwing saltbush, rabbitbrush, big sagebrush and winterfat. There is generally less grassland than in the Arizona/New Mexico Plateau to the south.

Predominant Noxious Weeds of the Colorado Plateau: Camelthorn, cheatgrass, Dalmatian toadflax, leafy spurge, Russian olive and tamarisk are dominant weeds of this region. The Kaibab Paiute Tribe is actively managing to reduce Scotch thistle and tamarisk

Wildlife: Elk, mule deer, pronghorn, coyote, kit fox, white-tailed prairie dog, cottontail rabbit, sage grouse, turkey vulture, burrowing owl, pinyon jay, common raven, western rattlesnake, Colorado pike minnow, razorback sucker, and bonytail chub.

Endangered and Threatened Species: Bonytail chub, California condor, Colorado pike minnow, Razorback chub, Kanab ambersnail, and Siler pincushion cactus.

3.1.5.4 Water Resources/Hydrology

There are many ephemeral and intermittent streams. Perennial streams originate in adjacent mountainous ecoregions. Approximately 90 percent of the plateau is drained by the Colorado River and its tributaries. Other large rivers cross the region, such as the Green and the San Juan. There are few lakes or reservoirs, except Lake Powell on the Colorado River. The Colorado Plateau is the only area in the United States where large mountain rivers run through exposed sandstone, one of the processes that created the Grand Canyon and other spectacular canyons in the region.

3.1.5.5 Land Use/Human Activities

Ranching and livestock grazing, oil and gas production, coal mining, recreation and tourism are the main human activities. There are Indian lands, a national park and monument lands. There are a few small areas of irrigated agriculture with pinto beans, hay, alfalfa, winter wheat, and fruit orchards. Larger towns include Vernal, Price, Moab, Grand Junction, Montrose, Cortez, and Shiprock.

3.1.6 22 Arizona/New Mexico Plateau

3.1.6.1 Location and Climate

This region covers a large portion of northern Arizona. Mountainous ecoregions border the region on the northeast and southwest. The Arizona/New Mexico Plateau represents a large transitional region between the drier shrubland and wooded higher relief tablelands of the Colorado Plateaus in the north, the lower, hotter, less vegetated Mojave Basin and Range in the west and forested mountain ecoregions that border the region on the northeast and south. Local relief in the region varies from a few feet on plains and mesa tops to well over 1000 feet along tableland side slopes. The Continental Divide splits the region, but is not a prominent topographic feature. The region extends across northern Arizona, northwestern New Mexico, and into Colorado in the San Luis Valley. The Hualapai, Havasupai and the Hopi Reservations are contained in this ecoregion.

Table 3.6 WR Reservations in Arizona/New Mexico Plateau

Reservations in the Arizona/New Mexico Plateau	Acres
Havasupai	188, 077
Hopi Reservation (partial)	1,749,359
Hualapai Reservation	761,934
Total Acres of Indian Land in the Arizona Plateau	2,511,293

The ecoregion has dry, mid-latitude steppe and desert climates. It is marked by hot summers with low humidity, and cool to cold dry winters. The mean annual temperature is about 52°F, but ranges from approximately 41°F in the northeast to 61°F in deep canyons along the Colorado River in the west. The frost-free period ranges from 50 days to more than 250 days. The mean annual precipitation is 11.5 inches, ranging from 4.9 inches to 15 inches at higher elevations.

3.1.6.2 Land Resources

Soils, Topography and Geologic setting: Alfisols, Aridisols, and Inceptisols are typical soil orders. Soil temperature regimes are wide-ranging but mostly mesic and frigid. Ustic to aridic soil moisture regimes occur. Topography consists of plateaus and mesas, cliffs, deep canyons, and valleys, some irregular plains. Rocks representing almost the entire geological timespan are exposed in this region. Sedimentary rocks of sandstone, shale, mudstone, limestone, and dolomite, and volcanic rocks of basalt and andesite are extensive. Local relief in the region varies from a few meters on plains and mesa tops to well over 300 meters or more along tableland side slopes.

3.1.6.3 Living Resources

Vegetation: At arid lower elevations, shadscale, fourwing saltbush, greasewood, galleta and blue and black grama are found. At higher elevations, pinyon-juniper woodlands dominate. In the northeast, where the Hopi Reservation is, the dominant vegetation is big sagebrush, rabbitbrush, winterfat, western wheatgrass and blue grama.

Predominant Noxious Weeds of the Arizona/New Mexico Plateau: Cheatgrass, musk and bull thistle, yellow star thistle, Russian olive, and tamarisk are the biggest threats on reservation lands. Scotch thistle along roadsides is a serious problem on the Hualapai Reservation. Dalmatian toadflax, leafy spurge and whorled milkweed are other species of concern. The Grand Canyon National Park has identified the invasive plants in Table 3.6a as having high impacts but can be easily managed.

Wildlife: Mule deer, pronghorn, cougar, bobcat, weasels, badgers, Gunnison prairie dogs, jackrabbits, desert pocket mouse, greater roadrunner, Swainson's hawk, burrowing owls, rattlesnakes, Rio Grande silvery minnow.

Endangered and Threatened Species: California condor, humpback chub, Colorado pike minnow, southwestern willow flycatcher, Siler pincushion cactus, Peebles Navajo cactus, and black-footed ferret.

Table 3.6a
Priority Weeds of Grand Canyon National Park
(An X is placed after the weeds (also in red font), if it has been determined a priority pest by one of the three tribes in this ecoregion, Hopi, Hualapai and Havasupai.

Camelthorn-X	Puncture vine	Sahara mustard	Tamarisk -X
Himalaya blackberry	Ravenna grass	Scotch thistle-X	Whitetop (Lepidium draba)
Houndstongue	Ripgut brome	Spotted knapweed-X	
Mediterranean sage	Russian knapweed -X	Tree-of-heaven	
Pampus grass	Russian olive-X		

(Source: Makarick, Lori 2010)

3.1.6.4 Water Resources /Hydrology:

Water is scarce, mostly ephemeral and intermittent streams. Perennial streams originate in adjacent mountainous ecoregions. Several large rivers cross the region, i.e., the Colorado, San Juan, and Rio Grande. There are very few lakes or reservoirs.

3.1.6.5 Land Use/Human Activities

Low density livestock grazing, oil and gas production, coal mining, recreation and tourism are the main activities. There are large areas of tribal land, national parks and national monument lands, and some public rangelands. There are a few small areas of irrigated agriculture along rivers. Larger towns include Tuba City and Winslow.

3.1.7 23 Arizona/New Mexico Mountains

3.1.7.1 Location and Climate

This is a region of separated mountains that extends from northwestern Arizona into central and southern New Mexico. It takes in the Tonto Apache, Yavapai-Prescott, Yavapai Apache, the White Mountain Apache and the northern portion of the San Carlos Apache reservations.

Table 3.7 WR Reservations in Arizona/New Mexico Mountains

Reservations in the Arizona/New Mexico Mountains *	**Acres**
Hopi Reservation (partial)	32,485
San Carlos Apache (partial)	702,000
Tonto Apache	378
White Mountain Apache	1,684,200
Yavapai-Prescott	1402
Yavapai Apache Nation	1823
Total Acres of Indian land in the Arizona Mountains	2,422,288
**These figures are approximate. In some cases, trust acres did not match GIS analysis.*	

This region has a variety of climates, depending on latitude and elevation, ranging from subalpine climates to mid-latitude steppe and desert climates. In general, the region is marked by warm to hot summers and mild winters. The mean annual temperature ranges from approximately 37°F at higher elevations to 66.2°F in lower southern valleys. The frost-free period ranges from 60 to 280 days. More than half of the precipitation occurs during July, August, and September thunderstorms. Pacific frontal storms December through March accounts for much of the other seasonal moisture. The mean annual precipitation is 18.8 inches and ranges from 10.6 inches to over 39 inches on the highest peaks.

3.1.7.2 Land Resources

Soils, Topography and Geologic setting: Includes both Colorado Plateau and Basin and Range physiography. There are steep foothills and mountains and some deeply dissected high plateaus. Elevations range from 4265 feet to 12,500 feet. The area is geologically diverse with Paleozoic sedimentary rocks of sandstone, shale, and limestone, Tertiary volcanic rocks, and Precambrian igneous and metamorphic rocks. Mollisols, Alfisols, Aridisols, and Inceptisols are typical soil orders. Soil temperature regimes are mostly mesic and frigid, with some cryic at high elevations. Ustic to aridic soil moisture regimes occur.

3.1.7.3 Living Resources

Vegetation: The vegetation is indicative of drier, warmer environments compared to mountainous regions further north. Chaparral is common on the lower elevations, pinyon-juniper and oak woodlands are found on lower and middle elevations, and the higher elevations are mostly covered with open to dense ponderosa pine forests. There is some Douglas-fir, southwestern white pine, white fir, and aspen. This is the southernmost extent of spruce-fir forest at higher elevations. Southern areas have some Madrean evergreen oak species.

Predominant Noxious Weeds of the Arizona Mountains: Chinese elm, jointed goat grass and bull thistle have had negative impacts on the Fort Apache Reservation. The San Carlos Apache Tribe identified tamarisk, red brome, puncture vine and other annuals as major invasive species. The Yavapai Prescott Indian Tribe (YPIT) is carrying out weed projects to control tree-of-heaven, tamarisk, Scotch thistle, hoary cress and Russian knapweed.

Wildlife: This ecoregion is considered to host more species of birds and mammals than any other ecoregion in the Southwest (Bell *et al., as cited in EPA 2010)*. Mule deer, bighorn sheep, cougar, Mexican gray wolf, coyote, bobcat, ring-tail cat, kit fox, black-tail jackrabbit, tassel-eared squirrel, Cooper's hawk, red-tailed hawk, turkey vulture, canyon wren, Gila trout. Northern extent of some Mexican wildlife species occurs in this region.

Endangered and Threatened Species: Mexican spotted owl, Apache trout, southwestern willow flycatcher, loach minnow, Arizona hedgehog cactus, and Chiricahua leopard frog.

3.1.7.4 Water Resources /Hydrology

Many ephemeral, intermittent, some perennial streams, moderate to high gradient are present. There are few lakes relative to other western mountainous regions but there are several small ponds or reservoirs. The mountain streams of this region provide water resources to settlements in adjacent lower elevation ecoregions. The Arizona-New Mexico Mountains Ecoregion contains the headwaters of a number of important streams and rivers, including the Little Colorado, Gila, and the San Francisco Rivers. Riparian habitats in this ecoregion host a variety of flora and fauna.

3.1.7.5 Land Use/Human Activities

Land use consists of ranching, rangeland and woodland grazing, recreation, forestry, and some mining. Large areas are in public forest land, along with some Indian lands, national monuments, and national park lands. Larger settlements include Flagstaff, Prescott, Sedona, Camp Verde, Payson and Show Low.

3.1.8 79 Madrean Archipelago

3.1.8.1 Location and Climate

Straddling the national border in southeast Arizona and southwest New Mexico, and northern Sonora, the region has ecological significance as a barrier and bridge between two major ranges of North America: the Rocky Mountains and the Sierra Madre. This ecoregion contains a small southeastern portion of the Tohono O'Odham Nation and horizontal strips are in the central and southern portion the San Carlos Apache Reservation.

Table 3.8 WR Reservations in Madrean Archipelago

Reservations in Madrean Archipelago*	Acres
Tohono O' Odham Nation (partial) & San Xavier	42,483
San Carlos Apache Reservation (partial)	843,000
Total Acres of Indian land in the Madrean Archipelago	885,483
**These figures are approximate. In some cases, trust acres did not match GIS analysis.*	

The ecoregion has a dry, subtropical to mid-latitude steppe climate with hot summers and mild winters. The mean annual temperature ranges from approximately 45°F to 66°F. The frost-free period ranges from 170 to 280 days. The mean annual precipitation is 16.6 inches and ranges from 10.2 inches at low elevations to over 37 inches on the highest peaks. Much of the precipitation falls during July to September thunderstorms.

3.1.8.2 Land Resources

Soils, Topography and Geologic setting: Basins and ranges with medium to high local relief typically 1,000 to 1,500 meters on ranges. Elevations are generally 2625 feet to 9843 feet. Tertiary volcanic, Paleozoic and Mesozoic sedimentary rocks and Precambrian granites are found on the ranges, while basins are deeply filled with Quaternary sediments. Soil orders are Aridisols, Inceptisols, Mollisols and Alfisols, with thermic temperature regimes and aridic and ustic soil moisture regimes.

3.1.8.3 Living Resources

Vegetation: This is a region of basins and ranges with medium to high local relief, typically 3,000 to 5,000 feet. Native vegetation in the region consists of grama-tobosa shrub steppe in the basins and oak-juniper woodlands. Ponderosa pine occurs at higher elevations. Listed below are the plants and vegetation zones within this ecoregion.

Grassy High Plains (Apachian valleys or low hills): Dominant vegetation consists of sideoats grama, black grama, cane beard grass; plains love grass, blue grama, hairy grama, sand dropseed, vine mesquite, curly mesquite, false mesquite, Mormon-tea, mimosa, yucca, ocotillo, cacti, and agaves.

The Madrean-Oak Woodlands (above 5,000 feet): The oaks of the evergreen and oak woodlands are Emory, silverleaf, Tourney and Arizona white oak. Other trees are pinyon, juniper, mesquite, chaparral, cottonwood, sycamore, and willows. Madrean Pine-Oak and Mixed Conifer Forests: At higher elevations ponderosa pine is predominant, along with areas of southwestern white pine, Apache pine, Chihuahuan pine, and some Douglas-fir.

Predominant Noxious Weeds of the Madrean Archipelago: Tamarisk, Sahara mustard, buffelgrass are serious noxious weeds in this ecoregion. Other invasive plants include red brome, filaree and Lehmann's lovegrass.

Wildlife: Coues white-tailed deer , mule deer, cougar, jaguar, coyote, bobcat, antelope jackrabbit, Mexican fox squirrel, Cooper's hawk, red-tailed hawk, raven, turkey vulture, ash-throated flycatcher, canyon wren, greater roadrunner, elf owl, acorn woodpecker, western diamondback rattlesnake, western whiptail lizard, Gila monster.

Endangered and Threatened Species: Mexican spotted owl, Chiricahua leopard frog, Arizona hedgehog cactus, masked bobwhite and yellow-billed cuckoo.

3.1.8.4 Water Resources/Hydrology

Surface water is scarce, consisting mostly ephemeral and intermittent streams and some springs. There are perennial streams at higher elevations. Groundwater levels are dropping, according to recent monitoring reports.

3.1.8.5 Land Use/Human Activities

Ranching and livestock grazing, wildlife habitat, tourism and recreation, copper mining are the common land use activities. There is open range and national forest land and some military land. Larger settlements include Safford, Wilcox, Sierra Vista, Bisbee, Douglas.

3.1.9 80 Northern Basin and Range

3.1.9.1 Location and Climate

This ecoregion is located in the northern Great Basin, covering southeast Oregon, northern Nevada, southern Idaho, and a small portion of northern Utah. The ecoregion is drier and less suitable for agriculture than the Columbia Plateau and higher and cooler than the Snake River Plain. The Summit Lake Paiute, Fort McDermitt and Duck Valley Shoshone reservations are in this region.

The ecoregion is arid, with mid-latitude steppe and mid-latitude desert climates with hot summers and cold winters. The mean annual temperature ranges from approximately 41°F to 48°F. The frost-free period ranges from 30 to 140 days. The mean annual precipitation is 13.8 inches, ranging from 5.9 inches to over 39 inches on high elevations in the mountains.

Table 3.9 WR Reservations in Northern Basin and Range

Reservations in the Northern Basin and Range	Acres
Shoshone-Paiute Tribes of the Duck Valley Reservation	293,805
Fort McDermitt	31,200
Summit Lake Paiute Reservation	10,863
Total Acres of Indian Land in the Northern Basin and Range	335,868

3.1.9.2 Land Resources

Soils, Topography and Geologic setting: This is a region of basins and ranges with medium to high local relief, typically 3,000 to 5,000 feet. It contains tablelands, intermontane basins, dissected lava plains, scattered north-south trending mountains, and valleys with long, gently sloping alluvial fans. Elevations range from about 2625 feet in deep canyons to 9843 feet on highest mountain peaks. Tertiary volcanic rocks are common, with some Paleozoic sedimentary rocks exposed in some mountains. Aridisols and Mollisols are common, with mesic and frigid soil temperature regimes and xeric and aridic soil moisture regimes.

3.1.9.3 Living Resources

Vegetation: Non-mountainous areas have sagebrush steppe vegetation and some cool season grasses including Mountain big sagebrush, Wyoming big sagebrush, low sagebrush, bluebunch wheatgrass, rabbitbrush, Idaho fescue and Thurber needlegrass with sporadic juniper. Ranges are generally covered in mountain sagebrush, mountain-mahogany, juniper, and Idaho fescue at lower and mid-elevations; Douglas-fir and aspen are common at higher elevations and scattered limber pine and whitebark pine in Nevada.

Native vegetation in the region consists of grama-tobosa shrub steppe in the basins and oak-juniper woodlands. Ponderosa pine occurs at higher elevations. The region has ecological significance as a barrier and bridge between two major ranges of North America: the Rocky Mountains and the Sierra Madre.

Predominant Noxious Weeds of the Northern Basin and Range: Hoary cress, black henbane, Canada, Scotch, musk and bull thistle, leafy spurge, medusa head, purple loosestrife, spotted knapweed, perennial pepperweed, tamarisk, cocklebur and puncture vine are causing problems for tribes located in the Northern Basin and Range ecoregion.

Wildlife: Mule deer, pronghorn antelope, coyote, gray fox, and black-tailed jackrabbit are found in this region. A waterfowl migration route crosses the region. There are tundra swans, lesser snow geese, American widgeons, pintail, canvasback, and ruddy ducks, sandhill cranes and white pelican on this flyway. Golden eagle, gray flycatcher and northern sage sparrow, Swainson's hawk, common raven and common harrier are other bird species. Endemic desert fish species are in basin lakes and springs.

Endangered and Threatened Species: Greater sage-grouse, Lahontan cutthroat trout, bull trout, desert dace, whitebark pine, Columbia Spotted frog, Yellow-Billed Cuckoo, Bruneau hot springsnail, Snake River physa snail.

3.1.9.4 Water Resources/Hydrology

The ecoregion contains mostly ephemeral and intermittent streams, some perennial streams at higher elevations fed by snowmelt or springs. Larger rivers include the Owyhee, Malheur, and Bruneau. There are some scattered lakes and ephemeral pools and internally drained basins and playa lakes.

3.1.9.5 Land Use/Human Activities

Ranching and livestock grazing is common and dryland and irrigated agriculture occur in eastern basins. Recreation and wildlife habitat are other land uses. Population is low and settlements are few. Larger towns include Burns, Soda Springs, and Jackpot.

3.1.10 81 Sonoran Desert

3.1.10.1 Location and Climate

This ecoregion is located in southeastern California, southwestern Arizona, northeastern Baja California, and northwestern Sonora. This vegetation zone includes many of the reservations in Arizona including the Tohono O'odham Nation with almost 3 million acres.

Table 3.10 WR Reservations in Sonoran Desert

Reservations in Sonoran Desert	**Acres**
Tohono O'odham Nation and San Xavier (partial)	2,807,769
Chemehuevi (partial)	26, 091
Cocopah	6411
Colorado River Indian Reservation	285,295.5
Hualapai	60
Quechan	51,700
Maricopa Ak-Chin	21,085
Gila River	374,948
Fort McDowell	24,948
Pascua Yaqui	1831
Salt River Pima Maricopa	50,161
San Carlos	300,000
Total Indian Land in Sonoran Desert	3,924,210

The ecoregion has a dry subtropical desert climate, marked by very hot summers and mild winters. The mean annual temperature ranges from approximately 66°F to 77°F. The frost-free period ranges from 200 to 365 days. The mean annual precipitation is 8.1 inches, and ranges 3 inches to 22 inches. Winter rainfall decreases from west to east, while summer rainfall decreases from east to west.

3.1.10.2 Land Resources

Soils, Topography and Geologic setting: Similar to the Mojave Basin and Range to the north, this ecoregion contains fault-block mountain ranges, scattered low mountains, alluvial fans, and alluvial valleys. Elevations range from sea level to over 4592 feet. Geology consists of Quaternary alluvium, boulder deposits, playa and eolian deposits with surface and subsurface Precambrian to Mesozoic igneous and metamorphic rocks, Tertiary volcanic and sedimentary rocks. Aridisols and Entisols are dominant with hyperthermic soil temperatures and extremely aridic soil moisture regimes.

3.1.10.3 **Living Resources**

Vegetation: The region is dominated by large areas of palo verde-cactus shrub and giant saguaro cactus. Creosote bush, white bursage, ocotillo, brittlebush, catclaw acacia, cholla, desert saltbush, prickly pear, ironwood, and mesquite are other common shrubs.

Non-native perennial grasses have replaced more than 20% of the native semiarid grasslands in Arizona (Gori and Enquist 2003) and their area is expanding. According to the Sonoran Institute; "Invasive species are the second most significant threat to biological diversity after direct habitat loss". (Sonoran Institute, 2009).

Predominant Noxious Weeds within the Sonoran Desert Ecoregion: Buffelgrass, tamarisk and giant reed are of highest concern for tribes located within the Sonoran Desert region. Major weeds such as knapweeds, thistles, whitetop, pepperweed, tamarisk and purple loosestrife are problems in rangeland and riparian areas. Sahara mustard is expanding its range within this region. Weeds common in agricultural areas such as prickly lettuce, yellow sweet clover, Russian thistle and Amaranthus species (pigweed) are a concern to some tribes. Giant salvinia and fountaingrass also pose a threat in the region. Dalmatian and yellow toadflax have been identified by Tonto National Forest and Arizona Invasive Plant Wildland Group as problems within the Sonoran desert zone, but tribes have not identified these plants as large problems on their lands.

Wildlife: Desert bighorn sheep, southern mule deer, coyote, bobcat, kit fox, gray fox, ringtail, javelina, black-tailed jackrabbit, kangaroo rat, desert pocket mouse, desert tortoise, kingsnake, western diamondback rattlesnake, red-spotted toad, desert horned lizard, elf owl, Gila woodpecker, red-tail hawk, Gambel's quail.

Endangered and Threatened Species: Lesser long-nosed bat, Nichol Turk's head cactus, Pima pineapple cactus, Acuna cactus, masked bobwhite Yuma clapper rail, and southwestern willow flycatcher.

3.1.10.4 **Water Resources/Hydrology**

There are mostly ephemeral and intermittent streams in this region. Few surface water resources occur, except for rivers, such as the Colorado with distant sources. There are some springs and a few reservoirs. There are many internally-drained basins that terminate in playas.

3.1.10.5 **Land Use/Human Activities**

There are small areas of intensive irrigated cropland with cotton, alfalfa, hay, lettuce, melons, onions, sweet corn, grain sorghum, citrus, and winter vegetables. Limited livestock grazing takes place in wetter periods and a few cattle feedlots are in operation. Drought and invasive weeds make supplemental feeding necessary for livestock on the Colorado River Reservation. This region includes military training land, national monuments, national parks, national wildlife refuges, tribal land and wilderness. Larger towns and cities include Blythe, Yuma, Gila Bend, Casa Grande, Phoenix, Tempe, and Tucson. (Griffith, G. 2010)

3.2 *Migratory Bird Treaty Act*

The Migratory Bird Treaty Act makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations. The migratory bird species protected by the Act are listed in 50 CFR 10.13. The migratory bird list contains several hundred birds, many of them quite common, such as bluebirds, buntings, cardinals, crows, chickadees, catbirds, doves, hummingbirds, juncos and jays. There are also a number of raptor species, such as kestrels, kites, eagles and hawks and numerous waterfowl including ducks and shorebirds. (USFWS, 2013)

3.3 *Water Resources*

3.3.1 Watersheds

3.3.1.1 Introduction

A watershed is an area of land that catches precipitation, such as rain and snow and drains or seeps into larger water body, such as a marsh, stream, river, lake, ocean or groundwater. The watershed provides a management unit to integrate ecological, geographical, geological, and cultural aspects of the land. Watershed analysis is often undertaken to incorporate science with historical, cultural, economic, and political issues. (Edgewood College, undated)

Watershed is an area above a given drainage point on a stream that contributes water to the flow at that point.

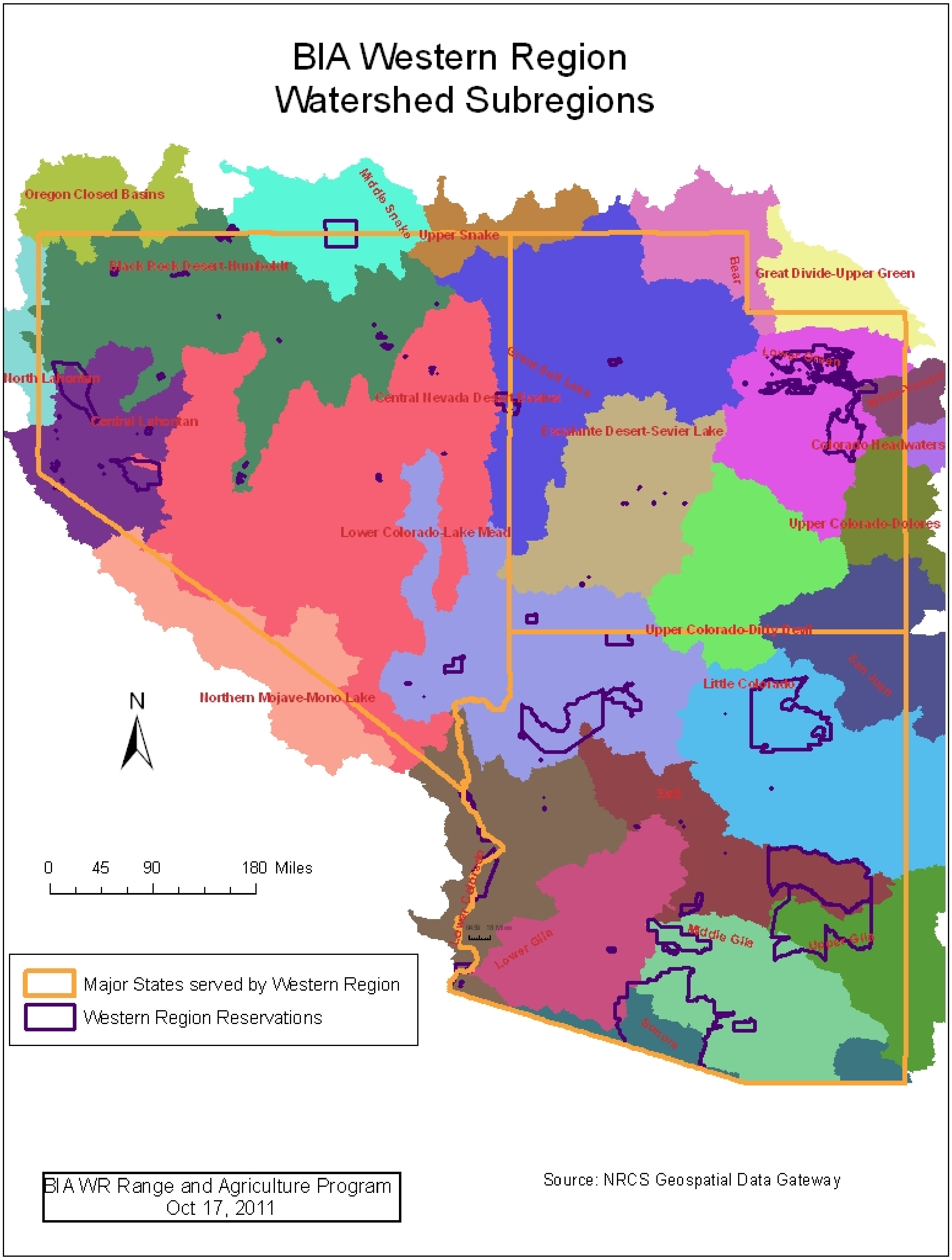
i. Watershed is a natural unit draining runoff water to common point of outlet.
ii. The watershed is geohydrological unit or a piece of land that drains at common point. Catchments basin or drainage basin are synonymous of watershed.

(Agriinfo, undated)

Watershed research began in the 1920's, primarily as a concern about sediment inputs into Roosevelt Dam in Arizona. By the 1930's, the Forest Service started researching and using watershed models. In the mid 1950's and 1960's, the concept of watersheds started to formalize in governments and was used as an avenue for public agencies and private groups to manage water for economic growth while maintaining watersheds in good condition. (Colorado State University, 2008 and University of Arizona Extension, February 2002.)

Today, government agencies such as BLM, USFS, NRCS and EPA use the watershed as a basis for their analysis and management strategies. Some tribes are also implementing this approach. In evaluating noxious weed management strategies, watersheds need to be taken into account.

Map 3-2 WR Watershed Subregions



3.3.1.2 Hydrologic Units

In the 1970s, the USGS (United States Geological Survey) and Water Resources Council created a mapping and classification system that partitioned the U.S. into four nested watershed levels. The levels are called **Hydrologic Units (HU)**, divided and subdivided drainage areas down to 250,000 acres (390 sq. mi) portions called Level 4 (subbasin) HUs. Recently the USGS, in cooperation with the Natural Resources Conservation Service (NRCS), further divided the HU system into six levels of hydrologic units (down to 10,000 acres or 15 sq. mi at their smallest). *(*Minnesota Department of Natural Resources, Undated) Map 3-2 shows the watershed subregions within Western Region.

Most of the watersheds/hydrologic units are named for the river or existing or remnant large water body component in which other streams and water sources drain. The Central Lahontan watershed Subregion contains most of the Pyramid Lake Paiute Reservation, Walker River Paiute Reservation and many other western Nevada reservations. The Confederated Tribes of the Goshute Reservation lies on the edges of the Great Salt Lake Basin and the Central Nevada Desert Basins. The Skull Valley Goshute Reservation is in the Central Salt Lake Basin. The Uintah and Ouray Reservation is in the Lower Green watershed. Duck Valley is in the Middle Snake watershed. Several Arizona and Nevada reservations are within the Subregion of the Colorado River basin such as Lower Colorado-Lake Mead which includes the Moapa, Shivwits, Hualapai, Havasupai and Kaibab reservations. The Hopi Reservation is within the Little Colorado River watershed. The White Mountain and San Carlos Apache are within the Salt and Upper Gila River watersheds. Two communities, the Salt River Pima-Maricopa Indian Community and Gila River Indian Community, are in the watershed of the river in their respective names, the Salt and Middle Gila. The Tohono O’odham Nation is within the Middle Gila River and Sonora watersheds. These watersheds could be further broken down into two and four more units for analysis and planning.

3.3.2 Water Quality

3.3.2.1 Surface Quality-Current Status and Assessments

Water resources in the desert regions of the west are limited and residents rely on good water to be available for their livelihood and well-being. This section describes the status of water quality on tribal land and some of the current issues and laws governing the use of pesticides on Indian lands and their effect on water quality.

3.3.2.1.1 Drinking Water Quality

The Safe Drinking Water Act (SDWA) passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. Amendments passed in 1986 and 1996 require additional protections of drinking water and its sources. Legislation focusing on tribal community water supplies was passed in 1988 and 1992.

Congressional findings 25 USC § 1632 – Safe water and sanitary waste disposal facilities
The Congress hereby finds and declares that—
(1) the provision of safe water supply systems and sanitary sewage and solid waste disposal systems is primarily a health consideration and function;
(2) Indian people suffer an inordinately high incidence of disease, injury, and illness directly attributable to the absence or inadequacy of such systems;
(3) the long-term cost to the United States of treating and curing such disease, injury, and illness is substantially greater than the short-term cost of providing such systems and other preventive health measures;
(4) many Indian homes and communities still lack safe water supply systems and sanitary sewage and solid waste disposal systems; and
(5) it is in the interest of the United States, and it is the policy of the United States, that all Indian communities and Indian homes, new and existing, be provided with safe and adequate water supply systems and sanitary sewage waste disposal systems as soon as possible.

(Cornell University Law School, 25 USC § 1632 - Nov. 23, 1988, October 29, 1992)

Despite this legislation to improve water quality on Indian lands, surveys conducted in the year 2000 to compare water quality on reservations to state and national water quality, found water quality disparities. Western Region reservations were not tested at the time, but studies of two Midwestern reservations discovered a greater percentage of reservation wells with high levels of nitrate nitrogen and coliform bacteria. The level of contaminants exceeded EPA standards for safe drinking water. According to the researchers, the pollution sources come from animal waste or septic systems. Land use practices, including the presence of livestock near wells, may have contributed to the problem. Many of the wells on reservations were outdated. Cracked or shallow wells can allow contamination to seep into the drinking water supply. *(*Cable News Network, April 2000)

According to the Indian Health Service, safe and adequate water supply and waste disposal are lacking for at least 12% of AI/AN (American Indian/Alaskan Native) homes, compared to 1 % of the US general population. The Bureau of Reclamation cites figures as high as 30% in a publication North Central Arizona Water Supply Study (Oct 2006). Water settlements to tribes often provide funding for tribal water supply systems. Congress took note of this and enacted 25 USC 1632 (a) (2) & (a) (3) prior to 1990 to designate safe drinking water systems for tribes as a priority. This code is current as of Feb 1, 2010. *(*Smith, R.; August 2011)

3.1.1.1.1 Pesticides

Pesticides, used to control weeds, insects, and other pests, are subject to public scrutiny because of potential impacts on humans and the environment. Negative effects from the use of pesticides are possible in the aquatic environment. Research has indicated that some pesticides disrupt endocrine systems and affect reproduction by interfering with natural hormones in fish and mammals, including humans.

In a comprehensive study of pesticide levels throughout the United States, the National Water-Quality Assessment (NAWQA) Program focused on water quality in more than 50 major river basins and aquifer systems that cover about one-half of the land area of the United States. NAWQA began investigations in in 1991 and phased in additional basins by 1997. The report was published in 1999. A large portion of Arizona was included and smaller areas in Nevada and Utah were part of this study. Major areas in Idaho, and California were also covered. Herbicide concentrations consistently ranked highest in agricultural streams and major rivers in intensive farming areas. Most streams with low herbicide concentrations were agricultural streams in areas with low to moderate herbicide use in their drainage basins. Among urban sites, only Las Vegas Wash in Las Vegas had relatively high herbicide concentrations compared to other streams. (U.S. Geological Survey, March 2006, Rev Feb, 2007)

Follow-up studies have been carried out by USGS under the NAWQA program. Additional sampling of groundwater for pesticides was done in 2001 and 2003. The herbicides found in groundwater in the 1993-1995 sampling were still present but had decreased. These compounds were the triazine herbicides (atrazine, simazine, and prometon); the acetanilide herbicide, metolachlor; the urea herbicide, tebuthiuron; and an atrazine degradant, deethylatrazine (DEA). *(*Bexfield, 2008*)*
Recent assessments of pesticide concentrations in water (2008) did not list pesticides as contributing to major impairments in Nevada and Utah. However, the Arizona Department of Environmental Quality (ADEQ) does list pesticides as contributing factor to impairments in three watersheds, the Gila River, Hassayampa River and Salt River.

Table 3.11 Arizona Pesticides-Cause of Impairment Group
Size of Assessed Waters with Listed Causes of Impairment

Cause of Impairment	Rivers and Streams (Miles)	Lakes, Reservoirs, and Ponds (Acres)
Chlordane	98.9	285.0
DDT	98.9	285.0
Toxaphene	98.9	285.0

Table 3.11 AZ Pesticides-Cause of Impairment

Source: http://iaspub.epa.gov/tmdl_waters10/attains_state.cause_detail?p_state=AZ&p_state_name=Arizona&p_cycle=2008&p_cause_group_name=PESTICIDES

The pesticides listed in Table 3.11 are banned insecticides showing residual accumulation in Arizona waters. See the Appendix E or EPA website for listing of areas where these pesticides are impairing waters in AZ. A few maps are in Appendix E. Remaining maps are available at EPA website.
http://ofmpub.epa.gov/tmdl_waters10/attains_state.control?p_state=AZ

3.3.2.1.2 Impaired Waters

The goal of the Clean Water Act (CWA) is “to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters”. Under section 303(d) of the CWA, states, territories, and authorized tribes are required to develop lists of impaired waters every two years. Waterbody condition information for determining impairment comes from monitoring programs carried out under CWA Section 305(b). A state’s impaired waters list is comprised of all waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards. The law requires that states establish a prioritized schedule for waters on the lists and develop Total Maximum Daily Loads (TMDLs). A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. Technical documents associated with the TDMLs summarize the analysis and outline remediation measures. The number of TDML's is increasing every cycle with over 40, 000 impaired waterways nationwide requiring this action.

Maps 3-3 and 3-4 show impaired water features and watersheds in Western Region reflecting river and creek segments and lakes, designated under Section 303(d) of the Clean Water Act. States have established Total Maximum Daily Loads (TMDLs) for these waters. Impaired waters for which other pollution control mechanisms are in place and are expected to attain water quality standards, or water where the impairment is not caused by a pollutant are not represented. For more information regarding impaired waters refer to EPA's Integrated Reporting Guidance at: http://www.epa.gov/owow/tmdl/guidance.html This layer was last updated in 2010.

Utah has the densest concentration of Impaired Waters with heavy intensities on the Uintah and Ouray Reservation in the Lower Green watershed. The Uinta River and the Lake Fork River and numerous creeks and tributaries are impaired, including Dry Gulch Creek, Pariette Draw, and Deep Creek. The Whiterocks River was previously listed; however, 2010 data shows that it is no longer impaired. The Escalante Desert-Sevier Lake Watershed also shows several impairments in areas where some Southern Paiute Indian lands are located. There is an impaired basin just south of the Koosharem Reservation adjacent to Otter Creek. The Santa Clara River has an impaired segment just north of the Shivwits Reservation in the Lower Colorado-Lake Mead Subregion, although this watershed does not show heavy impairments. In Utah, metals, oxygen depletion, salinity, phosphorus, ammonia, total dissolved solids and temperature are common causes of impairment. Most of the impairments to these water bodies are increased total dissolved solids due to agriculture and aquaculture.

In Nevada, the Humboldt River, south of the Elko Band lands, in the Black Rock Desert-Humboldt Watershed region, is impaired for most of it east-west length. The impaired waterway flows west from Elko near the Battle Mountain and Winnemucca Band Indian lands, a distance of around 175 miles. The Owyhee River, in the Middle Snake Watershed, is impaired in northeastern Nevada for 15 miles of its flow north to the Duck Valley Indian Reservation. It remains impaired eight miles in the southeastern corner of the reservation. Several creeks in the northeastern corner of Duck Valley are listed as impaired, primarily Mary's Creek and several tributaries. Portions of the Truckee, Carson and Walker Rivers are impaired but not within reservation boundaries. The most common causes of impairment in Nevada are metals, temperature, turbidity, nutrients (such as phosphorus) and mercury. Salinity, toxic organics and pH are other impairment problems.

In Arizona, the Verde River has impaired sections above and below Camp Verde but is not listed as impaired within reservation boundaries. This waterbody has high turbidity and is impaired for fish, shellfish and wildlife protection. The probable causes are listed as recreational activities and grazing. Portions of the Salt River in the Salt watershed and Agua Fria River within the Lower Gila watershed are impaired in areas where it could affect water quality on Arizona reservations Selenium and E. coli are serious impairments in Arizona, along with copper, turbidity, oxygen depletion, pesticides and pH. (Environmental Protection Agency, May 2012)

3.3.3 EPA National Enforcement Initiatives in Indian Country

EPA enforcement initiatives seek to improve compliance at public drinking water systems in Indian country. EPA works with Indian tribes to improve compliance at facilities through compliance assistance, monitoring and enforcement to address facilities in significant noncompliance. The goal is to enhance the ability of EPA and Indian tribes to monitor compliance through access to readily available, accurate and reliable data and training tribal compliance monitoring inspectors and other tribal environmental professionals.

3.3.3.1.1 EPA Tribal Pesticide Programs

The primary goal of the National Pesticide Tribal Program is to help protect human health and the environment by ensuring pesticides and alternatives are available in Indian country and can be used according to label directions without causing unreasonable risks. Out of the 562 federally recognized tribes, about 40 have pesticide cooperative agreements with EPA and are part of the Tribal Pesticide Program Council (TPPC). Eight tribes in Western Region and the Inter-Tribal Council of Arizona are part of the TPPC. (TPPC, Sept 2012)

3.3.3.1.2 Tribal General Assistant Program (GAP)

Congress passed the Indian Environmental General Assistance Program in 1992 to provide grants to federally-recognized tribes to plan, develop and establish environmental protection programs in Indian country, including solid and hazardous waste programs on Indian lands. Funds available nationwide for Tribal GAP grants have been about 62 to 67 million dollars from 2010 through 2012. Individual initial tribal grants have been about $75,000 per tribe.

3.3.3.1.3 Tribal Environmental Protection Offices

Nearly all tribes in Western Region have a tribal environmental protection office. Many are at least partially funded by the US EPA for US EPA priorities and programs. Some of these programs are maintained through Direct Implementation Tribal Cooperative Agreements (DICTA). DITCAs allow federally-recognized Indian tribes to carry out EPA's function and implement federal environmental programs directly and are an important avenue for EPA and the tribes to provide environmental protection in Indian Country. Examples of DITCA water quality-funded activities include: water quality standards review; National Pollutant Discharge Elimination System (NPDES) permit program under the Clean Water Act; Public Water System Supervision program and the Underground Injection Control program under the Safe Drinking Water Act; implementation of the Underground Storage Tank program, and certification and training program for pesticide applicators under the Federal Insecticide, Fungicide, and Rodenticide Act.

3.3.3.1.4 NPDES (National Pollution Discharge Elimination System) Permits

Water pollution degrades surface waters making them unsafe for drinking, fishing, swimming, and other activities. Under 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. Point sources are pipes or constructed ditches. Effluent limitations are the primary mechanism in NPDES permits for controlling discharges of pollutants to receiving waters. Effluent limits in permits are ideally based on the technology available to control the pollutants and the water quality standards of the receiving water. Where a watershed is listed as impaired, NPDES permits need to reflect the results of completed Total Maximum Daily Load (TMDL). A TMDL identifies the amount of a pollutant, from point, nonpoint, and natural background sources, including a margin of safety that may be discharged to water body and still ensure that the water body attains water quality standards. (Environmental Protection Agency, March 2009, November 2010, November, 2012)

3.3.3.1.5 Regulating Pesticides under NPDES

In 2009, the Sixth Circuit Court (National Cotton Council vs. EPA) struck down EPA's 2006 published Rule [Application of Pesticides to Waters of the United States in Compliance with Federal Insecticide, Fungicide and Rodenticide Act [(FIFRA) 40 CFR 122)] and mandated that pesticide applications to, near or over water, fall under the Clean Water Act (CWA) and require NPDES (National Pollution Discharge Elimination System) Permits. NPDES permits are required by the U.S. EPA for pesticide applications "to, over, or near" water of the US, as of October 31, 2011.

A Pesticide General Permit (PGP) has been developed to authorize the use of pesticides under this court order. This PGP has a number of restrictions and stipulations including an evaluation of options for each pest management area to include: **a**. No action; **b**. Prevention; **c**. Mechanical or physical methods; **d**. Cultural methods; **e**. Biological control agents; **f.** Pesticides.

The BIA Noxious Weed Program requires weed grant applicants to evaluate each of these options as part of the grant criteria. The PGP has other size and discharge limitations. Once finalized, EPA's Pesticide General Permit will cover pesticide applications in six states, most U.S. territories, Indian country lands, and many federal facilities. Permitting Authority is EPA Region 8 for Indian lands in Utah except for the Confederated Tribes of the Goshute Reservation. Permitting authority for Indian lands in Arizona, California and Nevada is EPA Region 9, including Duck Valley, Fort McDermitt and Goshute. (Environmental Protection Agency, Pesticide General Permit, Accessed February 16, 2012)

3.3.3.1.6 BIA Environmental Management System

From 2005 to 2008, EPA conducted environmental compliance checks of Bureau of Indian Affairs (BIA) and Bureau of Indian Education (BIE) buildings, schools, water systems and grounds. A number compliance gaps were discovered. As part of a settlement agreement for these violations, BIA and BIE are required to implement an Environmental Management System (EMS). Division of Environmental and Cultural Resource Management (DECRM) is the lead for developing the EMS. In 2010 and 2011, BIA field agencies received audits under the Environmental Management Assessment Program (EMAP). DECRM hired consultants to develop training for BIA and BIA staff and they are in the process of developing the EMS and an Environmental Management Plan. Many of the risks identified in the EMS process are associated with water quality but it also assesses risks to land and air quality, global warming, depletion of natural resources and other environmental concerns. A concerted effort is now underway to reduce environmental risks by identifying them and assisting BIA field staff with Standard Operating Procedures, education and other training to help them come into compliance.

3.3.4 Ground Water Quality-Status and Assessments

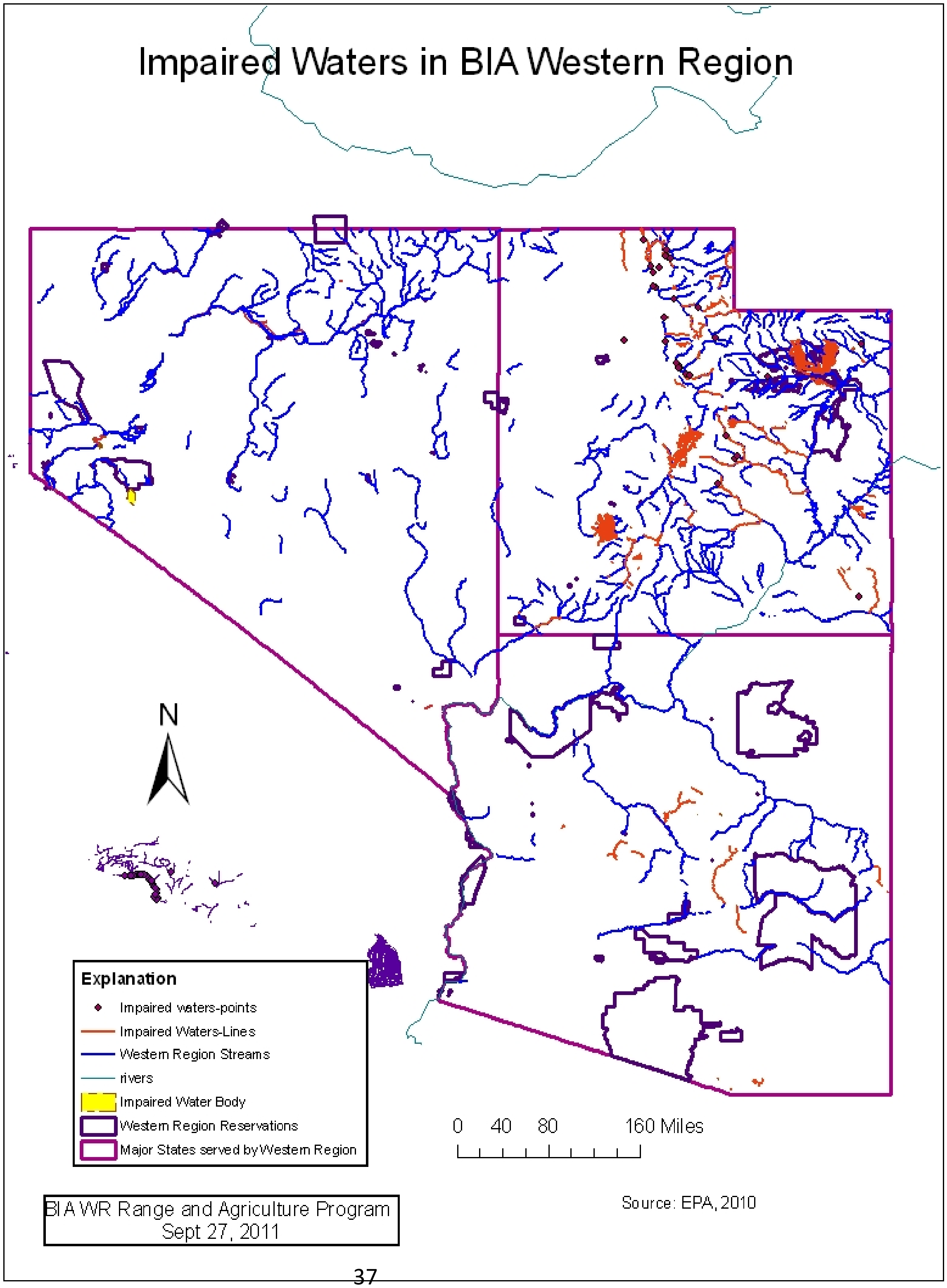
An assessment of general groundwater quality on BLM-administered lands was done, based on the measure of dissolved solids in mg/L in the western region states. (BLM Vegetation Treatments EIS, Nov 2005, Map 3-7). Although data is not displayed for most of Arizona and is not complete for Utah, it shows a general good to moderate quality for most areas. Poor groundwater quality was identified by US Geological Survey from 1994-1999 in areas along much of the Utah/Nevada border and adjacent to Goshute Indian lands.

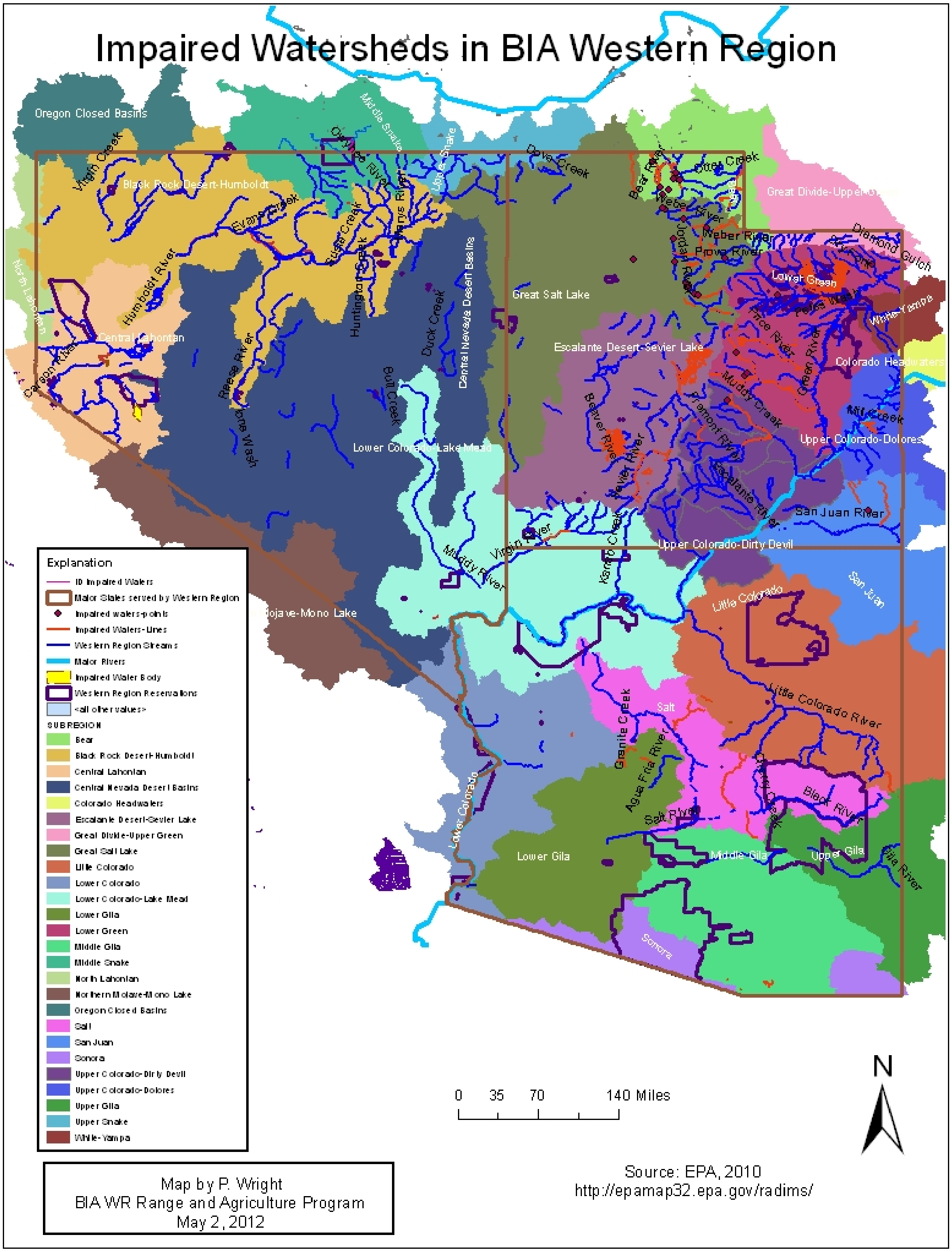
Recent groundwater studies published by USGS (Anning, D., USGS, Sept, 2012) are predicting increased levels of arsenic and nitrate in several watersheds in Arizona, California, Utah and Nevada and limited study areas in Colorado, Idaho and New Mexico. Areas predicted to equal or exceed the drinking-water standard for nitrate include basins in central Arizona near Phoenix; the San Joaquin, Inland, and San Jacinto basins of California; and the San Luis Valley of Colorado. Areas predicted to equal or exceed the drinking-water standard for arsenic are within the western portion of the Basin and Range Physiographic Province in Nevada, California, and Arizona.
Arizona Department of Environmental Quality (ADEQ) conducts regular groundwater monitoring in two areas of Arizona (Yuma and Buckeye) where it is considered likely to have pesticides detected in groundwater based on cultural practices, pesticide usage, shallow groundwater and coarse-textured soils. From 2008 to 2010, pesticides have been detected in Arizona groundwater in low concentrations. ADEQ has developed an Education and Outreach Plan to encourage users of pesticides to adopt voluntary best management practices (BMPs) to prevent pesticide movement into groundwater, particularly in areas with shallow groundwater and coarse-textured soils. These guidelines are in Appendix E. Results of groundwater monitoring have detected the following herbicide active ingredients in Arizona.

Table 3.12 Herbicides in Arizona Groundwater

Active Ingredient	**Type of Pesticide**	**Common Brands**	**Manufacturer Concentration**	**Range** (parts per billion**)**
Atrazine	Herbicide	Aatrex AL	Steadfast ATZ Syngenta	(0.02 – 0.36)
Diuron	Herbicide	Ginstar EC	Velpar; Alfamax; Bayer; DuPont	(0.02 – 0.30)
Prometryn	Herbicide	Prometryn 4L Caparol 4L	Loveland Syngenta MANA	(0.02 – 0.96)

Map 3-3 Impaired Waters in Western Region





Map 3-4 Impaired Watersheds in Western Region

3.3.5 Waters of the United States including Wetlands

3.3.5.1 Definition and Regulation

In additional to the regulation of discharge of pesticides into Waters of the United States (US), described in Section 3.2.2.2, the discharge of dredged and fill material in Waters of the US is also regulated under Section 404 of the Clean Water Act. Weed control projects using earth moving equipment to remove invasive species in wetlands and rivers may need clearances from the Corps of Engineers. Most of these disturbances would be covered under a Nationwide Permit 27 for aquatic habitat restoration activities. (See Appendix F)

The definition of “waters of the United States” includes the following

a. Navigable waters of the United States.
b. Wetlands.
c. Tributaries to navigable waters of the United States, including adjacent wetlands and lakes and ponds.
d. Interstate waters and their tributaries, including adjacent wetlands.
e. All other waters of the United States not identified above, such as isolated wetlands, intermittent streams, and other waters that are not part of a tributary system to interstate waters or to navigable waters of the United States, where the use, degradation or destruction of these waters could affect interstate or foreign commerce.

Section 404 of the Clean Water Act defines the limit of jurisdiction as the high tide line in tidal waters and the ordinary high water mark as the limit in non-tidal waters. When adjacent wetlands are present, the limit of jurisdiction extends to the limit of the wetland.

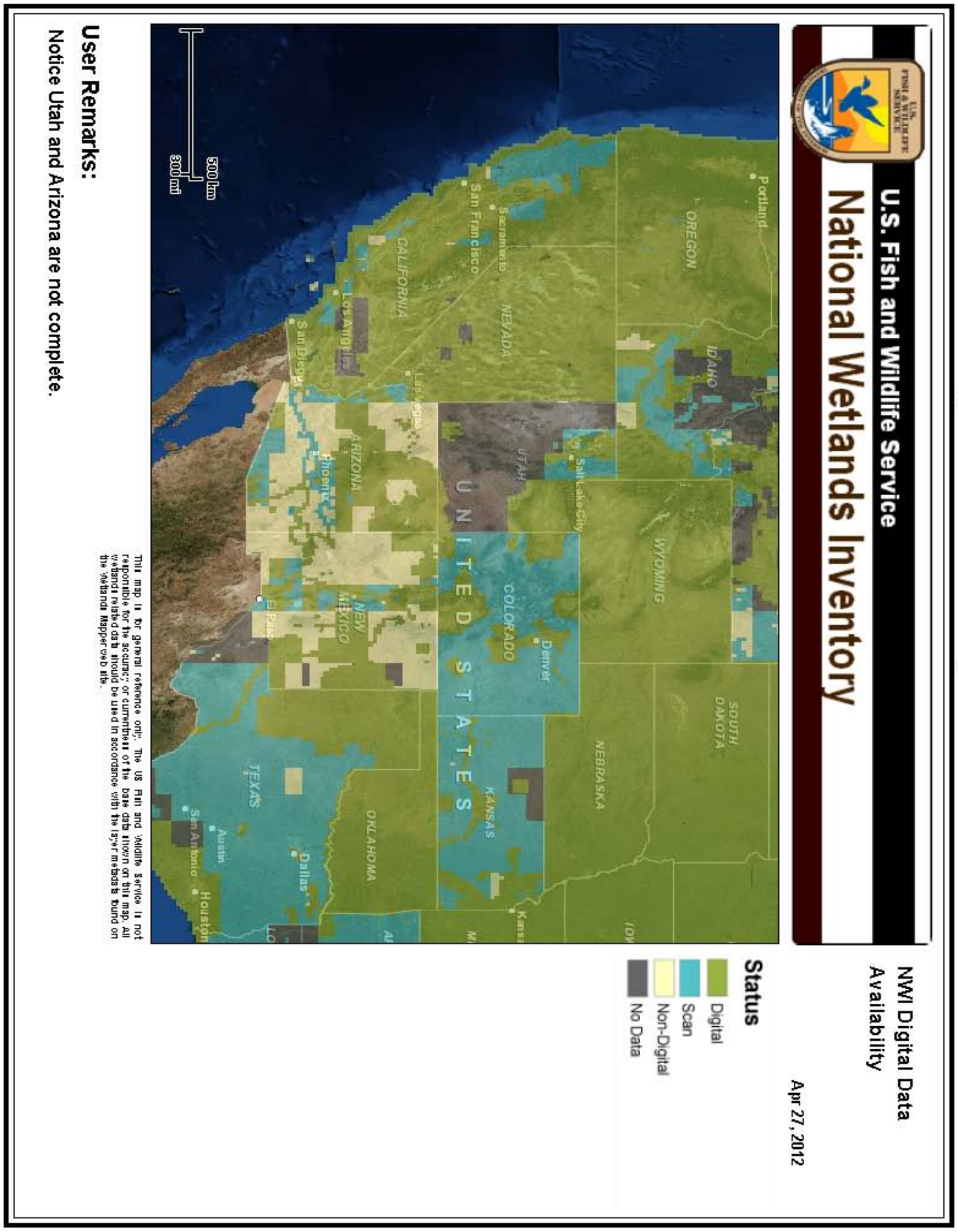
(US Army Corp of Engineers, Updated July 2012)

3.3.5.2 National Wetland Inventory

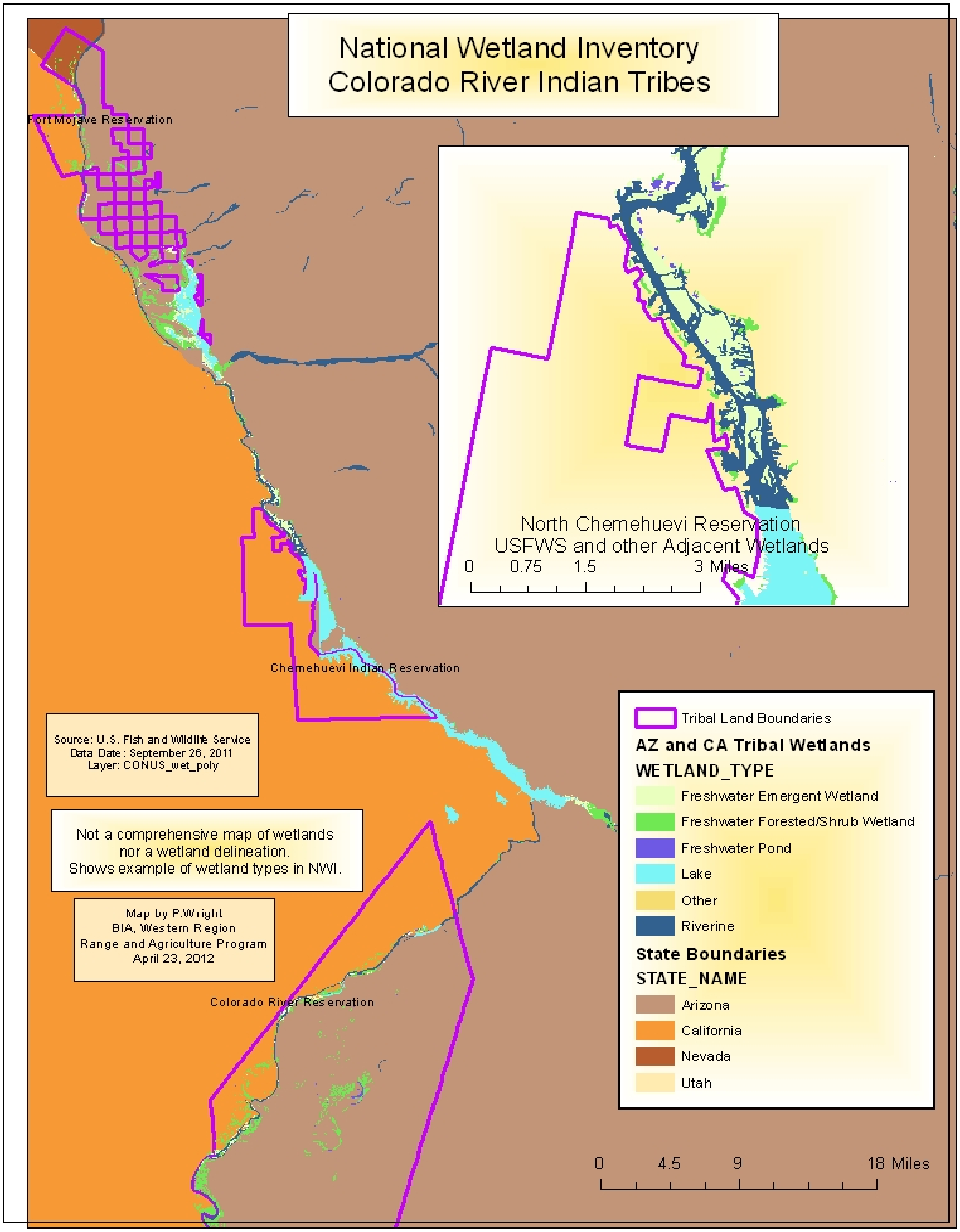
The National Wetlands Inventory Program (NWI) has been producing wetland maps for the United States since the mid-1970s. The focus on the program has been to provide maps and/or digital databases of wetlands for delivery to the public. The NWI program also reviews national wetland trends in order to assess the integrity and extent of this natural resource. Digital data is available for download through the internet via the Wetlands Mapper online tool. NWI digital data was used to assess the extent of wetlands on reservations that may potentially be affected by weed control techniques evaluated in this PEA.

The NWI uses aerial photo interpretation (image analysis) to interpret wetlands and deepwater habitats. The maps are made at 1:24, 000 scale. In the last 15-20 years, the NWI maps were digitized for geographic information system (GIS) applications. Map 3-5 shows the status of wetland inventory data for the states in BIA Western Region as of April 2012 when data was downloaded and NWI maps were created.

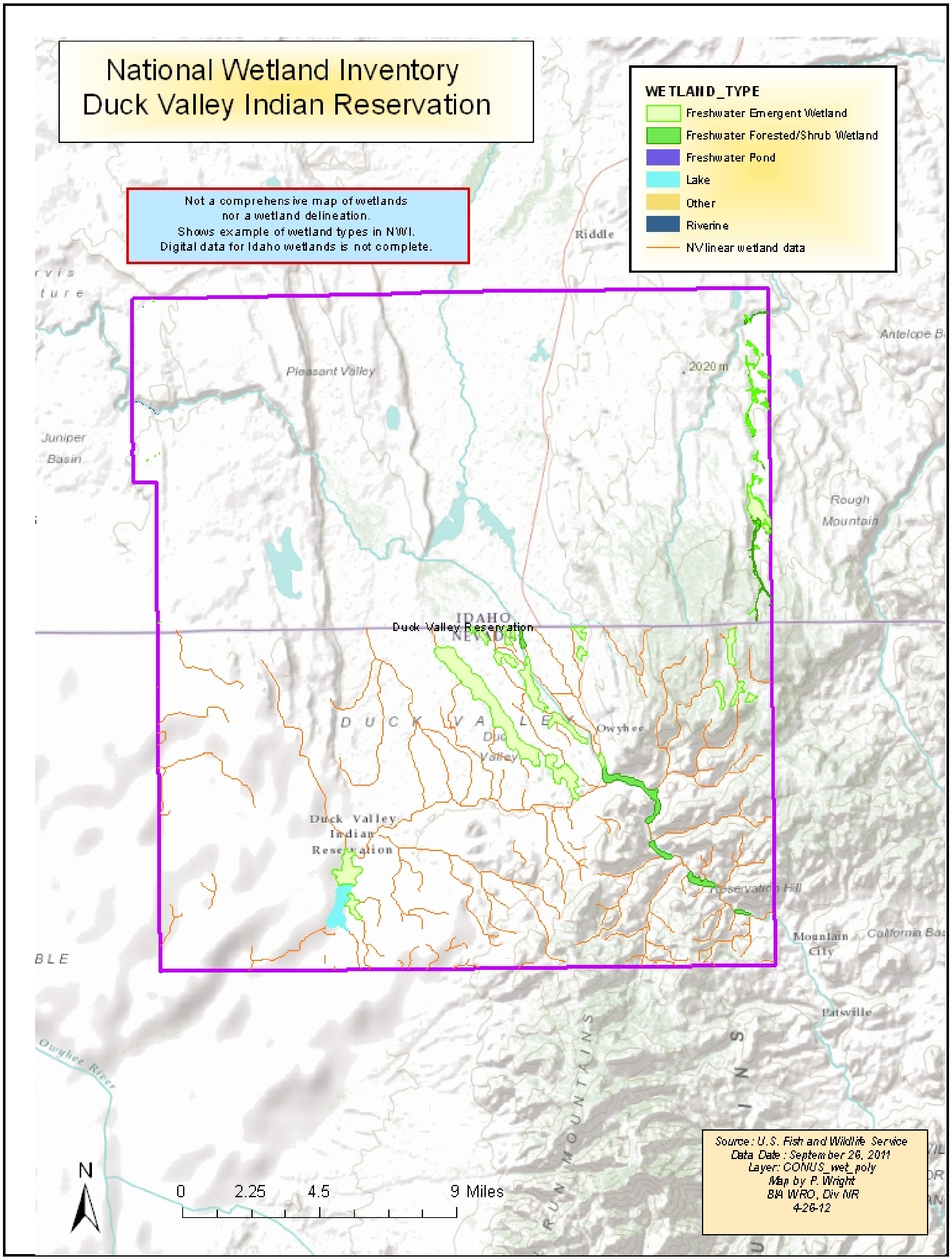
Map 3-5 Status of NWI



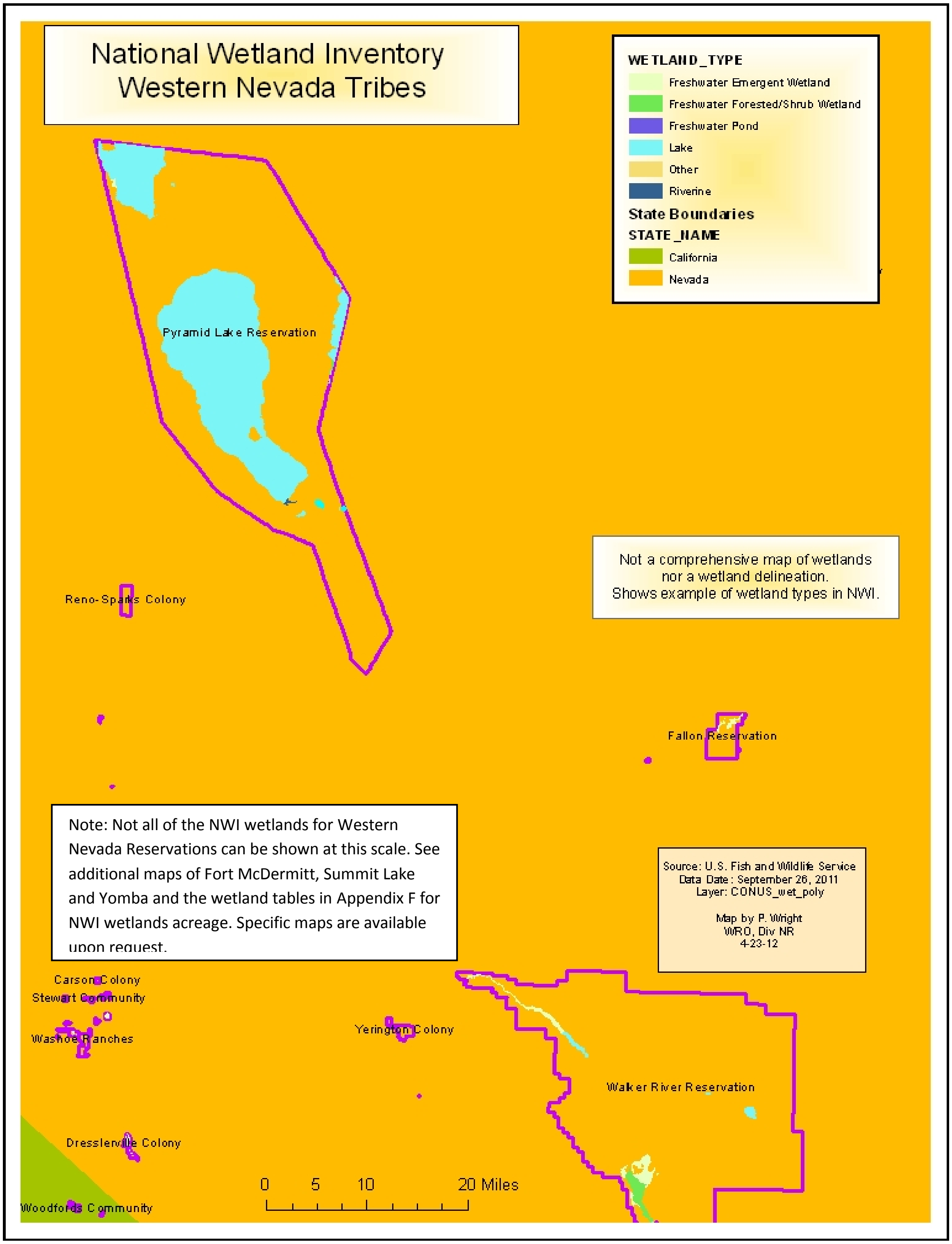
Map 3-6 NWI CRIT



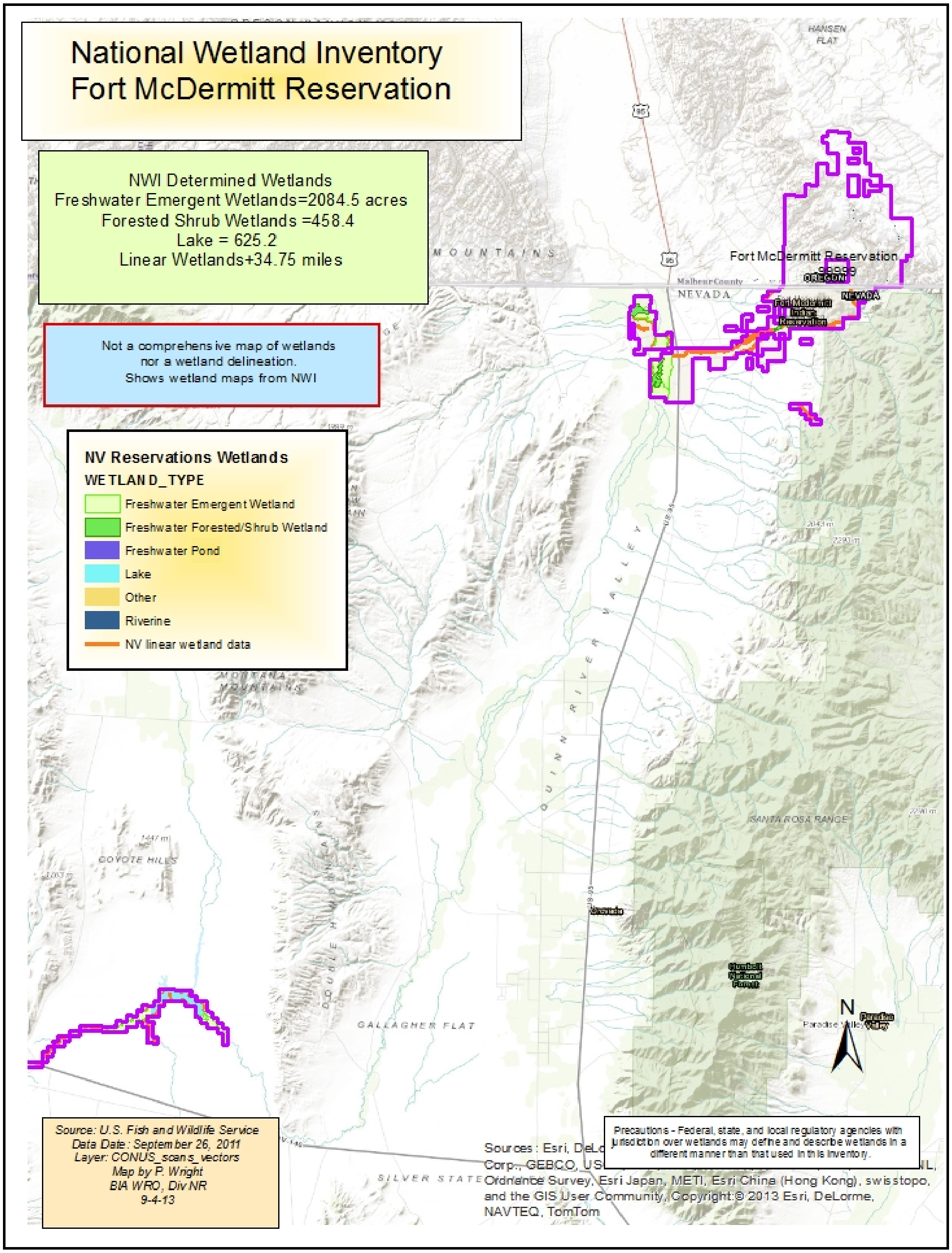
Map 3-7 NWI Duck Valley



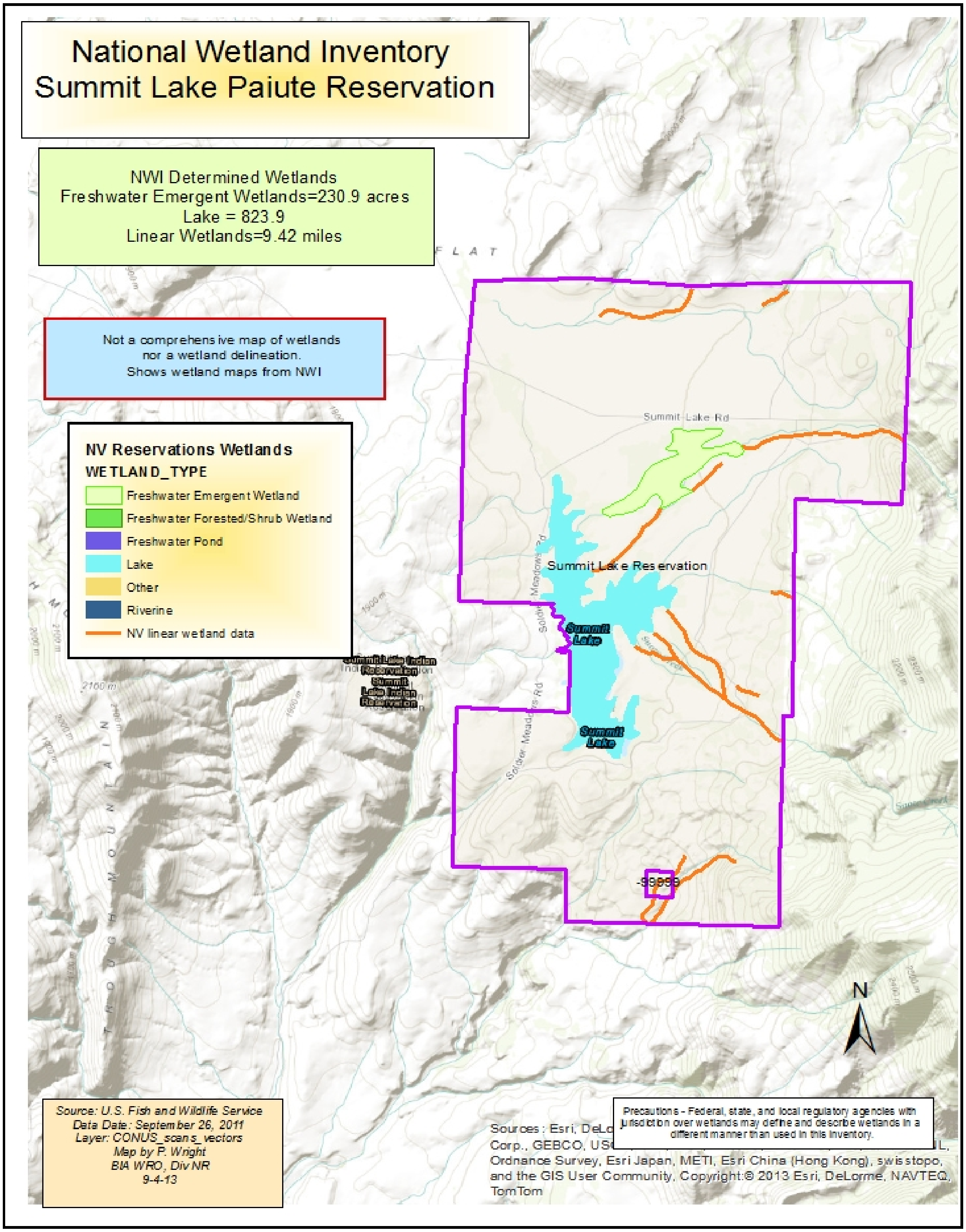
Map 3-8 NWI-Western Nevada



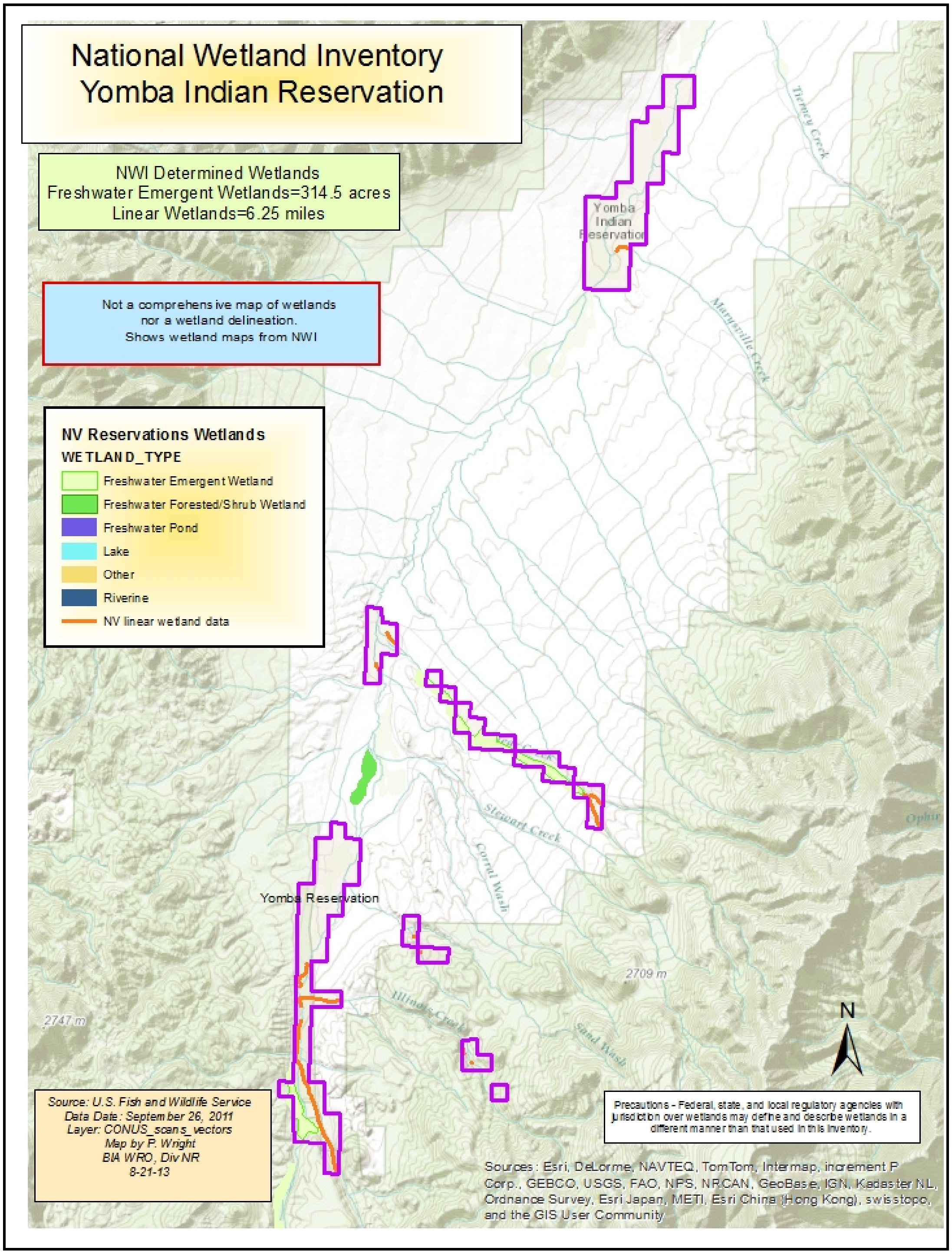
Map 3-9 NWI Fort McDermitt 1



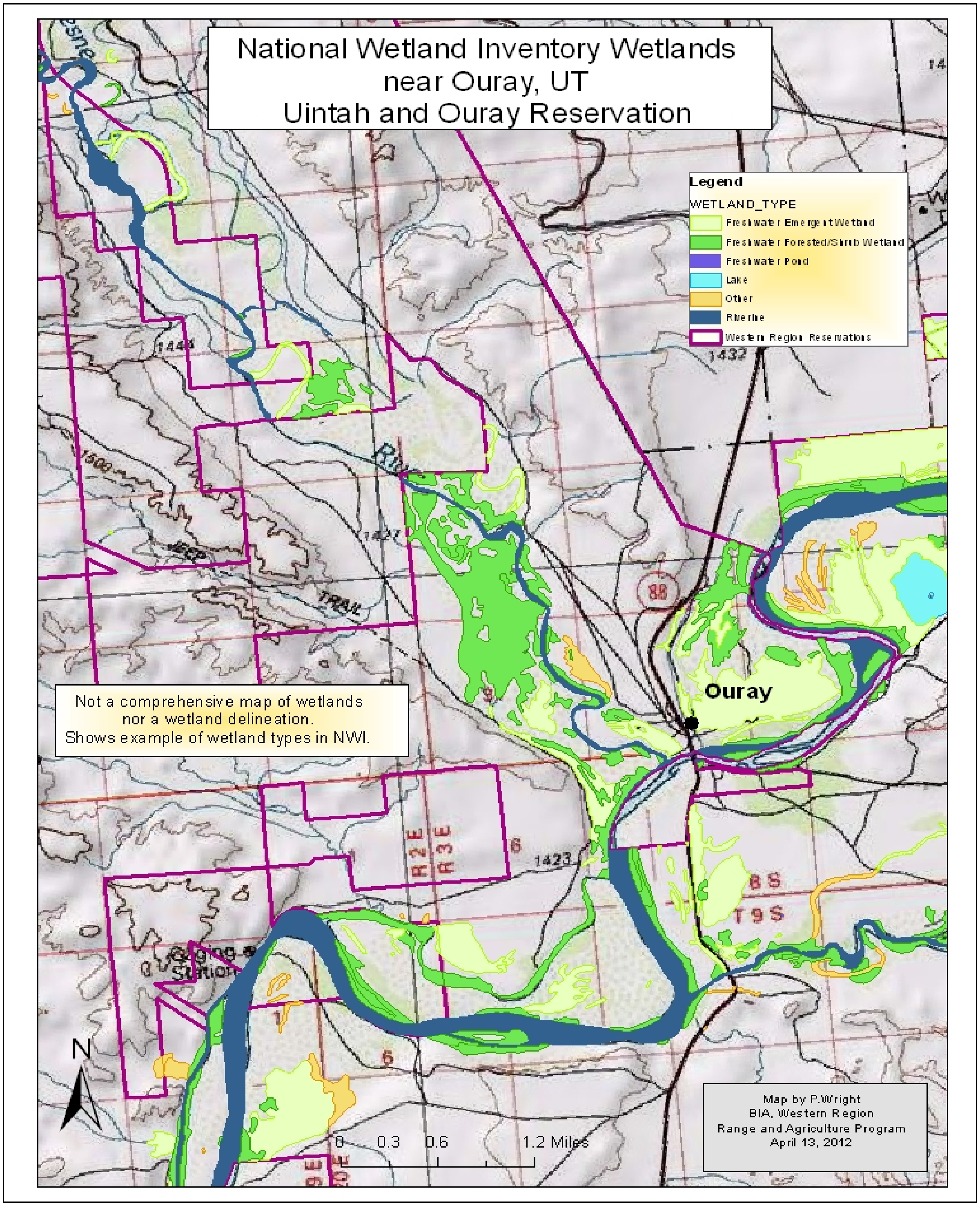
Map 3-10 NWI-Summit Lake



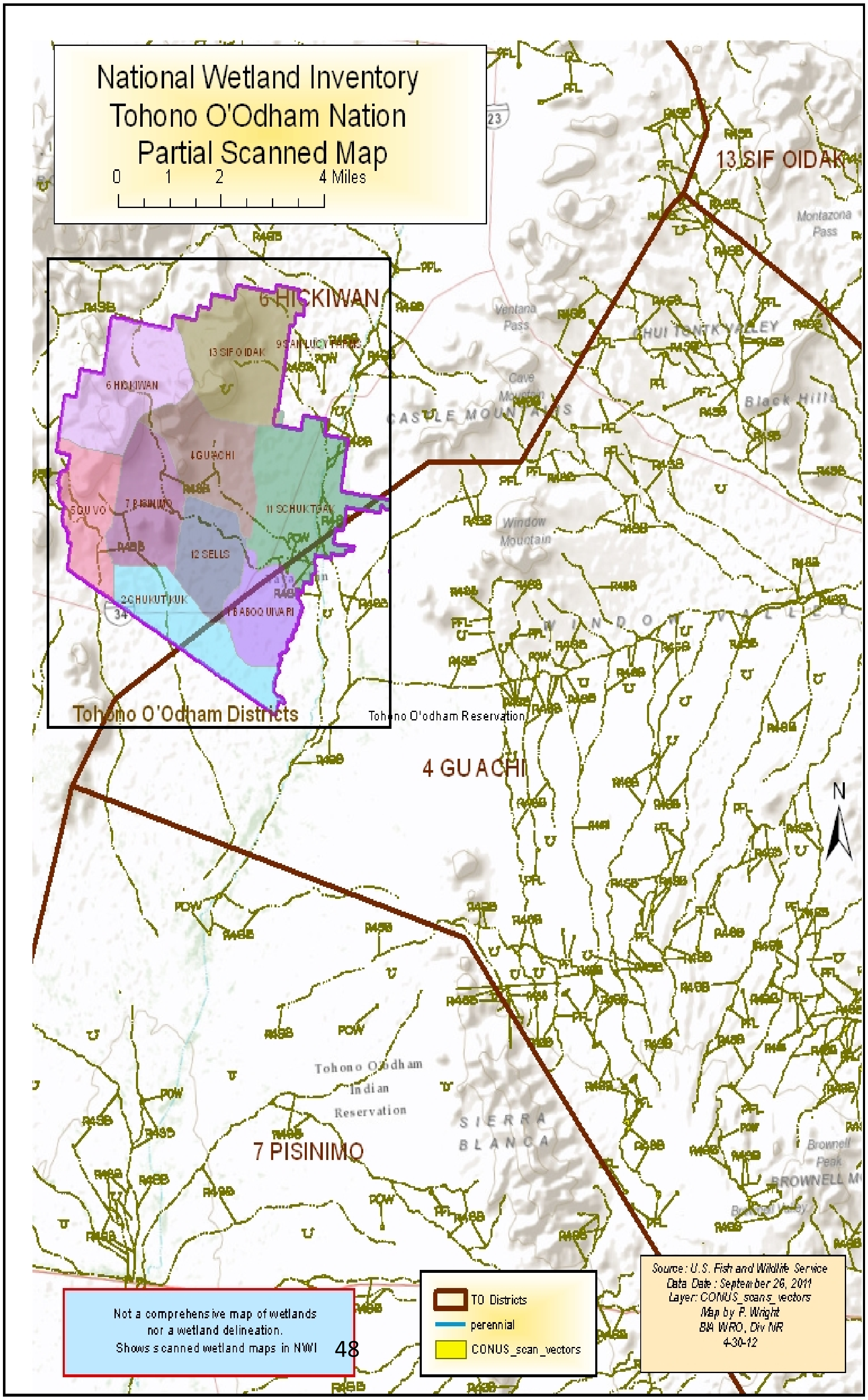
Map 3-11 NWI-Yomba Reservation



Map 3-12 NWI Ouray, UT



Map 3-13 NWI TO Nation



Nevada has nearly full coverage digital layers, while coverage for Utah is still missing for almost half the state and was not available for download in September of 2013. Arizona digital wetland data is primarily missing for Hualapai, San Carlos and White Mountain Apache Reservations, Hopi, Tohono O'Odham, the Salt River and Gila River Reservations, although some data was available with the 2012 download. Digital data may have since been removed for Indian lands. No linear wetland data was available for Arizona.

The amount and type of NWI data availability affects the results in the tables showing acreage of reservation wetlands produced in ArcGIS. Tables showing acreage of NWI wetlands for each reservation by state and agency are in Appendix F, Table 8.6.1 through 8.6.7. Scanned data could not be represented in the tables. Boundary layers used to calculate the wetland acreage may not reflect recent boundary changes.

Wetland acreage designated in the NWI is less than an acre on some of the smaller reservation or ranches to tens of thousands of acres on larger reservations. In Appendix F, Tables 8.6.1 through 8.6.4 show NWI acreage for reservations in Arizona. Several tribes along the Colorado River are conducting or may potentially conduct tamarisk removal projects in areas designated as forested wetlands.

In Appendix F, Tables 8.6.5 and 8.6.6 show the wetland acreage for reservations in Eastern and Western Nevada. Except for the smaller ranches, most Nevada reservations have several hundred to several thousand acres of wetlands. Western Nevada projects currently or previously funded by BIA occur in forested or emergent wetlands on the Fallon, Pyramid Lake, Summit Lake, Yomba and Walker River Paiute Reservations. BIA-funded projects may also potentially occur in or near wetlands on the Washoe Ranches and Fort McDermitt Reservation. Most Eastern Nevada tribes with wetland acreage listed in Table 8.6.5 do not have projects taking place directly in forested or emergent wetlands.

In Utah, the Goshute Reservation has about 200 acres of wetlands and the Uintah and Ouray Reservation has almost 23,000 acres of wetland habitat. Nearly half of the wetlands on the Uintah and Ouray Reservation are the freshwater emergent wetlands and another third are freshwater forested shrub wetlands. Riverine system wetlands make up another one-sixth of all the wetlands on the reservation. The extent of wetland habitats within a few specified areas is shown in Maps 3.6 through 3.13, but these maps are not comprehensive representations of wetlands on reservations. Map 3.13 shows some of the wetlands of the Tohono O' Odham Nation (TON) in the Guachi and Pisinimo Districts produced from scan layers available from USFWS online. Almost all of the wetlands are from riverine systems in intermittent drainages. The chart Wetlands and Deepwater Habitats Mapping Codes (Appendix F, Table 8.6.8) shows how to interpret the wetland codes. For instance, a common code on the TON map is R4SB. R4 are intermittent drainages; SB stands for streambed.

See Appendix F for definition and description of wetland types described in the NWI. An updated map of NWI as of September 2013 is in Appendix F, Section 8.6.2.

3.4 *Cultural Resources*

3.4.1 General

Cultural resource preservation is an issue of extreme importance on Indian reservations. Protection of cultural resources on Western Region Indian Reservations requires a unique understanding of federal and tribal laws and policies and past tribal cultural patterns. There is great diversity among the forty-seven tribes within Western Region which could influence the type of cultural artifacts and environment of preservation. The individual tribal histories and cultural patterns determine what cultural resources would be in the affected environment of this project. Potentially-affected resources are determined by the governing tribe within the legal framework described in Section 3.3.3

Many tribes have an archeologist or a Tribal Historic Preservation Officer (THPO). Other tribes may use State Prehistoric Preservation Officers (SHPO) or BIA archeologists. Archeologists determine affected resources by archeological surveys, but preservation does not only involve conducting surveys and analyzing things or objects. Archeologists attempt to reconstruct past cultural systems, including social relationships, economic relationships, community structures and interaction with other groups to come to an understanding of type and location of artifacts. (Grant, 1994) However, it is nearly universal that tribes are privy to their unique history and patterns and locations of protected cultural resources are guarded judiciously.

3.4.2 Archeological Time Periods

Archeologists have developed theories of the origins of American Indian people and devised groups of time periods and traditions, based on climate, location, language and cultural practices. There is considerable variation and overlap in these theories. The time period and traditions described here are taken from a lecture series from the American Indian Studies and Anthropology Department at Palomar College in California. (Crouthamel, 2013)

3.4.2.1 Paleo-Indian Period (5,000 years ago to 14,000 years ago)

The earliest cultural artifacts on Western Region Indian Reservations could have originated during the Paleo-Indian Period, which according to some theorists, was the first period Native American Indians populated "the new world", presumably from crossing the Bering Strait into what is now Alaska and migrating south. There have been challenges to this theory in recent years and some tribes and archeologists have come up with alternate theories. The earliest cultures were primarily mobile hunting-gathering groups of large game such as mastodons, mammoths and early species of buffalo. Arrowheads are one artifact that archeologists have classified extensively according to period, type and location.

3.4.2.2 The Archaic period (5,000-10,900 years ago)

The Archaic period came about as early as 10,900 years ago, as the climate shifted to a warmer, arid environment. Ice Age game such as mastodons and mammoths had died out. It involved a rise in human population and a shift to hunting smaller game and a less nomadic life style in some areas of the West.

Advances in spear throwers and projectile points and the onset of ground and polished stone artifacts, including cooking disks and bowls were attributed to this period.

Table 3.13 North American Culture Areas in BIA Western Region

Basin	Paiute; Ute; Shoshoni
Southwest	Pueblo (Hopi;Zuni;Keresan;Tanoans);Pimans (O'odam);Yumans (Havasupai,Walapai,Yavapai);Dene (Apache, Navajo)

(Crouthamel, 2013)

In Western Region states, classifications were made according to location and practices, such as the Basin people including the Paiutes, Utes and Shoshones of Nevada and Utah. Basin traditions involved hunting and gathering focusing on pinyon pine nuts, seeds, insects, jackrabbit and larger game. Cordage and baskets are tied to this location and time period. In the Great Basin Region of Utah and Nevada, maize and pottery were located, possibly due to the Southwest expansion of people. (Crouthamel, 2013)

The Southwest traditions of Southern Utah, Colorado, Arizona and New Mexico included the Desert Archaic period from 6,500 B.C. to 200 B. C. which include the Cochise, Chihuahua and others who evolved into the Anasazi, Pueblo, Mogollon, Hohokam, Patayan and Dene, who, except for the Dene, carried out agricultural practices, utilizing corn, bean and squash. These later tribal traditions took place from about 300 B.C. to the 1700's. There are many more subdivisions and groups and these two groups involve only the most basic divisions.

Several of the Western Region tribes, especially the Paiute and Shoshone Tribes in Nevada and Utah, continued nomadic lifestyle and did not rely on agriculture until contact with the Europeans. Some only took up agriculture and livestock management in late nineteenth and early twentieth centuries. (BIA, 2008) Although located in the Southwest in Arizona and New Mexico, the Apaches also were not agriculturists and were primarily buffalo hunters.

The affected environment may also include buildings and artifacts of Native Americans and early explorers and missionaries of the 1500's -1600's to missionaries and settlers of the late nineteenth and early twentieth centuries, including burial sites, missions, governmental buildings and forts.

3.4.3 Legal Framework for Historic Preservation

Prepared by Garry Cantley, BIA Western Region Archeologist

Federal historic preservation legislation provides a legal framework for taking into account the effects of federal actions on cultural resources such as archeological sites, historic buildings, and locations of traditional or cultural importance, particularly in regard to tribes. The National Historic Preservation Act of 1966, as amended (NHPA) established the Advisory Council on Historic Preservation, a National Register of Historic Places, and the State Historic Preservation Office (SHPO). A subsequent amendment to the NHPA provides a means for tribes to establish a Tribal Historic Preservation Office (THPO) and thereby assume the responsibilities and roles of the SHPO for federal actions within reservation boundaries. To date, those tribes in the BIA Western Region that have assumed THPO status include: White Mountain Apache Tribe, San Carlos Apache Tribe, Gila River Indian Community, Tohono O'odham Nation, Hualapai Indian Tribe, Skull Valley Band of Goshute Indians of Utah, Reno-Sparks Indian Colony, Pyramid Lake Paiute Tribe, and the Washoe Tribe of Nevada and California.

Regulations promulgated under Section 106 of the NHPA, found at 36 CFR 800, prescribe a consultation process that Federal agencies follow prior to implementation of a project that is funded or approved by the agency. After establishing that an undertaking is present, the agency then makes decisions regarding the consulting parties to be involved in the process and the level of effort to identify cultural resources in the area of potential effect (APE). If archeological survey, interviews with knowledgeable individuals, and/or historic research identifies cultural resources in the APE, an assessment is made in consultation with the SHPO/THPO and other involved parties regarding the significance of the cultural resource and the effect that the proposed undertaking would have on the resource. Once the parties agree on these determinations of eligibility and effect, and depending on the nature of the effect, the federal agency then consults with the parties about a means to either avoid the effect by project design or take further steps to lessen, minimize, or mitigate the effect.

Tribes have the option of using a clearance form shown in Appendix G or use their own cultural clearance method.

3.5 *Socio-Economic Conditions*

The socio-economic conditions of tribes in Western Region vary but there are similar trends throughout many reservations. On most reservations, unemployment is 10 per cent or higher and it is sometimes as high as 70 per cent. Per capita income is much lower than that of the surrounding communities and ranges from about $4000 to $15,000. (Tiller, 2005) Many tribal communities have deep ties to the land and still practice agriculture or ranching. Some tribes offer recreational opportunities of camping, boating, fishing and hunting. Many of the smallest tribes have a store or smoke shop. A number of tribes are sustained by government grants such as EPA funding or by contracting functions formerly carried out by BIA such as road maintenance, natural resource management or social programs. Mining and oil and gas exploration have buoyed the economy of some reservations. Others are refusing to allow mining on their land due to prior environmental damage. Several reservations are EPA Superfund sites as a result of mining or government testing near their lands. Tribal governments and communities strive to improve conditions for their people and a number of tribes are making headway.

Below are descriptions of the major economic enterprises for reservations in Arizona, Utah and Nevada. The information was compiled from a variety of sources, including Tiller's Guide to Indian Country, tribal websites or other miscellaneous websites.

3.5.1 Arizona

Ak-Chin Indian Lands are located along the Santa Cruz River Valley in Pinal County, 30 miles south of Phoenix. The Ak- Chin people live on 21,840 acres and the tribe has 575 members. The economy is based on farming and tribal enterprises such as the Harrah's Ak-Chin Casino.

Cocopah Indian Reservation is 13 miles south of Yuma and 15 miles north the San Luis, Mexico in Yuma County. The tribal community consists of 6226 acres and 774 members. Approximately half the land is in farm leases. The Cocopah people have a convenience store, gas station, smoke shop, bingo hall, a recreational vehicle park and the Cocopah Casino.

Colorado River Indian Tribes have land in both Arizona and California consisting of 270,000 acres of tribal and individually-owned land. In 2010, there was a population of 8,764. Agricultural leases are an important mainstay of the economy.

Fort McDowell Mohave-Apache Indian Reservation is along the banks of the Verde River in Maricopa County, 15 miles from Phoenix. The Tribe has 24,948 acres and 849 members. The Tribe’s business enterprises include the Fort McDowell Gaming Center, a tribal farm and recreational activities along the Verde River.

Fort Mojave Indian Reservation is in California, Nevada and Arizona along twelve miles of the Colorado River. It has 33,005 acres and 1,000 members. Economic enterprises include farming cotton and alfalfa, the Spirit Mountain Casino and recreation areas near the Colorado River.

Quechan Indian Tribe has 43,961 (tribal and individual) acres near Yuma, Arizona and 2,419 members. Most of their land is in Imperial County, California. The tribe has recreational spots along the Colorado River and operates the Paradise Casino.

Gila River Indian Reservation has 372,000 acres south of Phoenix with 11,550 members. In addition to agricultural leases, tribal enterprises include the Lone-Butte Industrial Park, Firebird Lake Water Sports World, Gila River Arts and Crafts Center and the Gila River Casino.

Havasupai Indian Reservation is located at the bottom of Havasu Canyon in the Grand Canyon. It is in both Coconino and Navajo Counties. The land includes 188,077 acres and 601 members. Recreational tourism provides income for the tribe and tribal members. Travel can only be done by foot, horse or helicopter to the village of Havasupai.

Hopi Reservation is located in Northern Arizona. There are 1,780,990 tribal trust acres and 8,114 members. The tribe is known for their handicrafts, such as kachinas and pottery. Cattle ranching and small subsistence farming are practiced. Peabody Coal has a mining lease on the reservation but it is not currently in operation.

Hualapai Reservation is near the Grand Canyon in Coconino and Mohave counties. They have 992,463 acres and 1,400 members. The tribe hosts the Hualapai Arts and Crafts Center, Hualapai Tribal River Runners and recreational areas.

Kaibab Paiute Indian Reservation is in Northern Arizona, near the Utah border. The tribe has 120,798 acres and 200 members. In addition to hunting and ranching, the Tribe generates income for their members through a lease agreement with the Pipe Springs National Monument, a gaming agreement, and several utility rights-of-way.

Pascua Yaqui Reservation is south of Tucson in Pima County. The reservation includes 1831 acres and there are 3000 enrolled members. The Pascua Yaqui Indian Tribe operates the Casino of the Sun.

Salt River Pima-Maricopa Indian Community has 6,400 members and includes 50,161 acres with about half of it being individual allotments. Additional acreage may have been added but not taken into trust. The Community has recreation along the Salt River, a waste disposal operation, sand and gravel plant and the Pavilions shopping center.

San Carlos Apache Reservation has 10,000 members in Eastern Arizona in Gila and Graham Counties. The reservation encompasses 1,821,274 acres of tribally-owned land and 800 acres of individual allotments. The San Carlos Apache people raise cattle, mine gemstones and provide recreational spots in the area.

White Mountain Apache Reservation covers part of Apache, Gila and Navajo Counties. The White Mountain Apache live on 1,684,225 acres and have 10,000 members. Recreational enterprises including a ski resort and casino, cattle grazing and forestry provide an economic base. The development of casino gaming made a difference to the Apache people. The success of some casinos have provide income for the tribes to invest part of this revenue into further economic self-sufficiency, such as building hotels and resorts, acquiring stores and other construction. (Moore, Shelley, Accessed July 8, 2011)

San Juan Southern Paiute Tribe has 209 members. Most tribal members live in Coconino County and ranch or farm in remote areas. There is no formal tribal government.

Tohono O'odham Nation is in Southern Arizona in Maricopa, Pinal and Pima Counties. The Tohono O'odham Nation encompasses 2,808,969 acres of tribal trust land and 41,000 acres of individually-owned allotments. The tribal lands are separated into four reservations: Tohono O'odham, Gila Bend, San Xavier and Florence Village. Tribal population is 18,061. The Tohono O'odham operate the Desert Diamond Casino, the National Historic Landmark of Mission San Xavier del Bac and have farming, ranching and mining enterprises.

Tonto-Apache Indian Lands are in Northern Arizona, near Payson in Gila County. They have 378 acres and 103 members. The Tonto-Apache operate the Mazatzal Casino and recreational spots.

Yavapai-Apache (Camp Verde) Indian Reservation consists of 1,200 members in Northern Arizona south of Flagstaff. They have two reservation parcels, 655 acres and a recent acquisition of 1168 acres. The tribe has the Cliff Castle Casino, two National Monuments (Montezuma Castle and Tuzigoot), along with the Yavapai-Apache Visitor Center.

Yavapai-Prescott Indian Reservation adjoins the town of Prescott. The Tribe has 1,403 trust acres and 139 members. The Yavapai-Prescott Tribe operates Bucky's Casino and sells baskets and other handicrafts.

(Machula, Paul; Accessed July 11, 2011)

3.5.2 Nevada

Sources of economic development among Nevada tribes include tribal smoke shops , ranches/feed lots, cattle/horse breeding, fisheries , firefighting , educational curriculum, arts and crafts, stores, recreational activities and camping, fish and game permits and food services.

Battle Mountain Band of Te-Moak Tribe is located on the west side of the town of Battle Mountain, Nevada. It consists of two separate parcels of land totaling 683.3 acres. The main economic source is the smoke shop/convenience store. A new tribal business, the Battle Mountain Filter Service Company, cleans filters for the nearby mines. The Battle Mountain Colony tribal government employs about 20 people. There is a senior citizens' center on the reservation. The Indian Health Service has a field medical team and a state public health nurse to conduct routine clinics on the reservations. Medical services are also available at the Lander County Hospital and in the city of Elko. Children attend schools in Battle Mountain.

Carson Colony is located in Carson City off Curry Street. The colony has a gymnasium that hosts various tribal events. The gym is also the location for youth recreation activities and afterschool programs. A small smoke shop provides some direct economic input to the Colony.

Duck Valley Shoshone Tribal membership is over 2000 with approximately 1700 living on the reservation. Farming and ranching are economic mainstays on Duck Valley with 12,000 acres irrigated or farmed. The reservation is composed of 289,819 acres held in trust by the US Government. This includes thousands of acres of wetlands in sloughs, creeks, rivers, lakes and reservoirs, with a tremendous diversity of waterfowl and shorebirds. The Owyhee Community Health Facility serves tribal residents. Recreational and outdoor activities such as hunting and camping are other economic sources.

Duckwater Shoshone Tribe has about 3,800 acres in east central Nevada. A tribally-owned catfish farm was decommissioned in 2004 and a geothermal spring has been restored by the tribe. About 900 acres are irrigated agriculture land or pasture. There is a small tribally-owned cattle operation and individual members graze on adjacent public lands. A tribal construction company and a greenhouse for native plants have operated in recent years. There is a Duckwater Shoshone Elementary School but high school students attend Eureka High 50 miles away. The Tribe has a clinic with a full-time physician. The Indian Health Service provides medical and social work services.

Ely Shoshone Tribe's land base has increased in the last six to ten years. They now have about 3600 acres. The tribe has numerous self-governing tribal departments including health and medical, environmental, law enforcement, housing, social services, elder center, education, maintenance and grants departments, among others. The Silver Sage Travel Center is a retail facility operated by the tribe and contains a convenience store and gas station, Shoshone Cloth Industries, smoke shop, deli, and trucker facilities such as showers and laundries.

Elko Band Colony of the Te-Moak Tribe is located in northeastern Nevada, near the Humboldt River. The reservation encompasses land adjacent to the city of Elko, Nevada. The tribe has acquired more land in recent years and now has about 2,800 acres. Many tribal members work at seasonal agriculture and ranching jobs throughout the region. The Elko Band operates a tribal child care center and a tribal convenience store and smoke shop. Expansions for these enterprises are planned for the near future. Tribal government employs a small number of people. The tribal community depends upon the employment provided by the mining industry but does not own or operate any mines in the Elko area.

The Indian Health Service operates a clinic on the reservation with one doctor and two nurses. Hospital and ambulances services are provided by Elko County. Tribal youth attend the public schools in Elko.

Fallon Paiute Shoshone have about 8200 acres of tribal and individually-owned land. About 4800 acres of this land is farmed. They have many active tribal departments. They are involved in the wetland restoration created by the closure of TJ Drain. A large grant for road reconstruction and paving has been awarded and will help improve conditions and the economy in the area.

Fort McDermitt Indian Reservation is located four miles southeast of McDermitt, Nevada in Humboldt County. A major portion of the reservation is located in Malheur County, Oregon. There are 16,354.5 acres of tribal Land, 145 acres of allotted land and 160 acres of fee land in Nevada. There are 18,829 acres of tribal land in Oregon. The economy in the area has historically been based on mining, ranching, and farming. Tribal government and Indian Health Service employ less than 40 people. The Fort McDermitt Health Clinic provides basic medical care, nutrition and diabetes counseling and a substance abuse program. The Tribe has recently received a grant from USDA Rural Development and construction of a travel /truck stop plaza is now underway.

Confederated Tribes of the Goshute Reservation derives most of their income from ranching and leasing rangelands. Wildlife hunting permits return a portion of the income to the Tribe. A field clinic provides medical care twice a month but most residents must travel to larger areas for medical needs. Indian Health Service facilities are located in Wendover and Ely, Nevada.

Las Vegas Paiute Tribe has 3853 acres and operates a gas station and three golf courses with a clubhouse, pro shop and restaurant and banquet facilities on their Snow Mountain Reservation north of Las Vegas. They also operate two smoke shops on trust lands at Snow Mountain and in Las Vegas. The Tribe also derives income from utility rights of ways across their trust land.

Moapa Band of Paiutes Reservation is located 55 miles northeast of Las Vegas and consists of 70,587 acres. The tribal government and corporations provide the major sources of employment for Band members. The tribal farm employs around six persons, some seasonally. The Band has a 2, 500 square feet casino and slots at a store located on Interstate 15. Economic development plans have included the Paiute Tribal Plaza, cement plant and water cooling for a power plant. The Tribe recently signed a long-term lease with the K-Road Corporation to construct and operate a 2,000 acre photovoltaic solar facility on the reservation, the first of its kind in Indian country. An EIS to evaluate the environmental impact of a smaller (1000 acre) photovoltaic solar facility on the Reservation is near completion. There is a partnership agreement to operate a mulching facility on the reservation. The Band also derives income from utility rights of ways across their lands.

Pyramid Lake Paiute Reservation is located thirty five miles northeast of Reno, Nevada. The area of the reservation contains 475,000 acres. Approximately 112,000 acres cover the surface of a terminal desert lake, Pyramid Lake. The economy on the Pyramid Lake Reservation is centered on fishing and recreational activities at Pyramid Lake. The Pyramid Lake Cattleman's Cooperative Association operates and manages several cattle herds on the desert rangelands.

Summit Lake Paiute Tribe is part of the Northern Paiute Tribe with a 10,098 acre reservation in northwestern Nevada. The leasing of Indian lands had provided some income and the tribe has sole fishing rights on Summit Lake. The tribe ended grazing leases around 2005 but may reinstate them in 2013. This is a remote reservation with few economic opportunities. There are less than a dozen permanent residents. Tribal offices are now located in Sparks, Nevada and they manage their natural resources primarily through government grants.

South Fork Band of the Te-Moak Tribe has 13,913 acres of land in northeastern Nevada, 28 miles south of the city of Elko. The tribe maintains a community center and a tribal administration building at the town of Lee. Health care services are provided by the Indian Health Services. Students on the reservation attend public schools in Elko. The second most significant source of tribal income behind federal contracts is raising cattle. The Band is currently exploring other economic enterprises.

Reno-Sparks Colony *i*s composed of three tribal groups, the Washoe, Paiutes and Shoshones. The displaced members of these tribes were assigned to urban colonies. There are about 2000 acres and 1400 residents with a tribal enrollment of 770. The tribe operates five smoke shops and other retail and many business-leasing opportunities. Tribal government employees 270 people, with 110 in general government, 65 in the health clinic and 45 in the smoke shops. A tribal construction firm has been employed by the city public works department.

Walker River Paiute Reservation is located in western Nevada about 100 miles southeast of Reno, Nevada on about 325,000 acres in a river valley, used mostly for grazing and some ranching. It has a population of over 1200 and several economic enterprises, such as cell tower leases, the Four Seasons Market and Renewable Energy Projects.

Washoe Tribe of Nevada and California consists of several tracts of land, mainly ranches. There are 2900 trust acres and 1300 residents. Washoe Tribal members have 68,428 acres of individually-owned land. The bulk of it is in Douglas County, Nevada. The main sources of revenue are federal contracts, sales and excise taxes. The tribe manages a cattle herd on 2600 acres of rangeland and 440 acres are in alfalfa hay and irrigated pastures.

Wells Band Colony of the Te-Moak Tribe is located in northeastern Nevada, just west of the city of Wells, in Elko County, 45 miles northeast of Elko, via Interstate 80. The Wells Band of Western Shoshone has 80 acres of federal trust land. The tribe operates a small gift shop and smoke shop and holds an annual pow wow open to the public. The Wells Colony has a small park and a community center for elders and tribal youth is in the planning stages. Health care is provided to members of the Wells Band by the Indian Health Service's Southern Band Clinic in Elko and the Northeastern Nevada Regional Hospital and Regional Clinic (50 miles southwest of Wells). There is a private physician in Wells. Tribal youth attend public schools in Wells.

Winnemucca Shoshone-Paiute Colony consists of about 350 acres of mostly individually-owned land and has 77 members. The tribe owns the Winnemucca Smoke Shop in the town of Winnemucca.

Yerington Paiute Tribe has about 1654 acres and a population of 117. Tribal enrollment is around 1000. The tribe has several retail operations, including a market, smoke shop and leases to business franchises. They also operate a small ranch.

Yomba Western Shoshone Colony consists of 4700 acres and has a tribal enrollment of about 200. It contains many miles of streams, wetlands and a small lake. It is bordered by two mountain ranges. It also has 370 acres of woodland forest, irrigated lands and open range. The tribe operates a convenience store and some tribal members graze cattle on adjacent federal land.

3.5.3 Utah

The Paiute Indian Tribe of Utah consists of five bands: Shivwits, Cedar, Koosharem, Kanosh and Indian Peaks. Their land is scattered in south central and southwest Utah. The Shivwits Band has 28,480 acres and the other bands have several parcels ranging from 425 acres for Indian Peaks to around 2100 acres each for the Cedar and Kanosh Bands. The Koosharem band has 1274 acres.

Over a hundred years ago, the Southern Paiute settled in the uninhabited hills and desert areas of southern Utah. The first Paiute reservation was established in 1891 on the Santa Clara River west of St. George and was formally recognized by the government in 1903. In 1916, the Shivwits Reservation was expanded to its current size and by 1954, each Paiute band, except the Cedar Band, had its own reservation and functioning tribal government. The federal government's policy of termination in the 1950's had devastating social and economic consequences for the Five Paiute Bands. Nearly one-half of all tribal members died during the period between 1954 and 1980, largely due to a lack of basic health resources. During termination, the Paiutes were forced to pay property tax on their land, but without adequate income to meet their needs, they lost approximately 15,000 acres of former reservation lands. In 1980 Congress restored the federal trust relationship to the five bands, which were reorganized as the Paiute Indian Tribe of Utah, but they did not regain all of their land. Today the Paiute Tribal government has improved healthcare and education on the reservations, and the Paiute Economic Development work to create job opportunities nearby.

Income is generated through utility rights-of-way and advertising billboards on their land. The Kanosh, Koosharem and Shivwits bands receive some income from grazing leases and permits. The Cedar Band operates a smoke shop. The Koosharem and Indian Peak Bands are in the process of constructing RV Parks on their land. The Shivwits Band is breaking ground for a convenience store.

The Skull Valley Band of the Goshute Reservation is located in a remote area in western Utah. There are 17,284 trust acres, 160 individually-allotted acres and about 125 members. Some tribal members find employment off the reservation but a high number are unemployed. A large portion of the Tribe's revenue came from leasing their land for rocket motor testing and waste management endeavors. A nuclear storage facility has been blocked after many years of controversy. A nerve gas incinerator for toxic chemicals is located east of the reservation. The remaining land is suitable for grazing and about 160 acres are irrigable.

Uintah and Ouray Reservation was established for the Northern Utes. They have a tribal membership of 3,157 and have 1,024, 643 million acres of tribal land and 14, 400 acres of individual allotments. The Utes operate several businesses including a supermarket, gas stations, bowling alley, and a tribal feedlot. Uinta River Technologies, Ute Tribal Enterprises LLC, Water Systems and Ute Energy are tribal companies. The mining of oil and natural gas is an important business on the reservation. Cattle ranching is another significant enterprise.

(Tillers, 2005) (Tribal websites, Accessed July 2011)

3.6 *Resource Use Patterns*

3.6.1 Hunting, Fishing and Gathering

A number of tribes in Western Region have well-developed hunting and fishing programs. The Hualapai, the Kaibab Paiutes, the San Carlos Apache, the White Mountain Apache, the Ute of the Uintah and Ouray Reservation, the Goshute and the Shoshone-Paiute Tribes of the Duck Valley have tribal hunting and fishing programs which provide for both member and non-member big game hunting opportunities. The Hualapai Tribal Wildlife Department sells a limited number of hunting permits for elk, javelin, deer and desert bighorn sheep, as do several other tribes. Among tribes with perennial streams and rivers, there can be good fishing. Some species are protected for catch and release only. (Arizona Office of Tourism, Accessed July 7th, 2011). Although some tribes do not have permitting programs for non-tribal members, there are many who hunt, fish and gather on their own reservations and/or ancestral lands.

Traditional ways of life are important to the American Indian tribes in Western Region. Most tribes responding to the Noxious Weed Survey identified protecting plants for cultural use as an important reason to control invasive species. The Cocopah and Quechan Tribes have been carrying out restoration projects along the Colorado River to return native species to the riparian habitat and to ensure enough native plants for cultural use. Traditionally, the Southern Paiute were hunter-gatherers, hunting rabbits, deer, and mountain sheep, and gathering seeds, roots, tubers, berries, and nuts. (Grahame and Sisk, 2002)

Some tribes have councils of elders to advise the business committees on important cultural matters. Elder councils provide guidance on environmental policies, endangered species surveys and appropriate use of and depiction of spiritual places and entities. Ethnobotany is the science of recording of the names, uses and preservation of culturally-important plants. Some tribes, such as the San Carlos Apache, employ ethnobotanists to preserve this aspect of their culture.

Yavapai and Apache families and bands subsisted for centuries by hunting, gathering, and small-scale horticulture. They would return to their homelands year after year, while ranging widely to hunt deer and collect agave, pinyon pine nuts, and other wild plant foods. The Yavapai and Apache often traveled to the Grand Canyon in summer and fall when edible plants like pinyon nuts were abundant.

The Hopi Tribe, like many tribes in Western Region, use native willows, cottonwoods, and aspen in the cultural traditions of gathering, weaving, and celebrating tribal ceremonies. These plants grow in wetland and riparian communities that make up only about 2 percent of the arid landscape. Nonnative invasive plants such as tamarisk and Russian olive have invaded these communities. Removing invasive plants in riparian areas is a major emphasis of many tribes. Hopi Tribal members built the Cultural Plant Propagation Center (CPPC) to produce native plants-including narrowleaf yucca, three-leaf sumac, and fourwing saltbush-for special tribal use. (Payne, March 2007)

The traditional diet of the early Walker River Paiute came from the trout in the Walker River. The Weber Reservoir still provides trout, bass, catfish, crappies, and other species of fish. Other food was mostly small game such as: geese, mud hen ducks, wild jack rabbits, prairie dogs, ground hogs, and some larger game that included: deer, antelope, and mountain sheep. Traditional customs include gathering of seeds of the waigrass, taboosi, pine nuts, buck berries, and thorn berries (hu pwi) from the desert land.

BLM (2005) describes American Indian Native Resource Uses and assigns traditional use culture areas to tribes in different states and ecoregions. Tribes residing in Nevada and Utah are part of the Temperate Desert group of the Great Basin culture area and Arizona and parts of Utah and California are in the subtropical desert/steppe of the Southwest cultures. Table 3.14 lists some of the cultural use materials for these groups.

Table 3.14 Hunting/Gathering Use by Cultural Group

Cultural Area/Group	Traditional Use Materials
Great Basin (NV and UT) Both High and Low Desert	Edible grains and seeds: native amaranths, chenopods, sunflowers, ricegrass, sand dropseed, blue grass and wild rye.
	Roots, bulbs, leaves of wild onion, sego lily, yellow bells, Indian potato, miner's lettuce and violets.
	Berries: chokecherry, currants, blue elderberry, Oregon grape, wild grape, wild rose, serviceberry, ground cherry, silver buffaloberry.
High Desert	
Northern Shoshone/Bannock (pre-horse)	Salmon, elk, deer, camus roots
(After horse introduction)	Buffalo, Pinyon nuts
Other important species for Northern Shoshone	Blazing star, grass seeds, mesquite, salvia, cacti and gourds.
Western Shoshone	Hats of sage bark and willow, clothing from bark, grass or fur.
	Baskets from yucca, juniper, tule, cattail, sagebrush, swamp grasses, Indian hemp, milkweed, cedar, cliff rose, white sage, willow, sumac and squaw bush.
Northern Paiute	Similar to Western Shoshone but less access to low desert resources and single leaf pinyon.
	Fisheries: cui-ui, cutthroat trout, suckers and waterfowl.
Low Desert (Mojave Desert to Colorado Plateau	Used deserts in winter and mountains in summer. Some horticulture.

Cultural Area/Group	Traditional Use Materials
Utes, Southern Paiutes, Individual bands	Berries: buffaloberry, chokecherry, currants, gooseberries, elderberries, serviceberries, squawberries strawberries and raspberries, both fresh and dried.
	Roots: sego lily, cattails, bulrush
	Pinyon, mesquite beans, cacti, mescal and yucca fruit
Utes	Made cordage from sagebrush and juniper bark, dogbane, yucca and nettle. Tule reeds were used for rafts, mats and blankets.
Moapa Paiutes	Desert fan palms are used for baskets, food and shelter.
Southwest Culture Area	
Pueblo group (Hopis, Pima, Papago)	Agriculture development of corn, beans and squash. Gathering of amaranth, chenopods, wild onion, celery and sage. Juniper berries, acorns and walnuts. Agave, prickly pear, cholla and other cacti.
	Yucca fibers for baskets, yucca roots for shampoo; cotton for weaving clothing, gourds for utensils.
Southwest Culture Area	
Yunan group includes Colorado River Tribes, Quechan, Cocopah, Maricopa, Mohave, Hualapai, Havasupai and Yavapai	Cultivation of corns, beans, squash, pumpkins, melons, and cotton. Hunting small game and fish. Prickly pear, saguaro, mesquite, mescal, yucca, pinyon, walnuts, sunflower seeds and juniper and sumac berries.
Apachean Tribes	Hunters, gatherers; later livestock grazing. Collected agave, saguaro, cacti fruit, yucca, mesquite beans, acorns, pinyon nuts, juniper berries, sumac berries grass seeds, wild root crops. Yucca for shampoo and Spanish bayonets and other plants for dyes. Willow and other plants were used for baskets. At least 29 species of plants used for medicine.
Compiled from text in (BLM, 2005) Appendices pp. D-6 to D-11.	

3.6.2 Timber Harvesting

Out of the approximately 12 million acres of tribal land in Western Region, about 4 million are forested. About 727,000 acres are commercial timber and there are over 1 million acres of commercial woodland species. Tribes within the Arizona and New Mexico Mountains ecoregions, primarily the White Mountain and San Carlos Apache Tribe have strong timber harvesting programs. The White Mountain Apache have about 1 million acres of commercial lumber. A little over half of this is commercial timber; the rest is woodland. About 55,000 acres of Ponderosa Pine on the San Carlos Apache Reservation are operable for timber harvesting. About 90,400 acres of woodland species such as pinyon-juniper, oak, mesquite and riparian woodlands are able to be harvested. Timber provides a viable industry on these two reservations. Tribal Forestry Departments are active with monitoring and measuring program of available timber. The Forest Resources Programs conduct timber sales, timber marking, thinning, prescribed burns and tree planting in the timber and woodland areas. The Apache timber industry in Arizona has seen some decline, especially in the wake of major forest fires.

Tribes with less developed timber harvesting programs do have available timber species. Hopi has 217, 000 acres of commercial woodland species. The Tohono O'odham nation has about 108,000 of commercial woodlands. Hualapai has 63, 000 acres of timber and 161,000 acres of woodland. Havasupai has 6,000 acres. The Ute Tribe and BIA Uintah and Ouray Agency manage about 20, 000 acres of commercial timber and 55, 0000 of operable woodland. The Gila River Reservation has about 25,000 acres of commercial woodland. The Pine Nut allotments have about 17, 000 acres of commercial woodland. Most other reservations in Western Region have only a few hundred to a few thousand acres of commercial timber or woodland. See the Catalog of Forest Acres in Appendix C.

3.6.3 Agriculture and Range

Irrigated and dryland agriculture and ranching provide income and a way of life on many of the reservations in Western Region. Out of the 12.5 million acres of tribal land in Western Region, about 10 million acres are used for rangeland and 360,000 acres are farmland. Appendix D summarizes the acres of rangeland and farmland within Western Region.

3.6.3.1 Agriculture

Agricultural pursuits within the Western Region vary between commercial farming operations of high value crops; to individual tribal members producing crops for profit or for subsistence use.

Several reservations have tens of thousands acres of farmland but on most reservations, farm acreage is small, ranging from a few hundred to a few thousand acres. Where no agriculture acres are reported to BIA, it may not mean that agriculture is absent. There may be small scale farming projects, such as community or indigenous gardening or other agriculture efforts. Livestock, primarily sheep and cattle, have become an important part of the economic well-being of the tribes as well.

Below is a snapshot of farming activities, by state, for tribes within the Western Region:

Arizona and California Tribes

Agriculture is an important enterprise for several tribes along the Colorado River and on other reservations in Arizona and California.

The Colorado River Indian Reservation has the highest acreage of farmland in Western Region, at about 100,000. Much of the farmland is leased to non-tribal members.

Chemehuevi has 1900 acres of farmland and have worked to revive a tribal farm, community garden and plant nursery.

Fort Yuma Agency tribes, the Quechan and Cocopah also have significant agriculture. Quechan has about 9000 acres in agricultural leases and Cocopah has about 2500 acres.

The Gila River Indian Community has about 75,000 acres in agricultural leases growing everything from Valencia oranges to durum wheat, alfalfa and beans.

The Ak-Chin Indian Community operates the Ak-Chin Farms, with more 15,000 acres of agricultural crops

Fort McDowell has a 1500 acre tribal farm. Salt River Pima-Maricopa Community has about 12,000 acres making up a tribal farm and leases growing barley, potatoes, alfalfa and corn.

Fort Mohave has a tribal farm of about 6000 acres and about 11,000 acres are leased to non-tribal members. Cotton, corn and soybeans are primary cash crops produced on the reservation.

The Tohono O' Odham Nation has 10,500 acres of agricultural land. The Nation also leases out a 1,200 acre farm at San Xavier. (Bureau of Indian Affairs, Western Region, 2011) The New Generation of O'odham Farmers program was introduced in January 2011 in order to train beginning O'odham farmers and revitalize O'odham agricultural economy. The program includes an 18 month apprenticeship for farmers, farmers markets, school and community education, and a new focus on non-traditional crops. (TOCA, Spring Newsletter, 2013)

The Hopi people annually grow corn, beans, squash, cotton and tobacco. Many of these crops, such as blue corn, are unique to the tribes and lands of the Western Region where historical farming methods have been passed down from generation to generation thereby sustaining these genetically unique crops. The Hopi Endowment Fund sponsored a project to restore a 100 year old orchard. Lack of water limits large-scale agricultural development. (Four Corners SW US, 2003)

The Havasupai people have practiced summertime irrigated farming in the Grand Canyon and wintertime hunting in the plateaus for over 1000 years. Limited subsistence farming is now practiced on 125 acres in the isolated village of Supai. (Arizona Office of Tourism, Accessed July 7th, 2011).

The Yavapai and Apache bands were deeply rooted to particular places based on their clan affiliations and planted crops such as corn and melons in familiar places to return to each year. (Gerke, n.d.)The Yavapai Apache Nation has about 200 acres of farmland managed by the Farm and Ranch Program located at Clover Leaf Ranch in the Middle Verde Tribal community. (YAN,n.d.) The Yavapai Apache Nation (YAN) Agricultural Resources Program has been working with Summer Youth Worker's on the Nation's farm lands, teaching the youth farming farm and field management and other agricultural practices. YAN has also applied for grants to develop vineyards as an economic enterprise. (YAN, July 2013)

The Tonto Apache are a Western Apache band that became distinct from that culture by their interrelatedness to the Yavapai Apache and early adoption of agriculture. However, a 2010 Census Report said that no members of the Tonto Apache Tribe make their living in agriculture. The Tribe received only 85 acres when it became a Federally Recognized tribe in 1972, but it has recently added several hundred acres into trust. The economy is tied more closely with gaming enterprises and handicrafts and agriculture is not currently practiced.

The San Carlos Apache Tribe has 1700 acres of agriculture land. There are several tribal farms in production, led by a Farm Board who oversees the operations and a farm superintendent and farm manager for daily field and office management activities. Around 600 acres have been in production for the past 10 years and 700 to 1000 acres have been planned for production since 2009. Cotton and alfalfa have been traditionally been farmed, with some specialty crops grown in recent years.

San Carlos community members also grow squash, gourds, watermelon, corn, and sugar cane in family plots. The Diabetes Prevention program has raised-bed gardens to teach youth how to garden. The beds have been provided to community residents at no cost.

The White Mountain Apache Tribe (WMAT) has about 5500 acres of farmland. Recent efforts of the WMAT are to develop a tribal farm and greenhouse. Community food projects to redevelop indigenous food systems and gardening are being carried out.

Limited farming and inactive orchards are located on 200 acres of the Kaibab Paiute Reservation.

Nevada Tribes

The Duck Valley Shoshone Paiute people have long engaged in agriculture. The Reservation has about 12,000 acres of irrigable land producing large quantities of native and alfalfa hay. Bolstered by an Irrigation project constructed by the Civilian Conservation Corps in the 1930's, and maintained by funds from the Bureau of Indian Affairs, agricultural pursuits provide the main economic mainstay for the Tribe and its membership.

The Duckwater Reservation was originally a ranch purchased in 1940 and consists of individual land assignments and pastures, primarily used for grazing or gardens.

Although the Ely Shoshone Reservation has grown in size from less than 100 acres to over 3600 acres, agriculture has not been established.

The Fallon Reservation currently has 4,500 acres of land under irrigated farm production. Dairy quality hay, corn, grain and grass hay are produced for livestock and dairy industries in the Lahontan Valley. Fallon is heavily infested with Russian knapweed.

The Fort McDermitt Reservation also relies heavily on agricultural activities including native hay production, and livestock, for its economic well-being. There are approximately 5574 acres of agricultural land, mostly in irrigated or non-irrigated pastures and small ranches. Lack of water hinders the Tribe's ability for economic stability and long-term expansion of farming activities.

The Moapa Band of Paiutes has a 667 acre farm. They have received BIA Noxious Weed grants in the last few years, to improve the land and restore the farm for multi-use. There are also pastures for horse and cattle.

The Pyramid Lake, Washoe and Yerington Paiute Tribes have smaller scale farms that are managed by individual tribal members or through agricultural leases. These irrigated farms produce alfalfa, onions, and native grass hay crops but are subject to annual water limitations within the respective irrigation projects that service these lands

The Washoe Tribe of Nevada and California has around 275 acres in agriculture, mostly pasture and alfalfa and grass hay, with 115 acres under irrigation.

The Yerington Paiute Tribe has 900 acres in alfalfa hay at Campbell Ranch. Some land assignment holders grow alfalfa and onions on private land holdings at the ranch.

The South Fork Band of the Te-Moak Tribe has 2,800 acres under cultivation, mostly in native meadow hay for livestock. The other Te-Moak bands (Battle Mountain, Wells and Elko) have members working at seasonal agriculture and ranching jobs but are not currently engaging in these practices on their lands.

Summit Lake has 500 acres of agriculture land listed in Appendix D, but active agriculture is not being pursued on the reservation at this time. There are some irrigated and wet meadow pastures.

The Walker River Paiutes began farming in the late 1800's and early 1900's. A cattle herd was purchased and crops of alfalfa were grown and harvested. About 3000 acres are currently farmed.

Yomba, although it is a small reservation of 4700 acres, it has around 2000 acres of farmland, with around 1216 irrigable land. Root vegetables, wild hay, barley, and wheat have been grown. (National Archives, 1942) Ranching is the prevalent land use today.

Utah Tribes

The table in Appendix D, Total Acres Range and Farmland in Western Region, does not list any agriculture acres for the Confederated Tribes of the Goshute Reservation, although they do have some pastures and rangeland. Farms were set up for the Goshute Indians in Ibapah, Utah in the 1860's and then in Skull Valley. Various efforts by the Federal government were made throughout the years to induce the Goshutes to farming. Today, 1632 acres are listed as agriculture land in BIA records for Skull Valley. Tiller, (Tiller, 2005) states that only about 160 acres are irrigable.

In Utah, the Uintah and Ouray Reservation has about 80,000 acres of irrigated farmland. Approximately 18, 000 acres are in agricultural leases for tribal and non-tribal members. Traditionally, the Southern Paiute Bands practiced flood-plain gardening and limited irrigation agriculture. They raised corn, squash, melons, gourds, sunflowers, and, later, winter wheat on the Shivwits Reservation. Today, Shivwits has about 200 acres of farm and pasture but the remaining four of the five Paiute bands do not practice agriculture on their land.

3.6.3.2 Range

Over 80% of the tribal land in Western Region is considered rangeland and all tribes rely on vegetation produced from rangelands for culturally significant and medicinal plants; and for forage that is utilized by wildlife, livestock, and horses. On many reservations, rangelands are a significant source of income for tribal members; but, more importantly, produce culturally significant animal and plant materials that support a traditional way of life since time immemorial.

The Bureau of Indian Affairs (BIA), Natural Resources Program, receives two annual appropriations from BIA Central office through non-base funding to protect this resource. One is the Noxious Weed Program and the other is for vegetation inventories on rangelands and pasture lands nation-wide. The latter funds were established to conduct full vegetation inventories on Indian trust lands in order to develop comprehensive resource management plans and establish stocking rates and seasons of use, in accordance with provisions contained within Federal law. (Smith, David N., November 2010)

The Kaibab Paiutes, Shivwits Band of Paiutes, San Carlos Apache, White Mountain Apache, Hualapai, Uintah and Ouray, Summit Lake Paiute, Ely, Walker River, Goshute, Pine Nuts Public Domain Allotments and Hopi have recently received annual funding to carry out range vegetation inventories. The rangeland is monitored regularly on these reservations. Range inventory updates and utilization studies are carried out every two years on the Shivwits and Kaibab Reservations. In addition to the reservations listed above, the Bureau of Indian Affairs has funded and finalized vegetation inventories on the Fort McDermitt, Tohono O'Odham Nation, South Fork Reservation, Pyramid Lake Paiute Reservation, Summit Lake Paiute Reservation and the Goshute Reservation within the last ten years. The BIA's objectives are to obtain up-to-date vegetation information on all lands within the Western Region by 2020 which will facilitate the development of comprehensive Agricultural Resource Management Plans, and individual conservation plans for each grazing unit on every reservation. Grazing occurs in districts of the Tohono O'Odham Nation and the Nation is performing range inventories in the districts and writing management plans.

3.6.4 Mining

Several reservations are home to sizable mineral reserves, such as copper, coal and uranium. On some reservations there is active coal mining, and coal plants. According to the Department of the Interior, twenty-five American Indian reservations have coal reserves. In Western Region, only Hopi had active coal mines.

The Southern Ute, Uintah and Ouray, Fort Berthold, Northern Cheyenne, and Zuni have coal reserves with potential for development. Uintah and Ouray Reservations is the only one located in Western Region.

The development of mining resources on American Indian lands has been guided in part by the treaties between the federal government and native tribes. The Bureau of Indian Affairs (BIA) has administered mining leases on Indian land while some tribes manage their own mining resources.

Mining and burning coal have a variety of impacts on American Indian lands and people. Economic conditions can influence the decision to develop mining resources. Within some tribal cultures, there is a deep resistance to mining and the environmental effects to the land and people. However, some tribes have embraced mining and mineral development on their lands for economic reasons.

Copper mines owned by the Tohono O'odham Nation are a source of income for their people. There is a tribal ordinance to govern mining proceeds. The Ordinance covers asphalt, rock, oil and gas, sand and gravel, clay pumice, limestone and building stone. (Tohono O' odham Nation, Tribal Ordinance 13-82, Amended March 1995)

The Hopi Reservation had an active coal mine for over 40 years. Black Mesa Mining operations closed on January 1, 2006. There were concerns about the depletion of water from Navajo Aquifer and pipeline breaks and leakages. In 2002, resolutions were passed by both the Hopi and Navajo Tribal Councils to prohibit the use of the Navajo Aquifer to slurry coal after Dec. 31, 2005. In 2009, the Office of Surface Mining approved a permit for Peabody Coal to operate the coal mine for the "the life of the mine". This decision was vacated by an administrative Law Judge at the US Dept. of Interior Office of Surface Mining in February of 2010. The Hopi Tribe has received annual funding from the Office of Surface Mining for reclaiming portions of this mine. In January of 2012, the Office of Surface Mining approved a 5 year renewal permit to Peabody Coal for the operation of the Kayenta mine on the Hopi and Navajo Reservations. Comments addressed in the environmental assessment stated that the coal slurry method would not be used and the equipment had been dismantled. (Office of Surface Mining, 2010 and 2012)

The Uintah and Ouray Reservation has coal reserves with potential for development. The Ute Tribe and Bureau of Indian Affairs, Uintah and Ouray Agency have completed an Environmental Impact Statement for the Uintah and Ouray Reservation Oil and Gas Development Project. The proposed project will include the drilling of up to 4,899 oil and/or natural gas wells over the next 15 years. In addition to well pad development, linear developments would include roads, pipelines, and power lines. The project would also include facilities such as compressor stations, water treatment facilities, and storage areas. (Bureau of Indian Affairs, Federal Register Notice, August 2010)

An energy company owned by the Ute Indian Tribe announced an agreement to expand oil drilling in the Uintah Basin. A new development agreement will allow Ute Energy and its partners to explore, develop and market oil and gas from 19,000 acres on the Uintah and Ouray Reservation located in northeastern Utah. The acquisition adds to the 26,300 acres of Ute Tribal land, allotted lands and fee lands previously acquired and provides up to 132 additional drilling locations based on 40 acre spacing. Ute Energy planned to drill 54 wells in 2011. (Deseret News, April 2011)

The Hualapai Tribe has renewed a ban on uranium mining on its land near the Grand Canyon. The tribal ban adds to a temporary mining ban on nearly 1 million federally owned acres around the Grand Canyon. The Havasupai tribe issued one of the earliest bans against uranium mining among Arizona tribes, citing the possibility of environmental, groundwater and air contamination as a reason. (Associated Press, September, 2009)

Mining sites are disturbed areas where noxious weeds get a foothold. Trucks and other equipment can bring in and distribute weed seeds. Many mining or oil and gas leases require that noxious weeds be controlled around disturbed areas. Contractors may do weed control work while they are there, but often they leave the site and the weeds return.

3.6.5 Recreation

Many tribes offer recreational opportunities for their members and the public. The White Mountain Apache Tribe (WMAT) has the Sunrise Ski Resort and many lakes, mountains and canyons for recreational activities. The WMAT Game and Fish Department manages the Black and Salt River Special Use Area for recreational activities with a Special Use Permit. Parts of this area are closed to use after Labor Day and other areas are closed to non-tribal members. Recreational opportunities on the San Carlos Apache and White Mountain Apache reservations include hunting and fishing, skiing, whitewater rafting, golfing, wildlife viewing and other activities.

Cocopah, Quechan, Colorado River Indian Tribe, Chemehuevi, Fort Mojave have resorts or recreation areas near the Colorado River. Fort McDowell Indian Reservation hosts some recreational activities along the Verde River. The Pyramid Lake Paiute offer boating and camping along Pyramid Lake. The Las Vegas Tribe operates a golf resort. The Koosharem Band will open an RV Park and issue fishing permits on the Koosharem Reservoir in the summer of 2013. The Ute Tribe of the Uintah and Ouray Reservation offer exclusive guided hunts and allow limited camping in designated areas and permitted access to stretches of the Green River for rafting.

The Havasupai and Hualapai Tribes offer camping, photography, horseback riding, rafting and the Hualapai tribe operates the Grand Canyon Skywalk.

3.6.6 Transportation Networks

3.6.6.1 Road Networks

Most of the reservations in the Western Region are in remote locations scattered across large expanses of rural, undeveloped portions of each state. As a result, transportation networks play a key role on Indian lands, impacting the economy, education, employment, health, and welfare of tribal communities and individual tribal members. Where a single road provides the only access to and from basic community services, the importance of such road networks are magnified. Transportation planning and development is an important process in serving the transportation needs of these communities. Transportation systems involve not only roads, but include multi-modal transportation facilities such as pedestrian paths, bike paths, trail systems, waterways, and small local airports. Reservation roads are connected to city, county, state, or federal roads, requiring the BIA and tribal governments to coordinate funding, planning, and maintenance efforts with neighboring government agencies. (Robinson, G., Lucas, P. Bureau of Indian Affairs, September 2007)

Many Indian reservation roads are public roads which provide access to and within Indian reservations, Indian trust land and restricted Indian land. In Western Region, approximately 7,000 miles are under the jurisdiction of BIA and tribes and another 5,500 are under State and local ownership. The BIA and tribal governments undertake most of the design and construction of Indian Reservation Road (IRR) projects. Under Public Law 93-638 contracts, tribal governments can develop and operate portions of the IRR Program within its boundary. (Personal Communication, Al Trimels, Western Region Division of Transportation, July 2011.)

The IRR Program addresses transportation needs of tribes by providing funds for planning, designing, construction, and maintenance activities. The program is jointly administered by the Federal Highway Administration's Federals Lands Highway Office and the Bureau of Indian Affairs (BIA) in accordance with a Stewardship and Oversight Agreement. (U.S. Department of Transportation, July 2012)

Map 3-14 shows the major roads providing access to and throughout Indian lands and Western Region. Most reservations are accessed by this network of roads, although a few are not. Summit Lake Reservation, Havasupai, and the Hill Creek extension of the Uintah and Ouray Reservation are examples of reservations served primarily by local tribal roads, unpaved roads or jeep and hiking trails shown in Map 3-15.

3.6.6.2 Noxious Weeds on Transportation Pathways

Roads, trails and utility corridors serve as the principal conduit through which noxious weeds are spread. Roads, transmission corridors, and trails give weeds access to areas they would not likely reach (Tyser 1992).

Weeds spread easily along roads and transmission corridors (Zink et al. 1995). Road and corridor construction can damage native plants (Vasek et al. 1975a, 1975b) and provide habitat for colonizing weeds. The

Weeds are dispersed primarily through vehicles. Seeds of hundreds of weed species have been found in the treads of tires and in the mud and debris attached to automobiles (Frenkel, 1970, as referenced in Zink, 1995).

Field studies carried out by Montana State University quantified the number of seeds gained and lost by vehicles over varying distances. More seeds were picked up off-trail than on-trail and more were picked up in wet, muddy conditions than dry conditions. The study found that 99% of the seeds collected under wet conditions could stay on a vehicle over 160 miles until shed by wet roads or additional rains. (Montana State University, June 24, 2011)

Many reservation roads are unpaved and unmaintained dirt or jeep trails where weed seeds can be picked up and transported. Vehicular traffic from road and construction crews is believed to have distributed weeds on some reservations. Several tribes within Western Region allow ATV use (some to non-tribal members for a fee) or permit ATV events or races to be held periodically on their land. This often causes land disturbance and erosion which provides an opening for the spread of noxious weeds.

Roads are also the most common point of origin for human-caused fires. Small fires accidentally ignited next to roads provide many opportunities for invasive weeds to begin to spread into adjacent vegetation.

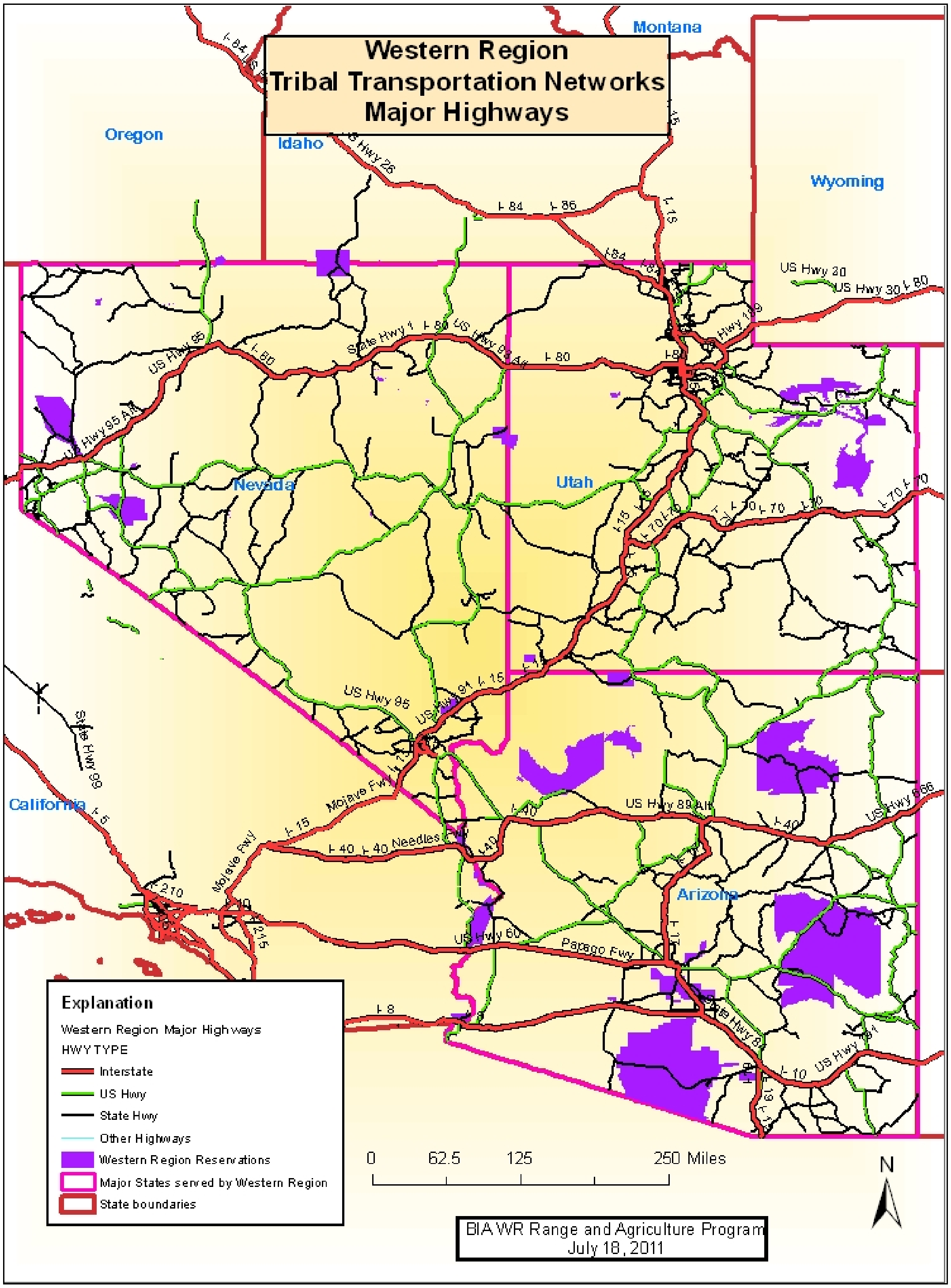
Buffelgrass is an example of an invasive weed spreading rapidly along roadways. In valleys and lower slopes, buffelgrass invades disturbed areas such as roadsides and cleared or grazed fields. It is spreading rapidly along medians and shoulders of major highways and more slowly on smaller roads in Arizona. Map 3-16 illustrates the expansion of buffelgrass along roadways and shows heavy concentrations along roadways in Mexico and heavy to moderate levels on Tohono O'odham Indian lands. (Van Devender. T and Dimmitt, M. Sonora Desert Museum, May 25, 2006)

Buffelgrass is a significant problem on the Tohono O'odham Nation. Chairman Norris of the Tohono O'odham Nation and a number of federal agencies presented testimony to the US House Subcommittee in April 2010 about the seriousness of this problem.

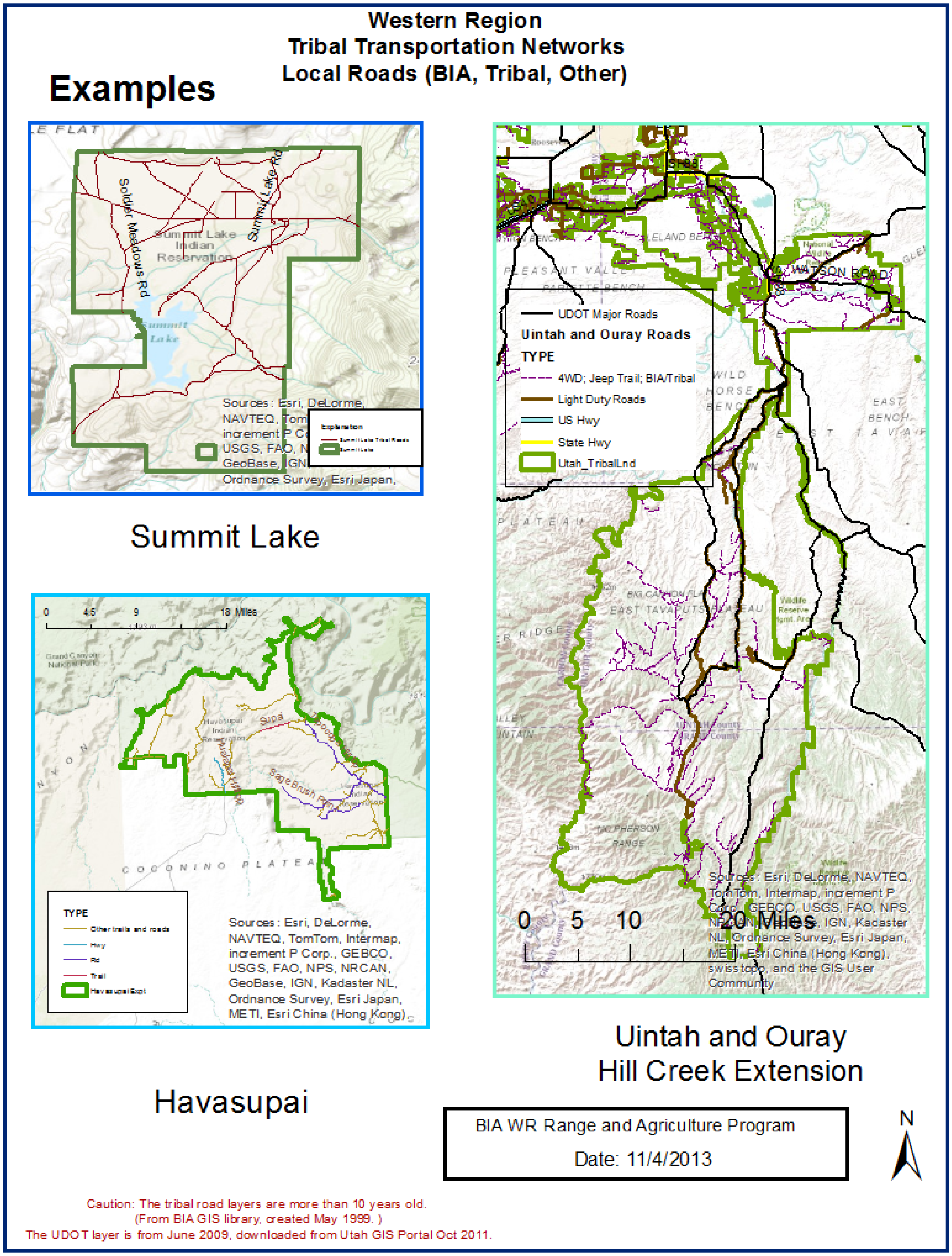
Camelthorn is invading Arizona roadways and has already become a serious problem on several reservations in Arizona. It thrives in cracks and joints in the roads and can work its way down through 6 inches of pavement. It widens the gaps and destabilizes roadbeds by funneling water underneath them. (Arizona Republic, July 17, 2006)

Weed surveys along reservation roadways are not complete, although state and county transportation departments may have some of this data. Many tribal and BIA transportation departments are beginning to collaborate on weed data collection and weed control along roadways. However, some tribes, such as the Pyramid Lake Paiute Tribe, have partnered with state and county road departments for many years on weed control on their reservations. When the BIA Noxious Weed Program was started, funding was to control weeds primarily on rangelands. In recent years, in recognition of the importance of controlling weeds along roads and waterways, greater emphasis has been given to these areas. Tribes are awarded extra points on their weed grant proposals if the BIA superintendent or Regional Director issues a written policy for cooperation between the various BIA and tribal departments, such as Transportation, Irrigation and Natural Resources. Cooperation often takes place informally, but very few written policies are in place.

Map 3-14 Tribal Transportation Networks-Major Roads



Map 3-15 Tribal Transportation Networks-Local

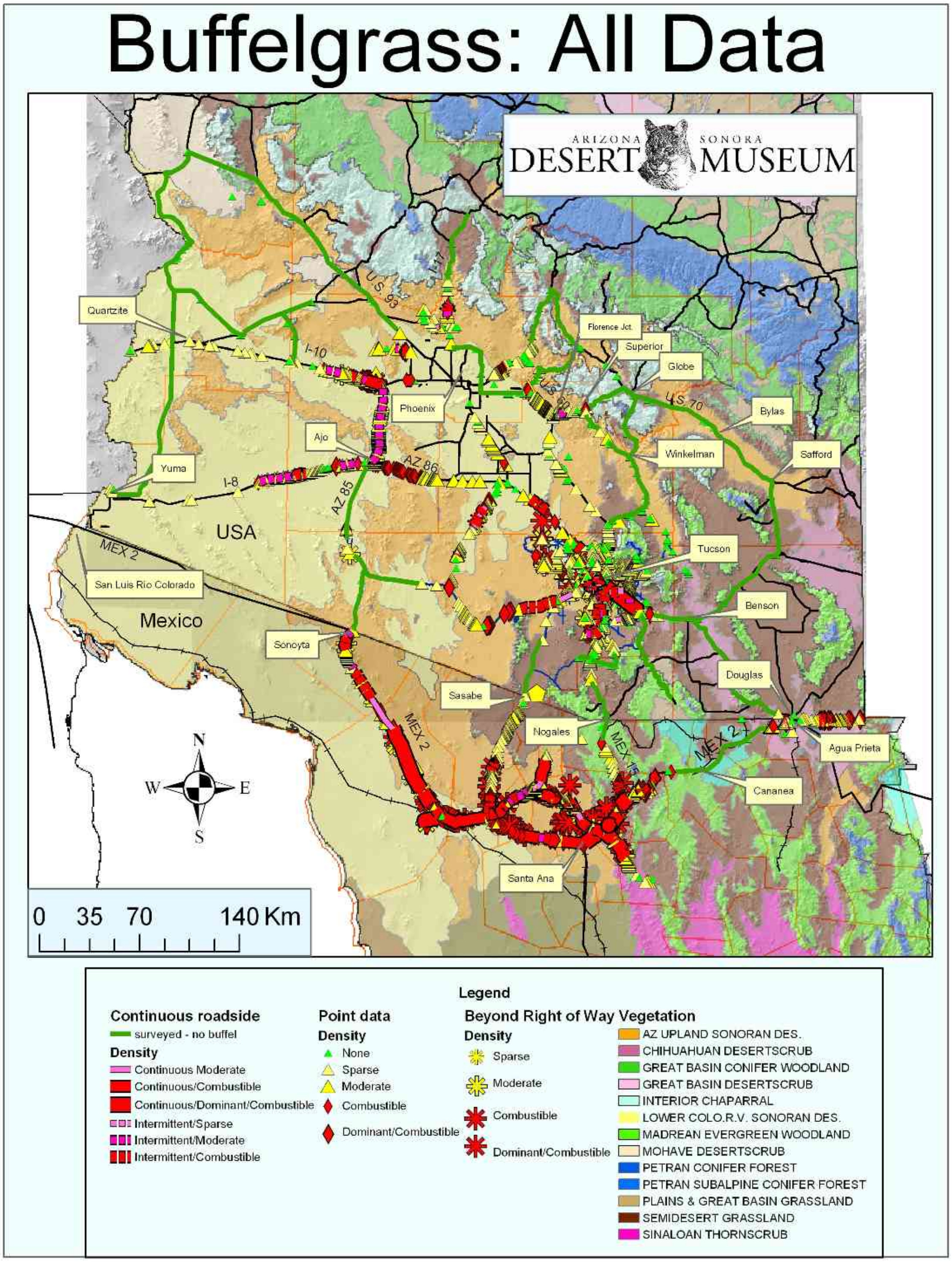


The Hualapai Tribe applied for a BIA Noxious Weed Grant in 2009 and is an example of how several government entities, including tribal and BIA departments, are working together to stop the spread of invasive weeds along roadways and subsequent invasion of rangelands. Indian Route 18 traverses forty (40) miles north from the junction of Route 66 to the northern boundary of the Reservation and Route 66 crosses the Hualapai Reservation for approximately twenty (20) miles east to west. These scenic routes through the Hualapai Reservation have been invaded by non-native noxious weeds; Scotch Thistle and Mexican Whorled Milkweed.

The Natural Resource Department's Agriculture Program is the lead entity in the eradication program. The Forestry program of NRD provide expertise and Tribal Roads equipment and manpower were utilized. The four District Livestock Associations are the active cooperators and affected entities. The Hualapai Nation is a member of the Southern Mohave County Coordinated Weed Management Council. The Arizona Department of Transportation (ADOT) is a member of this group. ADOT personnel in Kingman routinely apply herbicides on rights-of-ways within the Hualapai Nation. The local Bureau of Indian Affairs Truxton Canon Agency, the Natural Resource Conservation Service, and the University of Arizona's Cooperative Extension Program also provide technical assistance.
(Robinson Honanie, Hualapai 2009 Noxious Weed Proposal)

Figure 3.1-Scotch Thistle on Hualapai Roadsides

Figure 3.2-Sprayed Scotch Thistle on Hualapai Roadsides



Map 3-16 Buffelgrass Infestations along Road Corridors

3.7 *Other Values*

3.7.1 Wilderness

3.7.1.1 Designated Wilderness

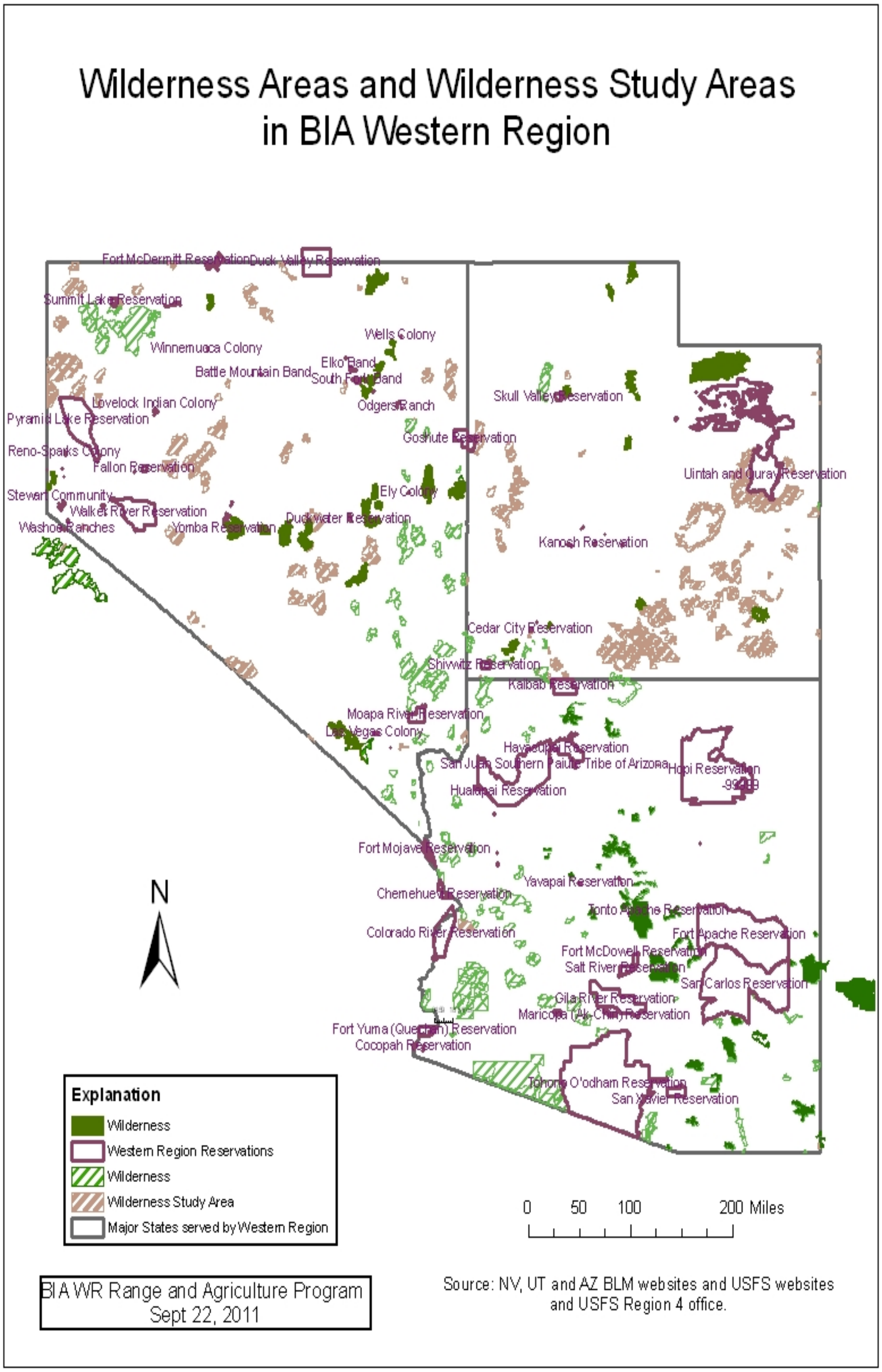
Characteristics of wilderness areas, as described in the 1964 Wilderness Act are: 1) appear to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; 2) five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; 3) have outstanding opportunities for solitude, or a primitive or unconfined type of recreation in at least part of the area; 4) contain ecological, geological, other features of scientific, scenic, or historical value.

There are no designated wilderness areas on Indian lands in Western Region. However, tribes have designated special use or wildlife areas within their boundaries. There are a number of wilderness areas adjacent to Indian lands, as shown in Map 3-17. Wilderness or Wilderness Study Areas are directly adjacent to the Goshute, Summit Lake, Uintah and Ouray, Pyramid Lake Paiute, Tohono O'Odham, San Carlos Apache and White Mountain Apache reservations. There are also wilderness areas near the South Fork Reservation, Yomba Reservation, Las Vegas Colony and Moapa Paiute Reservation. Indian lands with adjacent wilderness areas limit road access for weed control but also curb the spread of weeds by transportation pathways.

3.7.1.2 Wilderness Study Areas

In 1976, Congress enacted Section 603(a) of the Federal Land Policy and Management Act (FLPMA) mandating the inventory of Wilderness Study Areas to determine "roadless areas of five thousand acres or more and roadless islands of the public lands, identified during as having wilderness characteristics described in the Wilderness Act of September 3, 1964". Reports to the President were to be made within 15 years, as to the suitability or unsuitability of each such area or island for preservation as wilderness.
Federal agencies are required by Congress to manage each Wilderness Study Areas, (WSA) to maintain the wilderness characteristics of each WSA until Congress decides whether it should either be designated as wilderness or should be released for other purposes. Grandfathered uses such as grazing and mineral uses are allowed, with restrictions. Recreation vehicle use off existing travel routes and issuing new mineral leases are not allowed. Primitive recreation activities are encouraged. These include hiking and camping, backpacking, fishing and hunting, rock hounding, boating, horseback riding, and the use of pack animals. The mountain range runs north-south for 32 miles and is between 3 and 15 miles wide. The Deep Creeks contain alpine meadows with aspen, juniper Ponderosa pine and bristlecone pine on the fringes. There are numerous canyons cut into the granite and quartzite and nine perennial streams. As part of Secretary of the Interior Ken Salazar's push to build a bipartisan wilderness agenda that can be enacted in the 112th Congress, Bureau of Land Management (BLM) state offices will solicit suggestions and recommendations from state and local elected officials, tribes, and private entities.

Map 3-17 Wilderness Areas in Western Region



3.7.2 Air and Noise

3.7.2.1 Air Quality

Air quality standards are set by the United States Environmental Protection Agency as the primary enforcer of the Clean Air Act originally passed in 1955. A list of pollutants and criteria are outlined in the National Ambient Air Quality Impact Significant Criteria. (NAAQS) Standards for these pollutants (NO2, CO, PM10, PM 25, S02 and lead) are set. The levels of these pollutants have been monitored for areas of the Western United States and have been rated as to whether or not they meet the standards. Counties in each state that have not met the standards (non-attainment) are listed in Appendix H. Some reservation lands are located in these non-attainment areas but most non-attainment areas are in metropolitan areas such as areas of Maricopa County, AZ (Phoenix) Salt Lake County, Utah and Washoe County, NV. Maintenance plans are required for counties seeking to revise designation from Non-attainment to Attainment.

For example, in Arizona, parts of Maricopa County are in non-attainment for PM10, Carbon Monoxide and Ozone, but Gila and Mohave are on maintenance for PM10. Pima County is on maintenance for CO. Parts of Cochise, Pinal and Gila counties are in non-attainment status for SO2, most likely due to mining activity.

In Nevada, Clark and Washoe Counties are in non-attainment for PM10; Washoe County is in non-attainment for ozone and Carson City, Douglas and Washoe counties are in maintenance status for CO. In Utah, Salt Lake and Utah counties are in non-attainment for PM10; Salt Lake and Tooele counties are in non-attainment for sulfur dioxide; Utah County is in non-attainment for carbon monoxide and Salt Lake is on maintenance for CO and ozone.

Many resources and values are affected by air pollution. The ability to appreciate scenic vistas is dependent on good visibility. Human-made pollution can injure various species of trees and other plants, acidify streams and lakes, and leach nutrients from soils. Air pollution can cause or increase respiratory symptoms for residents. The harmful effect of air pollution on the visual and recreational experience could cause impacts and economic losses on Indian lands and surrounding communities. (National Park Service, updated 02/15/2007)

3.7.2.1.1 Federal Class 1 Areas

The Regional Haze Rule was developed to protect and improve visibility in the country's national parks and large wilderness areas (referred to as mandatory Federal Class I areas). The rule became final on July 1, 1999, and requires all states to develop State Implementation Plan (SIP) to address haze for the state's federal parks and wilderness areas caused by all sources of pollutants that impair visibility. The pollutants causing haze are primarily smoke, soot, oxides of nitrogen and sulfur dioxide from fires, vehicles, off road equipment, industrial sources and other activities that generate pollution. The Regional Haze Rule provides the choice for states and Indian tribes in the nine-state Grand Canyon Visibility Transport Commission (GCVTC) Region to implement a national or regional plan.

Mandatory Class 1 Areas are shown in Table 3.15. Only one reservation in Western Region has a Class 1 air shed, the Yavapai-Apache Indian Reservation.

Table 3.15 Reservations with Class 1 Air Quality Standards

American Indian Class I Areas
Flathead Indian Reservation (MT)
Fort Peck Indian Reservation (MT)
Northern Cheyenne Indian Reservation (MT)
Spokane Indian Reservation (WA)
Yavapai-Apache Indian Reservation (AZ)

3.7.2.1.2 Weed Control Activities affecting Air Quality

Herbicide use can release volatile compounds in the area primarily through spray drift. Spray drift is most difficult to contain under aerial applications and windy conditions. Spray drift can affect the health and safety of the workers applying the herbicide and any animals or persons within the immediate vicinity of the drift. Particulate matter in the air can be increased by mechanical and chemical weed control activities through the use of ATVs, trucks, sprayers or earth-moving equipment. These vehicles can stir up dust particles into the air especially under dry, dusty conditions and erodible soils.

3.7.2.2 Noise

Due to the rural location of most reservations in Western Region, ambient noise levels are relatively low. A small number of reservations are located within large metropolitan areas with heavy local traffic and noise from freeways. The reservations in urban areas such as Salt River Pima-Maricopa Indian Community and Ak-Chin do not contain noise levels as high as the surrounding urban area due to undeveloped reservation land and agricultural parcels.

3.7.3 Public Health and Safety

3.7.3.1 Health Risks

This section includes background information on human health risks in the states where noxious weed control projects will be carried out and those experienced by American Indians and Alaskan Native (AI/AN) populations as a whole and in the specific states within Western Region.

Residents on Indian lands are exposed to a number of risks common to most people in the United States but certain risks and diseases are much higher in American Indian and Alaskan Native cultures than the general population. Workplace trauma is the leading cause of death and disability for US workers. Deaths from automobile accidents, machinery, falls, electrocution and falling objects are the most common occurrences. (BLM EIS 2005). Accidents (unintentional injuries) are also a leading cause of death among American Indian/Alaskan Natives (AI/AN). Alcohol-induced deaths, motor vehicle accidents and unintentional deaths are 1.5 to 3 times higher than the Caucasian population.

Table 3.16 Cause of Death in Western Region

State	Cause of Death[2]				
	All[1]	Diseases			Accidents
		Cerebrovascular and Cardiovascular Disease	Chronic Respiratory Disease	Cancer	
Arizona	787.4	252.7	47.1	172.3	46.6
California	775.1	291.6	37.5	155.8	23.5
Idaho	798.0	269.8	44.0	158.5	43.3
Nevada	922.6	312.2	54.2	181.9	35.2
Utah	776.8	241.6	49.8	203.8	37.5
United States	864.8	305.7	43.2	194.4	35.7

1 Based on 2002 data; all other columns are based on 2001 data. 2Age-adjusted death rate per 100,000 population, which accounts for changes in the age distribution of the population. Source: NCHS (2004).

Other leading causes of death for AI/AN are heart disease, cancer, diabetes, and stroke. American Indians/Alaska Natives have also been found to higher rates of suicide, obesity, substance abuse, sudden infant death syndrome (SIDS), teenage pregnancy, liver disease, and hepatitis. The tuberculosis rate for AI/AN is nearly 6 times the rate of the non-Indian population. (Office of Minority Health, Accessed July, 2011) (Indian Health Service, January 2006.

Based on 2001-2002 data, Table 3.16 (BLM EIS, November 2005) shows that residents in the state of Nevada have the highest mortality rate of the three states encompassing Western Region. Cerebrovascular and cardiovascular diseases are higher than in the other states and cancer is also high. Utah has the lowest mortality rate but slightly more deaths by cancer than in the other states for this time period. These figures do not hold true for the American Indian populations of the same states. American Indians and Alaskan Natives, as a whole, have a lower overall rate of cancer than the general population. They have lower rates of breast, lung and oral cancer, but higher rates of certain cancers such as cervical, liver, kidney and stomach cancer.

Figures 3-3 and 3-4 show a slightly different perspective. In 2007, although the death rate from cancer for the general population in Nevada is 187 to 192 persons per 100,000, the death rate for American Indians from cancer in Nevada is about half that figure (75 to 112/100000). In Utah, the death rate from cancer is among the lowest in the nation in the general population at 136 to 172/10000 (a significant drop from 2002). The death rate from cancer for American Indians in Utah is still lower than the general population (112 to 148/100000) but higher than AI/AN in the neighboring states of Nevada and Arizona.

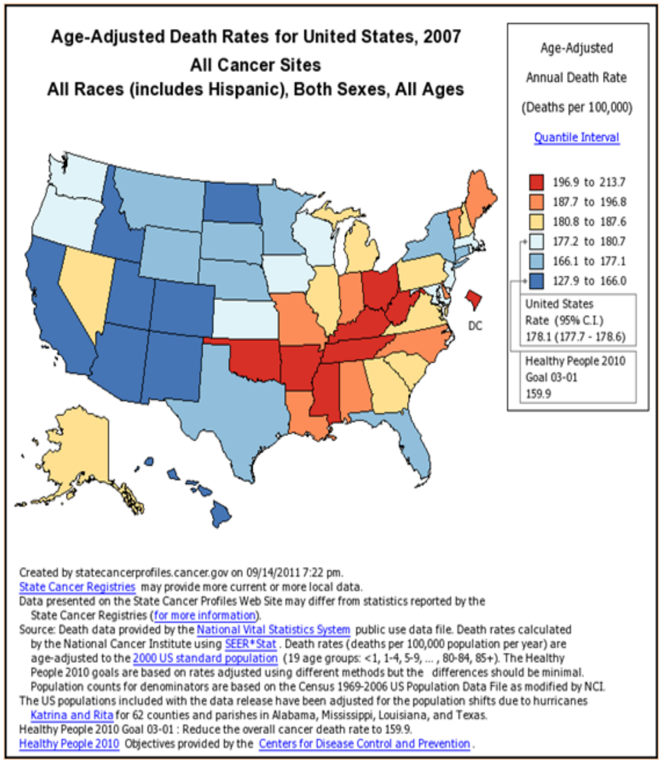


Figure 3-3 Death Rates from Cancer-All Races

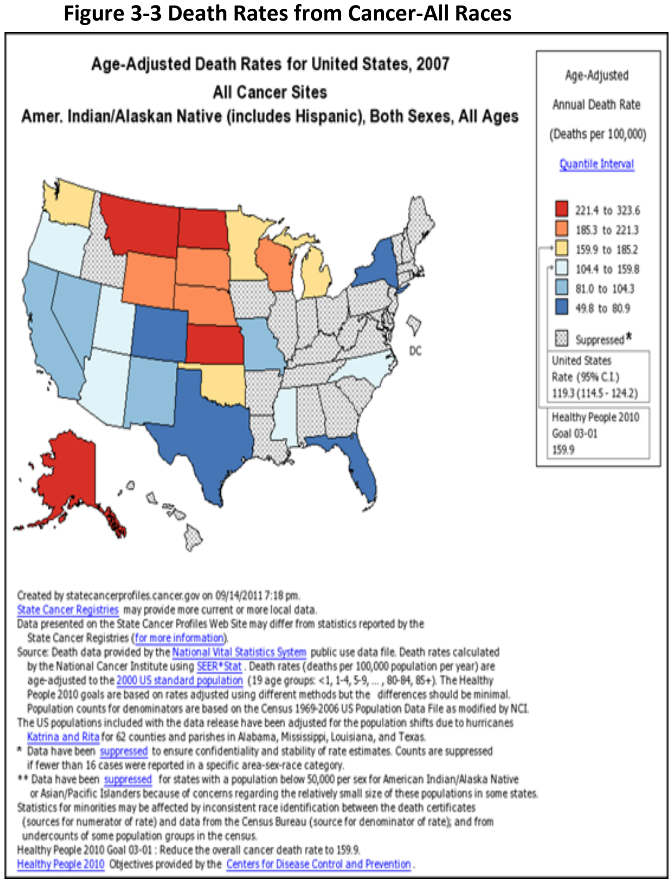


Figure 3-4 Death Rate from Cancer for American Indian/Alaskan Native

3.7.3.2 Risk from carrying out Weed Control Projects

The BLM (2005) in their Vegetation Treatments EIS reported only one minor injury from use of herbicides, or prescribed fire during one year. (2005). Anecdotal accounts of injuries of using herbicides and chainsaws for vegetation control on Indian lands use are similar to that, with one or two minor injuries per year occurring on noxious weed projects. No actual statistics on these injuries have been compiled.

The BLM Vegetation Treatments EIS stated that chronic injuries may be linked to the type of work performed in certain vegetation treatment projects. Vibration syndrome, which causes reduced sensitivity in fingers, affects a large proportion of workers using chippers, grinders, chainsaws and other hand-held power tools. Musculoskeletal disorders associated with the repeated trauma from the use of power tools account for 62% of all work-related illnesses. Noise-related hearing loss is another effect on workers exposed to noise levels of 80 decibels or more a day.

3.7.3.3 Safety Procedures in Place

3.7.3.3.1 Pesticide Applicator Certification and Documentation

Under the BIA Noxious Weed Program, pesticide applicators are required to be licensed or work directly under a licensed applicator. Pesticide Use Proposals are required and Pesticide Use Records need to be filed with the Bureau of Indian Affairs Regional Noxious Weed Coordinator. Many tribal weed programs have developed safety training for the weed crews in chainsaw and herbicide application. A few tribes have developed weed management training manuals containing proper pesticide application and safety procedures and Material Data Safety Sheets.

3.7.3.3.2 Restricted Use Pesticide Certification

In 2010, the Environmental Protection Agency determined that there was no legal mechanism in place for certification and use of Restricted Use Pesticides (RUP) in Indian Country. EPA decided that unless the tribe has an approved certification plan, entered into a cooperative agreement with a state, or EPA has issued a federal certification plan, RUP could not be used legally on tribal land. EPA determined that state-issued certifications are not valid except for those few tribes with agreements with a state or explicitly recognize a state certification in their tribal certification plan. Prior to this determination, most tribes using BIA Noxious Weed Program funding obtained the RUP state certification. EPA will no longer recognize the state certification due to the lack of enforcement capability by the states.

The United States Environmental Protection Agency (EPA) is implementing a federal pesticide applicator certification plan (Plan) for those areas of Indian country where no other EPA-approved or EPA implemented plan applies. The federal certification plan, once final, will dictate how EPA will implement a program for the certification of applicators of restricted use pesticides (RUPs) in Indian country. EPA will administer routine maintenance activities associated with implementation of this Plan and will conduct inspections and take enforcement actions as appropriate. (Environmental Protection Agency; April, 2011)
The final rule, effective September 4, 2012, reduces the burden to restricted use pesticide applicators and simplifies federal certification expiration dates. Restricted use pesticides (RUPs) are those which may generally cause adverse effects on the environment without additional restrictions. RUPs may only be applied by or under the direct supervision of an applicator certified as competent by a certifying agency. A State, tribe, or Federal

agency becomes a certifying agency by receiving approval from EPA on their certification plan. One way EPA may issue a Federal certificate is based on an existing valid certificate from a certifying agency, and this final rule will synchronize the expiration dates on the Federal certificate with that of the certifying agency certificate on which the Federal certificate is based.
The latest guidance from EPA and BIA Central Office (March, 2014) is as follows:

> *"With the recent release of the EPA Plan for the Federal Certification of Applicators of Restricted Use Pesticides (RUPs) within Indian Country, is now possible, in all of Indian Country, for pesticide applicators to be certified to use RUPs. Previously, the EPA had approved tribal certification plans in seven areas. These are listed at:*
> *http://www2.epa.gov/pesticide-applicator-certification-indian-country/areas-indian-country-covered-epa-plan*
> *To be certified in these areas the applicator must follow procedures set forth by the tribe in question.*
> *In all other areas of Indian Country, the applicator must obtain federal certification through the EPA. This process is described at:*
> *http://www2.epa.gov/pesticide-applicator-certification-indian-country/how-apply-applicator-certification-indian-country*
> *The applicator must have a current and valid tribal, state, or federally issued applicator certification or license in order to apply for RUP certification.*
> *Please advise all cooperators that the requirement to have RUP certification under either the federal or an approved tribal plan in order to use RUPs in Indian Country is a strict requirement of federal law."*

Prior to this guidance, there had been conflicting interpretation of the rule in the different EPA and BIA regions and for several years, the BIA Agriculture and Range program leader decided not to fund weed control projects where RUPs were used. Tribes in Western Region submitting proposals that included the use of RUPs were contacted and alternative herbicides for the projects were named.

3.7.3.3.3 Medical and Emergency Facilities

Access to medical and hospital facilities vary with the location of the reservation. Some project areas are very remote and emergency personnel may be up to hour or more away. Most tribes have access to BIA or tribal or local government police and emergency-trained personnel within or adjacent to the reservation. Depending on the location of the weed project, most injured workers would be able to receive timely medical treatment.

Table 3.17a 2008 Fire Statistics by State and Agency

Table 3-16a 2008 Fire Statistics by State and Agency

		Wildland		Rx		WFU	
State	**Agency**	**# Fires**	**Acres**	**# Fires**	**Acres**	**# Fires**	**Acres**
AZ	BIA	595	11,528	47	30,175	0	0
	BLM	177	2,213	51	8,924	0	0
	DDQ	0	0	0	0	0	0
	FWS	5	634	9	12,031	0	0
	NPS	18	532	2	172	2	112
	PRI	2	1	0	0	0	0
	ST	270	5,402	0	0	0	0
	USFS	783	65,186	304	81,649	16	28,036
AZ	**Totals**	**1,850**	**85,496**	**413**	**132,951**	**18**	**28,148**
NV	BIA	8	10	0	0	0	0
	BLM	262	21,839	5	2,280	5	81
	DDQ	0	0	0	0	0	0
	FWS	7	61	6	2,616	0	0
	NPS	20	6	4	66	1	0
	OTHR	51	4,559	0	0	0	0
	ST	34	26	0	0	0	0
	USFS	70	45,429	5	3,437	13	10,458
NV	**Totals**	**452**	**71,930**	**20**	**8,399**	**19**	**10,539**
UT	BIA	32	45	3	510	0	0
	BLM	331	5,766	16	2,491	0	0
	DDQ	1	35	0	0	0	0
	FWS	2	492	2	194	0	0
	NPS	24	564	8	5,356	1	0
	PRI	161	844	10	458	0	0
	ST	264	10,082	15	2,373	0	0
UT	**Totals**	**999**	**28,490**	**119**	**34,620**	**21**	**3,060**

Rx=Prescribed Burns

WFU=Wildland Fire Use (Using a naturally-caused fire as a managed burn.)

Data compiled from Fire and Aviation Management Web Applications

Table 3.17b 2012 Fire Statistics by State and Agency

Table 3-16b		**2012 Fire Statistics by State and Agency**			
		Wildland		**Rx**	
State	**Agency**	**# Fires**	**Acres**	**# Fires**	**Acres**
AZ	BIA	535	37,439	30	20,133
	BLM	183	51,181	5	568
	DOD	0	0	0	0
	FWS	11	20	4	2,805
	NPS	27	46	19	5,871
	OTHR	0	0	0	0
	PRI	0	0	0	0
	ST	192	8,227	0	0
	USFS	736	119,177	185	51,582
AZ	**Totals**	**1,684**	**216,090**	**243**	**80,959**
NV	BIA	2	1,199	0	0
	BLM	622	506,913	5	830
	DOD	1	0	0	0
	FWS	4	61	4	419
	NPS	16	28	4	1,657
	OTHR	67	9,131	0	0
	ST	90	53,297	24	3,145
	USFS	142	42,497	4	259
NV	**Totals**	**944**	**613,126**	**41**	**6,310**
UT	BIA	47	7,385	0	0
	BLM	489	125,653	12	1,245
	DOD	6	1,640	0	0
	FWS	0	0	0	0
	NPS	15	11	3	114
	PRI	0	81,624	1	167
	ST	664	52,481	39	447
	USFS	313	146,473	27	14,459
UT	**Totals**	**1,534**	**415,267**	**82**	**16,432**

Rx=Prescribed Burns

Data compiled from Fire and Aviation Management Web Applications

3.7.3.4 Risks from Wildfire Control

Table 3.17 (a&b) shows the number and acres of fires occurring on land managed by government agencies for 2012 and 2008. The yearly totals for wildfires and 10-year averages by state for Indian land located within BIA Western Region are in Appendix N, Tables 8.14.1 through 8.14.6. The maps and tables in Appendix N are from an ArcGIS database derived from a collection of fire records from six federal agencies N display only BIA records.

Tables 3-17a & 3-17b and the tables in Appendix N were compiled from different sources and vary slightly. Table 3.17 was compiled from the Fire and Aviation Management Web Applications Program and the figures listed for BIA may not include smaller incidents which were handled by BIA and tribal fire crews on their own or fires that BIA and tribal fire crews participated in on non-Indian land, such as BLM or Forest Service land or other lands adjacent to Indian land.

A few generalizations can be made from these tables. Reservations in Arizona have far more wildfires than reservations in Utah, Nevada and other adjacent states within WR. According to Table 3.17a, in 2008, there were a total of 595 BIA fire incidents in Arizona on 11, 528 acres. Table 8.14.1 shows a higher fire number and acreage for 2008, but indicates that many (458) of the incidents were less than an acre in size. In comparison, reservations in Nevada had a total of 22 fire incidents on 140 acres in 2008 and Utah had 29 incidents on 771 acres. However, 2008 was a much worse fire year for the USFS with wildfires on over 65,186 acres in Arizona and 45, 429 acres in Nevada. Great devastation occurred on the White Mountain Apache Reservation and adjacent lands in 2002 with the Rodeo-Chediski fires on nearly a half million acres (Shown in Table 8.14.1).

According to the Interagency Fire Center, two-thirds of wildfires are caused by lightning and the rest are human-caused. According to BIA records, the number of fires caused by humans on reservations is larger. Around two thirds were caused by humans and one third had a natural cause. This is largely true for reservation fires in Arizona and Nevada. In Utah about half were caused by humans.

During the periods from 2000 to 2010, 82 DOI/USDA firefighters died from wildland fire accidents, nationwide. Most of the fatalities are associated with aircraft (50%); 20 % were due to burnovers and 13% were caused by driving accidents. Deaths were also due to heart attacks, hazard trees and other factors. (National Interagency Fire Center, 2011)

Burned area emergency response (BAER) teams are part of a holistic approach to address post wildfire issues which also includes suppression activity, damage repair and long-term restoration. BAER plans are implemented within one year of wildfire containment to stabilize and prevent unacceptable degradation to natural and cultural resources, to minimize threats to life or property resulting from the effects of a fire, or to implement physical improvements necessary to prevent degradation of land or resources. (DOI, Undated)

3.8 *Environmental Justice, Climate Change and Adaptive Management*

3.8.1 Environmental Justice

The United States Environmental Protection Agency defines **Environmental justice** (EJ) as "the fair treatment and meaningful involvement of all people regardless of race, color, sex, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations, and policies".

Environmental injustices include the proper consideration of the negative effects of proposed projects on underserved ethnic or population groups. Modification of land, water, energy and air; unresponsive, unaccountable government policies and regulation; and lack of resources and power in affected communities contribute to environmental injustice.

Historically, tribes are vulnerable to impacts on Environmental Justice. Many are economically disadvantaged and susceptible to accepting projects that will make money but may have negative effects on the health of the population. Tribal leaders are forced to make difficult choices to help the economy of their tribe and may not always be fully cognizant of the negative impacts of some of these projects. Examples are strip mining, coal-fired power plants, oil and gas development and nuclear and toxic waste facilities that have documented effects on the air, water and health of residents.

The U.S. Environmental Protection Agency has established a National Tribal Toxics Committee (NTTC) to give Indian tribes greater input on issues related to chemical safety, toxic chemicals and pollution prevention. The goal is to empower tribal communities to protect their health and environment from the risks of toxic chemicals. EPA has had several initiatives within the last four years (2008 to 2012) (Described in Section 3.6.3 Public Health and Safety) to increase pesticide safety on Indian lands, reduce exposure to toxic chemicals and prevent pollution in Indian Country. (Tribal Law and Policy Institute, May, 2011)

3.8.2 Climate Change

3.8.2.1 **Severe weather events**

Climate change effects such as droughts, floods, wildfires, and snowstorms have a detrimental impact on American Indians and Alaska Natives. Extreme weather events increase plant and wildlife mortality and amplify the risk of wildfires and habitat loss. These events can affect Indian tribes more than others due to their relative lack of infrastructure, capacity, and financial support to address them. Climate and weather extremes occur in a broader context with other problems facing tribes, from other environmental degradation to limited economic resources.

3.8.2.2 **Existing Impacts in Western Region**:

Several severe weather impacts have occurred within Western Region. There have been major forest fires, flooding and droughts which damaged resources on the reservations of western region. Drought has affected pinyon pines in the west, which are culturally and environmentally significant to most western tribes. A severe fire, the Rodeo-Chediski occurred on the White Mountain Apache tribal land in 2002. Tribal forest management programs have kept additional fire impacts to a minimum. Flooding occurred on the Hopi Reservation in 2010, causing erosion and damage to roads and infrastructure.

(Curry, R. et al**,** National Wildlife Federation, August, 2011)

3.8.3 Adaptive Management

In an effort to provide consistency within the Department of Interior (DOI) agencies, the DOI revised NEPA policies to define adaptive management as:

"A system of management practices based on clearly identified outcomes, monitoring to determine if management actions are meeting outcomes, and, if not, facilitating management changes that will best ensure that outcomes are met or to re-evaluate outcomes. "

(Department of Interior, March, 2004)

This strategy, as applied to weed management, is inherent in the process as weed treatments are completed, they are evaluated for effectiveness and new techniques are employed, if current control methods do not seem to be working. Early detection, early response is advocated in the grant process, as well as inventory and monitoring. Since 2010, the BIA Range and Agriculture program has been conducting program assessments for managing natural resources. Self-assessments are used to determine the level of agriculture resource management and conservation plans and practices. In 2012, assessments were conducted for tribal and agency

Noxious Weed Programs. Additional information on Adaptive Management will be addressed in the Noxious Weed Management Plan.

3.9 *Consultation and Coordination*

Five scoping meetings were held in July and August of 2010. Two were held in Arizona, in Phoenix and Yuma. Two were held in Nevada, one on the Pyramid Lake Paiute Reservation and one in Elko. One meeting was held in Utah in St. George. Each meeting had an average of about 12 tribal representatives attending. Tribes were also asked to participate in an online survey and about 20 responses were received. All comments are summarized in Appendix A and B and suggestions are incorporated or responded to in this EA.

4 Chapter 4 Environmental Consequences/Effects of Alternatives

This chapter examines the effects of the three alternatives on land and water resources, air quality, biological and cultural resources, socio-economic conditions, land use patterns and public health and safety. Tables of herbicide and other treatment effects from the BLM Vegetation Treatments EIS may be summarized and/or referred to but not reproduced in this text. Direct, indirect and cumulative effects will be evaluated. Description of effects will assume that Noxious Weed Treatment Guidelines in Appendix O and methods described in the Noxious Weed Integrated Management Plan will be employed and that all applicable laws will be followed. Mitigation measures will be identified where the environmental consequences have been identified as significant.

4.1 *Land and Living Resources*

4.1.1 **Land Resources-**Soil and Soil Quality

4.1.1.1 Alternative 1–No Action

If native perennial bunchgrasses were replaced by invasive annuals, the herbaceous biomass would still provide protection of soil not covered by woody plants. The plant adds organic matter to cycle soil nutrients. Herbaceous plant material serves as mulch to slow velocity of wind and flowing water.

Research has shown that some exotic plants contribute toxic chemicals to the soil. Tamarisk adds high levels of salt to the soil. Some invasive plants in the mustard family alter the soil chemistry and kill beneficial soil fungi for certain tree species. Many invasive plants add allopathic chemicals into the soil which inhibit the growth of native species. The replacement of native plants with weeds alters soil structure, moisture and organic matter and decreases the land's ability to produce in natural or cropland ecosystems.

When a weed, such as knapweed, replaces dense, native riparian vegetation, it can cause an increase in soil erosion (Lacey, 1990). Erosion results in: (1) higher project costs, (2) damage to aquatic habitat, (3) reduced water quality, (4) elimination of trout and salmon fisheries, (5) lower shorefront property values, (6) higher property taxes, and (7) loss of business and jobs. (Howery, 2002) Increasing water runoff and soil erosion induces higher sediment loads in streams, rivers and lakes and impacts fisheries. Eroded areas are also potential hosts to weed seed carried by air, animal, vehicle and water, continuing the destructive cycle.

Soil and water losses occur on millions of acres where grass communities have been replaced by tap-rooted plants. Soil-water relationships have been altered due to the presence of some weeds, such as spotted knapweed.

Research has found surface water runoff and soil erosion was 56 percent and 192 percent higher, respectively, on spotted knapweed dominated sites. Soil on spotted knapweed dominated sites is eroded to a higher degree compared to bunchgrass communities and water infiltration is decreased. This means greater sedimentation of streams, rivers, and lakes and negative impacts to fisheries.

There has been a fourfold increase in invasive weed populations on BLM lands in the Western United States since 1985. Wildfires, drought, and invasive weeds are causing a steady degradation of soils, water quality and quantity, native plant communities, wildlife habitat, wilderness values, recreational opportunities, and livestock forage. (BLM 2007)

4.1.1.2 Alternative 2 – Integrated Weed Management

Chemical

Herbicide treatments benefit the soil by removing unwanted vegetation and allowing the native vegetation to return. Herbicide or biological treatments are often the most appropriate option for large-scale infestations and treatments in remote areas. Herbicide runoff, overspray and drift can degrade the soil and affect soil biology. Some residual herbicides can remain in the soil and have long term detrimental effects on soil organisms.

Biological and Cultural

Biological treatments to be carried out on Indian lands would be through the introduction of an approved biological control insect pathogen.

Goats or other grazing animals are used in a managed grazing capacity. Cattle have not been used in this capacity in Western Region. The goats do cause soil disturbance with their grazing but it is of short duration and the grazed area are allowed to recover with the target weed weakened by the grazing.

Treatments for Noxious Weeds would affect soil physical, chemical and/or biological properties. This could include the loss of soil through erosion by mechanical treatments and changes in structure and bulk density and organic matter content. Fire treatments alter nutrient availability and pH. Some treatments would alter the type and amount of soil organisms affecting soil quality. The long-term effects of the treatments would be to restore native ecosystems, reduce fuel loading for wildfires and improve soil quality. Thorough descriptions of the effects of Fire and Mechanical treatments are found in the BLM Vegetation treatment EIS on pages 4-11 and 4-15.

Mechanical

Chaining of native trees would not be carried out under any of the alternatives but for some non-native tree removal, such as for Russian olive and tamarisk, tree debris is moved with heavy equipment to slash piles which can disturb the topsoil.

There is the potential for soil contamination by fuels associated with mechanical treatments. This could cause localized reduction in water infiltration and prevent plant re-growth. Fires can cause changes in soil structure, burning of litter and organic matter will increase runoff. Fires can cause a waxy coating to form around soil particles which repel water. Low intensity fires, as practiced in prescribed burning would have fewer effects than high intensity wildfires.

If mechanically-treated areas are not reseeded to native plant communities, erosion and soil impacts may increase. Additional invasive plant populations may occur. However, emphasis within the Integrated Weed Weed Management Plan includes revegetation efforts, which would restore plant communities and reduce soil erosion.

4.1.1.3 Alternative 3 Integrated Weed Management without chemical or biological treatments

This method would limit management techniques available and the effects of the treatments to those induced by fire and mechanical methods. This alternative could include using grazing as a cultural control method. Without the use of chemical or biological treatments, ground disturbing mechanical or grazing methods may need to be used more often and increase potential for soil disturbance and erosion.

4.1.2 Living Resources-Vegetation

4.1.2.1 Alternative 1-No Action

Untreated noxious weeds can create monocultures and crowd out native vegetation. Noxious weeds can aggressively take over an area. This is usually due to prolific seed production or other propagation method, without natural predators. Knapweed plants produce 1,000 seeds in its lifecycle. The seed remains viable in the soil for 8 years. The most prominent consequence of non-native species is the reduction of native plants affecting the biodiversity of an area. (Hole Weed Control, Accessed October 25, 2011)

Invasion of non-native species is considered one of the five top causes of biodiversity loss. Invasive species can threaten local native species due to competitive exclusion, niche displacement, or hybridization with related native species. Invasive plant species could result in homogenization of the native fauna and flora and the loss of biodiversity. The displacement of native grasses occurs at increasing rates on invaded sites.

Untreated weeds can increase the chance of wildfires, which do the most damage by creating disturbance that allows weed seeds to get a competitive advantage. In recent years, the severity and intensity of wildfires in the West has increased dramatically from levels in the 1970s and 1980s. Rangeland sites in the Great Basin Desert and other desert ecosystems can be invaded with Eurasian annual crucifers, Sahara mustard, pinnate tansy mustard (Descurainia pinnata) and tumble mustard (Sisymbrium altissmium). These annual mustards, red brome and cheatgrass can dry out early and cause brown coloration across range sites. Russian thistle (Salsola kali) is another annual Eurasian species found in disturbed areas. The eventual effect of Alternative 1 is the gradual reduction and replacement of native grasses and forbs with invasive non-native species.

4.1.2.2 Alternative 2-Integrated Weed Management

The removal of non-native woody species, such as Russian olive and tamarisk are of considerable concern in Western Region and involve more than fifty percent of the projects. The Integrated Weed management method in the removal of invasive woody species would help restore the natural balance in the ecosystem.

Chemical

The most effective means of tamarisk control involves a mechanical and chemical combination. Tamarisk re-sprouts from roots or cut stems and using mechanical-only treatments are unsuccessful. Cutting down the tree in combination with direct chemical application of the stump with herbicide has been successful. Some studies have shown that aerial chemical treatments are able to achieve "90-99% control of tamarisk in riparian areas but environmental concerns and costs have kept this method from being used in Western Region.

Biological Control

The use of insect pathogens is not expected to have a detrimental effect on cultural species or affect traditional practices of hunting, fishing and gathering. Many tribes have embraced this method in order to reduce chemical use or more expensive labor- intensive mechanical practices. However, some tribes remain cautious about using any non-native species on their lands.

The insect pathogens have been thoroughly researched to make sure they are host specific but some errors were made in older studies, specifically with the thistles. The adult thistle-head weevil, *Rhinocyllus conicus,* feeds and mates on musk and other thistles while they are in the rosette stage. Since they also feed on native thistles, they may decrease populations of rare thistle species too. Because of their wider-than-expected host range, USDA APHIS has prohibited interstate movement of the *Rhinocyllus* weevils.

A flower weevil, *Larinus planus,* also attacks Canada thistle and reduces seed production much as the musk thistle-head weevil does. The larvae feed on the flowers, and the adults consume foliage. Larinus weevils were introduced accidentally and are no longer permitted for interstate transport by USDA APHIS, The weevils occur in the wild on the eastern and western coasts of the U.S. (Sullivan, P., August 2004)

Noxious Weed Treatment Guidelines, as outlined in Appendix O, Table 8.15.3, would reduce effects to non-targeted vegetation. Only thoroughly tested and researched biological control agents would be released according to APHIS regulations. Currently, USDA APHIS has placed a ban on the movement of the Diorhabda beetle for tamarisk control due to willow flycatcher habitat concerns.

4.1.2.3 Alternatives 2 and 3-Methods used in both alternatives

Fire treatments

Fire drastically alters the desert ecosystems found within Western Region and should only be used with great caution in managing invasive weed infestations. Most vegetation types can regenerate after fire if the dominant plants are unharmed or if there is sufficient time for them to reestablish in the burned area. Longer recovery intervals occur within the desert where the vegetation is dominated by fire-intolerant species.

Fires must be planned and carried out with trained personnel and used sparingly in arid environments, especially in the Sonoran Desert zone. Fire can stimulate the growth of certain plants while negatively impacting others. Some woody species may be top-killed and readily re-sprout after burns. Some important native grasses such as bluegrasses, fescues, needle and thread and Black grama have a difficult time recovering from fires. Tables 4-1 through 4-3 show the effects of fire on invasive species and the ability of the native habitat to regenerate after fire. Desert ecosystem and semi- desert grasslands make up most of the plant communities on reservations in Western Region. These ecosystems have a poor fire tolerance.

The Sonoran desert community is especially vulnerable with species such as saguaro (Carnegiea gigantea) and palo verde (Parkinsonia spp.). (Rogers, 1985; Schmid and Rogers, 1988) In the Sonoran Desert, most native shrubs and trees are killed by fire, and recovery is slow (Rogers and Steele 1980). Adaptations to fire are weak and inadequate to justify large scale burning. Most land management policies call for fire suppression throughout the Sonoran Desert.

Plant communities in the Mojave and Sonoran deserts are too sparse to carry out prescribed burning in most years. In the Mojave and Sonoran deserts, burning can increase the spread of the invasive bromes and high mortality can occur to palo verde, ocotillo and creosote bush as a result of fire. Burning during drought periods negatively impacts the re-growth of native grasses. Honey mesquite and Harvard (sand shinnery) oaks (Quercus harvardi) have the ability to vigorously re-sprout after fires. Cacti, palo verde, burroweed, bursage, ocotillo, and creosote bush are desert species that would suffer high mortality rates during burns.

Fire in Evergreen woodlands is an important natural disturbance. Fires are estimated to have occurred every 10 to 30 years. This fire regime kept junipers on shallow rocky soils. Under natural fire cycles, there are normal successional stages of the juniper woodland. Without the normal succession the habitat is disturbed.

Pinyon-juniper woodlands and mountain shrub communities tolerate fire moderately, but are not normally where the dominant weed problems are found. Fires carried out in grass dominated communities can end up removing vegetative cover and causing erosion. Using prescribed burning alone can fail to restore natural conditions by using it inappropriately by burning too much or too little. A proper evaluation of the conditions prior to the burn is important.

Burning may be an option for treating large infestations of some noxious weeds but it would not be an effective method for treating a number of problem species such as Lehmann lovegrass or buffelgrass or other opportunistic invaders after fire. The effect would be similar to the No Action Alternative on the invading species and may destroy other valuable native species of plants and animals in the process.

If sagebrush communities burn, with its annual grass and forb component providing fuels for high intensity fire, the big sagebrush will be killed, leaving an annual invasive grass range.

Tamarisk is a fire-adapted species and sprouts vigorously after burning. Flowering and seed production increases after fire. Without frequent flooding, tamarisk communities accumulate litter rapidly and can burn every 16 to 20 years. Fire prevents most tamarisk stands from either reaching maturity or persisting as mature communities. Native riparian vegetation is usually replaced by tamarisk after a fire, established on burned sites through off-site seed sources. (Barranco, A.**,** Nov, 2001)

Mechanical

Mechanical treatments are usually selective and can minimize the effects to non-target species. Mechanical treatments can spread seed but not kill roots and cannot be used for all weed species. Mechanical methods that remove the root and the whole plant are the most successful. Mechanical treatments plus revegetation are often more successful than mechanical treatments alone. Woody species are most affected by mechanical treatments and can take up to 10 years to recover. Herbaceous species flourish after mechanical treatments with lack of competition from woody species. (BLM EIS)

Consistently hand pulling or grubbing can result in a seed bed prime for germination of weed seed and are only successful for certain weed species. Species such as Johnson grass and Canada thistle have rhizomes, (creeping, horizontal roots) that sprout when broken or fragmented. Thus mechanical control methods for some species could result in maintenance of populations of this species, or its continued spread.

Because tamarisk can easily sprout from roots or cut stems, mechanical removal of tamarisk is unsuccessful. Cutting down the tree in combination with direct chemical treatment of the stump with herbicides effective against tamarisk) has been successful. Prescribed burning alone is not an effective control method for tamarisk because it can promote sprouting and flowering. However, burning followed by herbicide application has been shown to be effective.

4.1.2.4 Alternative 3-Integrated Weed Management without chemical or biological treatments

This method would limit management techniques available and the effects of the treatments to those induced by fire and mechanical methods. Fire is not a viable alternative in every ecoregion as noted in the discussion above. The effects of fire on plant species is summarized in Table 4.1. Many of the important weed species in Western Region can readily regrowth after fire. This alternative includes using grazing as a cultural control method. Without the use of chemical or biological treatments, mechanical or grazing methods may need to be used more often and may not work as a viable alternative for every weed species.

Table 4.1 Effects of Fire on Representative Noxious Weed

Table 4.1 Effects of Fire on Representative Noxious Weed			
Species	**Enhancement of Colonization by Fire**	**Effects of Fire on Survival**	**Ability to Regrow after Fire**
Bermuda grass	Unknown	Direct mortality unlikely	Dormant season burns enhance growth
Cogongrass	Slight enhancement	Mortality unlikely	Very rapid recovery
Crested wheatgrass	Likely	Various results reported	Various results reported
Downy brome	Likely	Killed by fire	Must reestablish by seed
Japanese brome	Fire removes litter and inhibits colonization	Plants and seeds killed	Populations slow to recover
Kentucky bluegrass	Likely	Direct mortality low	Burns during spring growth period more strongly reduce plant density
Leafy spurge	Unclear	Mortality unlikely	Extremely rapid recovery
Musk thistle	Likely	Survival likely	Rapid recovery
Purple loosestrife	Unknown	Most survive	Rapid recovery
Quackgrass	Unknown	Direct mortality low	Plants can regrow quickly; may depend on burn time
Russian knapweed	Unknown	Some survival likely	Unknown
Tamarisk	Likely	Top-killed, but most survive and re-sprout	Rapid recovery
Smooth brome	Likely	Direct mortality low	Burns during spring growth period more strongly reduce plant density
Spotted knapweed	Enhanced	Substantial mortality	Population recovery aided by persistent seed bank
Yellow starthistle	Enhanced	Adult plants killed	Must recover by seed
White sweet clover	Enhanced	Killed by growing-season burns	Rapid recovery by seed if burning is infrequent.
Source: Grace et al. 2001.			

Table 4.2 Plant Community Fire Tolerance

Table 4.2 Plant Communities and Their Tolerance to Fire	
Level of Tolerance	**Plant Communities**
Tolerant - interval between fire and recovery is 2-5 years;	Chaparral, Oak woodland, Mesquite-acacia woodland
Moderate tolerance- interval between fire and recovery is 5-15 years	Pinyon-juniper Mountain shrub
Low tolerance = interval between fire and recovery is 20+ years	Semidesert grasslands
Source: Payne and Bryant (1988).	

Table 4.3 Tree Fire Resistance and Ability to Regenerate after Fire

Species	Ability to Regenerate after Fire	Size when Fire Resistance Gained	Fire Resistance at Maturity
Pines			
Jack pine3	None	None	Low
Jeffrey pine	None	Pole	High
Longleaf pine	Root crown	Seedling4	High
Pinyon pine	None	None	Low
Pitch pine	Root crown, stump sprouts	Mature	Medium
Ponderosa pine	None	Sapling/pole	High
Red pine	None	Pole	Medium
Lodgepole pine	None	Mature	Medium
Shortleaf pine	Root crown	Sapling4	High
Western white pine	None	Mature	Medium
Whitebark pine	None	Mature	Medium
Firs			
Balsam fir	None	None	Low
Douglas-fir	None	Pole/mature	High
Douglas-fir, Rocky Mountain	None	Pole	High
Grand fir	None	Mature	Medium
Noble fir	None	Mature	Medium
Pacific silver fir	None	None	Low
Subalpine fir	None	None	Very low
White fir	None	Mature	Medium
Junipers			
One-seed juniper	None	Mature	Low/medium
Utah juniper	None	Mature	Low/medium
Western juniper	None	Mature	Low/medium
Other Conifers			
Black spruce	None	Mature	Low/medium
Blue spruce	None	None	Low
Engelmann spruce	None	None	Low
Sitka spruce	None	None	Low
Tamarack	None	Mature	Medium
Western hemlock	None	None	Low
Western larch	None	Pole	High
Western red cedar	None	Mature	Medium
White spruce	None	Mature	Medium
Oaks			
California black oak	Root crown, stump sprouts	Mature	Low/medium
Canyon live oak	Root crown, stump sprouts	Mature	Medium
Gambel oak	Root crown, roots	None	Low
White oak	Root crown, stump sprouts	Mature	Low/medium
Other Hardwoods			
Aspen	Roots, root collar	Mature	Low/medium

4.1.3 Living Resources-Wildlife

4.1.3.1 Alternative 1-No Action

Established, non-native species have the ability to displace native plant and animal species, disrupt nutrient and fire cycles, and alter the character of the community by fostering additional invasions (Osborn *et al.* 2002).

4.1.3.1.1 Terrestrial Species

Some weeds and invasive trees can provide forage and cover for wildlife when the species have adapted to the invaded habitat. Untreated invasive weeds degrade and fragment wildlife habitat, decrease diversity and the amount of wildlife that can be supported in the community. Other negative effects of invasive weeds include:

- Reduction in wildlife forage
- Alteration of thermal and escape cover
- Change in water flow and availability to wildlife
- Reduction in territorial space necessary for wildlife survival

4.1.3.1.2 Fish and Aquatic Organisms

Nuisance aquatic species such as giant salvinia, Eurasian watermilfoil can cause an overabundance of organic matter, decreasing light and oxygen levels for aquatic organisms.

4.1.3.2 Alternative 2-Integrated Weed Management

4.1.3.2.1 Terrestrial Species

Chemical

The use of herbicides has the potential to harm wildlife, mostly individual animals. Possible direct effects of chemical applications include death, damage to bodily organs, decrease in healthy reproduction and increased predation. Indirect effects include lowered plant diversity, food and habitat. Habitat is disturbed by the spraying of chemical and may be avoided by wildlife. Territorial boundaries and breeding areas may be affected. Areas cleared of vegetation can increase predation.

Herbicide treatment can result in habitat modification, resulting in less forage. Treated areas usually recover within two years.

There are many factors to consider when determining the effects of herbicide treatments on wildlife. Species that have a small home range (such as insect and small mammals) and live year-round in the habitat will be more likely to be adversely affected. Species feeding on animals with bio-accumulation of herbicide in their system could be also adversely affected. Subsurface animals could be affected if the herbicide has long residual times in the soil. Site-specific assessments of effects should be done to determine the degree of effects.

Effects of herbicides on wildlife are summarized in Table 8.9.7 in Appendix I. The results in Table 8.9.7 differ from the LD50 studies carried out by the EPA. The Forest Service conducts Risk Assessment studies on using herbicides for invasive species management. A study carried out in Region 6 indicated enough concern for several herbicides to establish standards for their invasive plant treatments. The studies seemed to indicate that the effects are not detrimental if applied at the appropriate rate but misapplications or drift may cause detrimental effects. As a result of the risk assessments, the Forest Service will no longer use dicamba or 2, 4-D and will not broadcast spray triclopyr. All proposed projects must have design criteria to reduce risk. BIA has not implemented such a policy, although the proposal must show the use of integrated weed management principles for point assignment. More education on the effects of using these herbicides will be carried out and other alternatives will be encouraged.

There are risks to wildlife associated with using chemicals and herbicides need to be used in a safe and judicious manner. Many tribes use a variety of control methods and are reducing the use of herbicides as the primary control method. Many are relying on mechanical, biological and cultural methods in addition to selective use of herbicides. However, at this stage, herbicides are still important control method. They can be used prudently to enhance weed control on reservations.

Biological

Biological treatments may be used for medusahead, yellow starthistle, knapweeds, leafy spurge and purple loosestrife and Dalmatian toadflax. The use of insect pathogens for biological control would have few effects. Approved insects have high host specificity. The target plants stay in place and there is no ground disturbance. The insects move to new host plants after initial release. The effects on target plants are slow and wildlife would have time to respond to the changes.

4.1.3.2.2 Fish and Aquatic Organisms

Chemical

Herbicides have the potential to enter aquatic areas and affect organisms directly through targeted applications, by accidental means, or through runoff. At low levels, there may be no effects on the aquatic environment. At moderate levels; growth, survival, behavior and reproduction could be affected. High levels of herbicide use could have lethal effects to organisms. Chronic and acute toxicity of herbicides to salmon and other organisms has been evaluated for typical and worst-case scenario exposures. (USDI, BLM 2005a, C-29 to C-87) The assessment showed that most of the common terrestrial herbicides do not pose a serious threat to aquatic organisms, but one, Diuron, shows a moderate risk. The aquatic herbicides such as diquat, fluridone and glyphosate do present a risk to fish and invertebrates when applied in water bodies. The risk is greatest when applied in streams, as authorized by the label, or accidently.

Several studies have shown that certain surfactants, especially R-11, increase the toxicity of glyphosate for certain fish species. Although the manufacturer states that R-11 is non-toxic and no toxicity is listed on the Material Data Safety sheet, independent studies carried out in New York and California have shown R-11 to be highly toxic to Delta Smelt, Sacramento splittail (CA Dept. Fish & Game, 2004) and several other fish species. A major difference between the effect of glyphosate and glyphosate formulations on aquatic and terrestrial organisms occurs when a surfactant is used in Roundup. The surfactant is more toxic than glyphosate to aquatic organisms, especially in alkaline water (USDA, APHIS, 1997).

Biological

Insects used as biological control agents would have little or no effect on the aquatic environment. The insects would be released on foot or by ATV's or other motorized vehicle but do not require much off-road travel. The vegetation would stay in place, after feeding by the insect, so soil disturbance would be minimal. Biological control can take longer than other methods and a complete eradication rarely happens.

4.1.3.3 Alternative 2 & 3 Integrated Weed Management without biological or chemical control

4.1.3.3.1 Terrestrial

Cultural, Fire and Mechanical

Major habitat changes, as induced by fire, or mechanical removal of vegetation can cause a reduction in productivity and health of some wildlife species. Mobile species are less affected by the changes than species that depend on only a few habitats and have limited mobility. Large scale projects are potentially more catastrophic. Most of the changes are temporary but recovery in some areas can take several years. BLM prepared a Biological Assessment for wildlife species in their 2005 Vegetation Treatment EIS.

More than half of the projects funded by the BIA Noxious Weed Program in Western Region include tamarisk removal in riparian areas. Removal of tamarisk would also remove the vertical structure of vegetation currently found in the habitat. This could affect bird species seeking cover and perches while traversing through the area. More open habitat will be favorable to certain animal species and unfavorable to others. The change in vertical structural diversity may have an effect on avian populations. It is believed that this effect will be temporary and once the removal of the tamarisk is accomplished, the native vegetation will re-establish and provide cover.

Cultural

Treatments using grazing animals would have a greater effect on terrestrial wildlife than insect pathogens. In some areas, wildlife and wild horses provide enough grazing pressure on wildlife and these techniques should not be employed. Grazing treatments that fragment larger wildlife habitat would not be beneficial. The effect of the grazing treatment on existing wildlife would depend on the nesting and mating habits of the animal. Sensitive riparian areas and wet meadows should be protected from intensive grazing. Removal of grass and shrub cover can affect white-tailed deer survival and grazing and drought may have been the cause of the degradation of the masked bobwhite quail habitat in Arizona. Some sparrow species do better in lightly grazed areas and can be taken into account when planning treatments. Wildlife diversity normally increases after livestock are removed. Grazing can harm rodents. Rest-rotation grazing can provide benefits for some deer. Most deer avoid areas of short-duration grazing.

4.1.3.3.2 Fish and Aquatic Organisms

Cultural

When grazing animals are used for weed control, stream channels can become wider and shallower, causing the water to become warmer and reduce habitat for cold-water fish species. There can be direct negative effects on the aquatic environment through animals defecating, trampling vegetation, disturbing the streambed and compacting soil. Other methods may include general feeders, such as grass carp, or the use of native herbivores. These methods would have few detrimental effects. Neither of these methods has been widely used on Western Region reservation for weed control projects funded by the BIA.

Fire and Mechanical

Improving upland habitat and reducing fuel levels for fires will reduce erosion and sedimentation and lead to improved aquatic habitat. Vegetation treatments that include restoration of the native plant community provide shade and reduce water temperatures. Although stream flow is increased when vegetation is removed, it is moderated when banks are protected by native grasses, forbs and shrubs.

All vegetation removal activities have the potential to disturb soil and cause erosion and sedimentation into the aquatic environment. Sedimentation negatively impacts the survival of aquatic species by reducing sunlight and visibility for feeding success, preventing emergence into fry stage, burying spawning habitat and tainting gills of fish. Vegetation removal can increase sunlight penetration and increase water temperatures. High temperatures can alter metabolism and behavior, affecting aquatic species survival. Trout and salmon are coldwater fish sensitive to temperature changes, which can be lethal. Vegetation removal can reduce the amount of water captured by plants and lead to increased runoff. This can scour stream channels, alter morphology and affect the distribution of aquatic organisms.

4.1.3.4 Alternative 3

4.1.3.4.1 Terrestrial

As a result of changes on lands throughout the western U.S. from altered fire regimes, habitat has declined for many species. Species that rely on a particular habitat can be vulnerable to changes in their habitat. Mobile species can move to a different habitat if disturbances are not large scale. When populations are small, disturbance can cause habitat fragmentation and breeding pool becomes limited.

Fire

Fire has an ecological role in most habitat development. It has ecological and an economic advantages over other treatments. However, it cannot be used in all ecoregions and is especially detrimental in the Mojave and Sonoran Desert regions. In temperate desert regions, fire treatments could make habitat less suitable for some wildlife species over the short term. Fire returns the habitat to an earlier successional stage favoring some wildlife species. The time of year of the burn is important to wildlife survival. Prescribed burning should not be planned during nesting and rearing stages for young birds and mammals. Prescribed burns should be planned to encourage mosaic burn patterns to improve animal survival. Many fires naturally burn in different intensities, ultimately creating a more diverse habitat for wildlife. Small mammals, such as rodents or hares and woodrats who build their nests near the ground are susceptible to fire. Some small mammals can escape fire by hiding in rock crevices, burrows, stumps and roots. Some wildlife soon returns to the burned area to feed on insects or other animals. Geese have been known to return to burned marshes to feed on roots of burned plants. Butterflies can be harmed when the fires take place while they are in the larvae stage on grasslands. Patches that are not burned should left in the project area so the butterflies can repopulate.

If sagebrush habitat burns, the annual grass and forb component provide fuels for high heat fires which can kill off big sagebrush and incite the growth of annual invasive grass range that is poor to fair wildlife habitat.

Only a very small portion of the projects take place in evergreen shrub and forest communities. BIA Noxious Weed funding does not include the removal of native species. When woody plants are targeted, bird species decline but as the communities continue to develop, bird populations will increase. Most forest communities benefit from low-intensity burns to reduce woody undergrowth and encourage herbaceous plant growth. These methods have been evaluated extensively by the BIA Forestry and Fire Division Management Plans and Environmental Assessments.

Fire has not been shown to be effective as the primary treatment method for removal of tamarisk but could be used in combination with other treatments. Impacts to wildlife would be short term following the prescribed burn. Any fire, whether natural or human-caused, causes some mortality of small animals, reptiles and birds. Some animals seeking tamarisk piles as cover would be especially vulnerable. In most cases, wildlife would be displaced in the short term by the fire and the loss of surrounding vegetation and then would return when vegetation begins to grow back. Recommended Treatment Guidelines practices will include leaving a small number of tamarisk piles as habitat to mitigate the loss of vertical structure which adds to habitat diversity.

After treatment of tamarisk, the increase of forb and grass species would most likely lead to an increase in use of the treated areas by wildlife species that prefer a grassland type, such as mule deer and pronghorn antelope, and certain avian species. (BLM, 2002)

Mechanical

Mechanical treatment is the prime method used to restore wildlife habitat. Mechanical treatments would remove unwanted plants but may have some impact on native species in the treatment area. Manual methods would have less of impact on habitat than large machinery. Large machinery such as dozers and backhoes are noisy and would alter wildlife behavior or cause animals to leave the area during the treatment period. Large openings created by mechanical treatments are beneficial to some species but detrimental to other wildlife, such as turkeys. This would have a temporary effect on wildlife species. Negative impacts could be reduced by avoiding the bird nesting season and critical reproductive periods (from April to June).

4.1.3.4.2 Fish and Aquatic Organisms

Fire

Heat generated by fires can raise water temperatures and induce mortality in coho and cutthroat trout. The effects of fire-induced temperature changes are usually short-term. Fire-suppression activities can negatively impact organisms. Fire retardants contain chemicals harmful to organisms. Foam retardants contain higher levels of these harmful chemicals should be avoided around streams. Ash and smoke can increase ammonia and acidity and negatively impact fish species. A study of macro invertebrate levels in a stream after a fire in Arizona showed that nearly all died as a result of the fire and did not return to former levels.

Mechanical

The detrimental effects on fish and aquatic organisms would be depend on the mechanical method used, the type and amount of soil and vegetation removed, the proximity to water and the potential for possible spills into the water. Heavy equipment in riparian areas could degrade aquatic habitats and contribute to bank collapse and leakage of fuel. The use of mechanical harvesters, weed rollers, rotovators (underwater rototillers), or upland treatments such as blading, tilling and grubbing can all disturb the soil and degrade aquatic habitat. Chaining, roller chopping and mowing leave plant debris on the surface and would control erosion. Using vegetated buffers between treated area and water could reduce negative effects of mechanical treatments. Manual treatments such as hand pulling or cutting are more selective and involve smaller areas. Most manual treatments can remove unwanted vegetation without disturbing desirable plan

4.1.4 Living Resources- Endangered and Threatened Species

4.1.4.1 Alternative 1- No Action

Non-native or invasive species are thought to have caused the decline of 42% of species listed under the federal Endangered Species Act (ESA) (Center for Wildlife Law 1999). Established, non-native species have the ability to displace native plant and animal species, disrupt nutrient and fire cycles, and alter the character of the community by fostering additional invasions (Osborn et al. 2002).

4.1.4.2 Alternatives 2 & 3

Effects to Threatened and Endangered Species (TES) will be determined through consultation with United States Fish and Wildlife (USFWS) through this Programmatic EA consultation process. Conditions determined in agreement with USFWS will be employed. Previously-completed environmental assessments on reservations in Western Region within the potential habitat of the Southwestern willow flycatcher, Carson Wandering Skipper and other threatened and endangered species have concluded with a Not Likely to Affect determination due to the timing of the project and surveys did not show any threatened individuals in that particular region. Consultation and coordination will be carried out and recommendations implemented on a programmatic or individual reservation basis, as determined through the coordination process. The primary goal of the Noxious Weed Management Plan is the reduction of invasive species and the enhancement and improvement of native range conditions and riparian habitat to ultimately benefit T/E species.

4.2 *Migratory Bird Treaty Act*

4.2.1 Alternative 1-No Action

Although this alternative would not disturb or remove existing vegetation, the natural habitat for the birds has already been reduced by the invasive weeds and the goal of the other proposed alternatives is to reduce the weeds and increase the native habitat. This alternative would maintain the status quo and not improve or increase habitat for migratory birds.

4.2.2 Alternative 2-Integrative Weed Management-All Methods

Large scale vegetation treatments can alter migratory bird habitat and structure and reduce bird populations. Several studies were carried out in sagebrush and other brush removal areas. One study found that using 2, 4-D herbicide reduced Brewer's Sparrow populations but not Vesper Sparrow. Vesper sparrows build ground nests and Brewer's Sparrow nest in sagebrush. Some nests were found in surviving sagebrush plants after spraying.

Bird populations remained low in other shrub removal studies for up to 5 years. Herbicides indirectly affect bird populations by changing food availability. If the bird species relies on the grass, forb or shrub reduced during removal, bird populations will be reduced. (Finch, 1995)

Data obtained from Forest Service studies (summarized in Table 8.9.7) indicates that certain herbicides can be toxic to birds and should be used carefully and sparingly. Garlon (triclopyr), dicamba and 2, 4-D are toxic to birds at standard and high rates.

Vegetation removal by mechanical, cultural or biological methods would have a similar effect on migratory birds by disturbing and/or removing nesting habitat and reducing the food source. However, once the treatment area is re-vegetated, this effect will be minimal.

Conservation measures for bald eagle nesting habitat, willow flycatcher habitat and other sensitive species will be followed in project areas where this is a concern. Section 8.14.2.3 specifies these measures.

4.2.3 Alternative 3-Integrative Methods without chemical and biological control

This alternative relies heavily on mechanical and cultural means of weed removal and depending on the methods employed, would likely have fewer negative effects on migratory bird habitat. The exception would be the use of large ground disturbing equipment that removes large brush and trees and understory vegetation. The use of small hand tools to remove weed species would have a minimal effect. Managed grazing could also temporarily damage migratory bird habitat. All methods should be timed when sensitive species would not be affected.

4.3 *Water Resources*

4.3.1 Water Quality and Quantity

4.3.1.1 Alternative 1-No Action

Aquatic nuisance species can directly affect water resources by crowding out desirable species, and reducing oxygen levels in water. Invasive plants can affect streambank stability, turbidity, shade and temperature and other chemical and physical properties of water. However, only a few tribes in Western Region are directly targeting submerged aquatic nuisance species and none are using BIA funding directly for removal of the submerged aquatic species. Several tribes have voiced concern over giant salvinia, hybrid cattail and Eurasian watermilfoil and all except cattail are listed as high priority on the BIA Western Region Noxious Weed list. Many tribes are directly targeting giant reed, perennial pepperweed, purple loosestrife and tamarisk, commonly associated with wetlands and riparian areas.

Indirect social behavioral effects can result in water quality impacts. Fear of non-native pests can prompt non-judicial use of pesticide and herbicides by individuals without a managed approach, resulting in over-application and potentially increasing the amount of the chemicals entering water bodies through runoff.

Invasive weeds can change water tables, influence runoff, increase fire frequency and alter other water body their previous states. Terrestrial invasive plants can aggravate conditions that modify water quality and quantity. Water quality factors altered by invasive plants include stream bank stability, sediment and turbidity, shade or stream temperature.

Examples of watershed impacts by specific weeds include:

- **Buffelgrass and Cheatgrass** can have negative and positive impacts on water resources. Fire frequency and size may increase. Fire-related impacts on water bodies from burned watersheds are amplified. However, invasive grasses can reduce runoff in western watersheds by establishing a ground cover early in the season and using early season moisture.

- **Perennial pepperweed** invades wetland edges, riparian areas, salt marshes and other habitats in the West. It interferes with the regeneration of cottonwoods and willows (two desirable native species which stabilize western stream corridors).

4.3.1.2 Alternative 2-Integrated Weed Management

Chemical

Herbicides can create runoff, overspray and drift to directly impact water quality and should be monitored closely. Herbicides applied in aquatic systems risk contamination to drinking water, depending on the herbicide used. Triclopyr and 2, 4,-D cause greater risks than diquat, fluridone or glyphosate. Herbicides applied in terrestrial systems can increase toxins in water systems through spills, drift and accidents. The effects of the accidental infusion of herbicides into surface water would depend on herbicide properties and application method and rate. It would also depend on ground cover, the presence of buffers and soil type. There could be indirect effects of herbicide applications with increased nutrient loads to surface and ground water leading to algal blooms and eutrophication of the water body. There could be indirect effects to water quantity caused by reduced uptake by plants contributing to increased flow.

Biological

There would be minimal effects to water quality due to the use of insect pathogens for biological treatment. The plants are killed slowly and usually remain in place with little likelihood of runoff or sedimentation.

4.3.1.3 Alternatives 2 and 3-Methods used in both alternatives

All noxious weed management techniques can affect surface and ground water quality and quantity. Removal of invasive vegetation can increase runoff, erosion and sedimentation. Removal of vegetation over large areas can increase groundwater flow, peak and magnitude, temporarily increasing groundwater availability. When shade trees are removed, water temperature increases.

Removal of vegetation affects water quantity by altering the extent and frequency of low and peak flows. Groundwater availability could increase. The changes would be temporary and reversible once the native vegetation grows back. Surface runoff could increase in the short-term, land void of vegetation does not permit the water to be intercepted and transpired by plants. The increased runoff would increase velocity and alter channel morphology. When the native plant communities are restored, optimal hydrologic function would return.

Increased flows due to scouring and erosion of stream banks would increase turbidity and lower dissolved oxygen levels. Lack of vegetation to intercept nitrogen and other soluble nutrients would allow pollutants to enter into streams and rivers. Studies have shown higher levels of nitrite nitrogen in streams following vegetation disturbance resulting in reduced oxygen levels in the water systems.

The effects could be short-lived when vegetation has been re-established. The duration of effects would vary, depending on how much vegetation is removed and the type of restoration practices.

Cultural

When grazing animals are used as a treatment method, the intensity of the grazing can increase surface runoff due to trampling and soil compaction. Heavily grazed systems can increase runoff up to nine times that of a lightly grazed system. However, grazing treatments are usually short-term and treated areas have been known to recover quickly from high impact, short-term grazing.

Grazing treatments can affect water quality due to nutrient loading and fecal coliforms. Excess nutrients can cause algal blooms and reduced oxygen levels. Severity of the effects would depend on the number of animals used, the intensity and duration of the treatment and the distance to surface water.

Mechanical

Ground disturbance from wheels or tracks, as a result of mechanized vegetation removal techniques, such as grubbing, plowing, scraping, chaining or rutting, would increase the probability of erosion and surface runoff. Plant debris left in place can reduce these effects. There also would be the risk of fuel spills associated with the machinery. Manual treatments without mechanized tools usually do not occur over large areas, cause minimal disturbance of the soil and reach target plants better. Negative effects on water quality and quantity from manual treatments would be negligible.

Fire

Low intensity burns would degrade water quality less than large uncontrolled fires. Fires that are closer to water bodies are more likely to affect water quality. Fire retardants containing nitrogen and phosphorus would cause nutrient enrichment of the water. Surface runoff is increased after burns. Runoff would depend on the timing and intensity of the fire, the slope of site and the amount of precipitation. Wright, et al (1976) studied sediment loss on sloping sites and determined a 10 to 100 fold increase on moderate to steep slopes.

Burning before a precipitation event would increase runoff and sedimentation. Limiting use of burned sites by grazing animals, equipment or off road vehicles until site is re-vegetated would reduce sedimentation. Fire can increase the mobilization of nutrient loadings from fire ash.

4.3.1.4 Alternative 3-Integrated Weed Management without chemical or biological treatments

This method would limit management techniques available and the effects of the treatments to those induced by grazing, fire and mechanical methods. Fire is not a viable alternative in every ecoregion and can be damaging to water resources. Many weed species can readily regrow after fire. Without the use of chemical or biological treatments, mechanical or grazing methods may need to be used more often and may not be a viable alternative for every weed species.

4.3.2 Effects on Impaired Watersheds

Watersheds can be impaired due to high metals, temperature, turbidity, nutrients (such as phosphorus) and mercury, salinity, toxic organics, pH and other pollutants. The most severely impaired watersheds are in the Lower Green River Basin, encompassing the Uintah and Ouray Reservation, and the Salt River watershed in Central Arizona. There are many factors influencing the water quality in these impaired watersheds, with agriculture, aquaculture and oil development and mining cited as contributing factors.

Vegetative treatments can increase temperature, salinity, toxic organics and turbidity. Erosion in existing watersheds should be assessed and stabilization of these areas should be made prior to the treatments. Appendix O, Table 8.15.4 lists Noxious Weed Treatment Guidelines to reduce herbicide impacts on impaired waters.

4.3.2.1 Alternative 1-No Action

Invasive plants left in places can change water quality through stream bank alterations, sediment loading and turbidity, shade and temperature, dissolved oxygen levels, and pH. Tamarisk and giant reed are common invasive plants that alter stream banks and replace native habitats.

Hazardous fuels left in place increases the chance of high intensity wildfires that destroy vegetation and remove litter protecting the soil. High-intensity fires can cause hydrophobic soil layers that increase runoff.

Major erosion and mass movement of rock and soil can occur. Fire retardants used in wildfire suppression can cause nutrient enrichment of waters and have the potential to form toxic hydrogen cyanide or ammonia. Water used in fire suppression activities reduces water quantity.

4.3.2.2 Alternative 2-Integrated Weed Management

Chemical Effects

Chemical applications could affect ground and surface water in impaired watersheds depending on type of herbicide applied and where it is applied within the watershed. High solubility and persistence in the environment can contribute to negative effects. Common herbicides used in riparian areas are 2, 4-D, glyphosate, imazapyr and triclopyr. Appendix I shows the characteristic of some common herbicides used on Indian lands in Western Region.

Biological

There would be minimal effects to impaired waters from the use of insect pathogens as biological treatment. The plants are killed slowly and usually remain in place with little likelihood of runoff or sedimentation.

Biological insect pathogens have been used in many of the tamarisk watersheds in Utah and Nevada and on purple loosestrife infested waterways. A widespread belief about biological control is that the pathogens kill the plants more slowly and allow time for recovery of the native vegetation. This premise has been disputed with the rapid spread of the Diorhabda beetle on tamarisk in some rivers and washes in Southern Utah and Nevada. The beetles spread rapidly and large expanses of dying vegetation were seen within one season. More research needs to be done to determine the effects of the beetle and how soon native vegetation can recover in the dense thickets of dying tamarisk trees. In most of the tamarisk projects within Western Region, an integrative approach is used to remove the partially dead trees and re-vegetate with native plants.

4.3.2.3 Alternative 2 and 3–Integrated Weed Management without biological or chemical control

Mechanical, Cultural and Fire

Vegetation removal can increase surface runoff and erosion, especially in steep watersheds. Erosion increases sediment loading and turbidity and lower dissolved oxygen levels. Removing vegetation reduces nutrient uptake by plants and more nitrate and phosphorus enters the waterways. Removal of vegetation also increases water temperature due to lack of shade. The adverse effects would be temporary because most vegetation removal projects involve revegetation or other measures to discourage erosion and invasive plants and encourage native species.

Loss of vegetation in large river basins such as the Colorado River Basin can increase already high salt levels. The exception to this would be tamarisk removal which may decrease salt content, especially if replaced with native vegetation. Natural sources of salt, such as saline seeps and springs, are responsible for about half of the salt levels in the watershed, but human activities, such as soil disturbance, irrigation and evaporation from artificial reservoirs have further increased salt levels.

Treatments using livestock have not been widely used in Western Region, although some tribes have expressed an interest in it to reduce chemical use. Runoff is increased in heavily grazed watersheds. Livestock grazing in streambeds can increase nutrient loading and bacteria levels. Grazing in these cases should be short duration to lessen negative impacts.

The removal of hazardous fuels would reduce the risk of future wildfires. However, the closer a burn is to a waterway, the greater the potential effects on water quality. There have been mixed effects with using fire to increase water yields for groundwater recharge.

When doing fire treatments, slope needs to be taken into account to determine detrimental effects. Wright, et al, 1976 determined that adverse effects last longer on steep slopes and sediment loads from steep slopes were 10 to 100 times the amount from level sites.

4.3.2.4 Alternative 3 Integrated Weed Management without chemical or biological treatments -

4.3.3 Effects on Wetlands

The National Wetland Inventory digital layer indicates that there are around 230,000 acres and 680 linear miles of wetlands on reservations within Western Region. This does not include areas where the digital polygon and linear data were not available, as described in Chapter 3. The wetlands include lakes, forested and shrub scrub riverine systems and freshwater emergent wetlands. Since data is missing in the Southern Arizona and Southern

Utah layers, actual wetland acreages on reservations could be closer to 300,000 to 345,000 acres. About half of the projects funded by BIA in 2012 are tamarisk removal projects taking place in riparian areas or forested wetlands. The remaining projects target terrestrial species in uplands. At this time, no BIA-funded projects are targeting submerged aquatic vegetation, although some tribes carry out cattail removal and giant reed is a problem on some reservations.

4.3.3.1 Alternative 1-No Action

Riparian areas and forested wetlands have become degraded by the rampant growth of tamarisk. The no action alternative would allow the habitat to continue to degrade. The no action alternative also means that no chemicals will be applied and there will be less of a chance to cause impairments to wetlands and waters. Even without tamarisk removal projects, the tamarisk beetle will continue to spread and weaken and destroy tamarisk in riparian areas. No removal of dead and dying trees and revegetation programs would occur and return to the native habitat may not occur or occur at a slower rate. Recent research has indicated that tamarisk habitats weakened by the Diorhabda beetle are slowly returning to native habitat but more research needs to be done to support this. If left in place, thick tamarisk habitats have greater potential for catching fire and grazing is difficult in impenetrable thickets. Cattle can get trapped and separated from the rest of the herd.

4.3.3.2 Alternative 2-Integrated Weed Management

The most common removal method for tamarisk trees in riverine systems on BIA-funded projects is the cut-stump method. The trees are cut with chain saws and stumps are painted with an herbicide. Backpack or hand sprayers may be used to spot spray young trees. Backhoes, tree clippers and mulchers are other equipment used by tribes in tamarisk removal. Aerial spraying has been used by other regions and governmental entities, but that is generally not a technique employed by tribes in Western Region.

An increase in soil erosion and runoff could result from the tree removal techniques. The largest impact would come from the heavy equipment, but even the increased field traffic of the work crews in the riparian areas could disturb and compact soils and increase runoff in the wetlands. The cut stump method uses a targeted application method and would result in reduced herbicide exposure to other plants, animals and human. Broadcast or aerial spraying would have a much greater risk of reaching non-target species.

The removal of vegetation will reduce the amount of rainfall captured by the plant and plant debris and increase stormwater flows. Higher velocities alter wetland morphology and hydrology. Most projects have included a revegetation plan in their proposal. The goal is to ultimately restore the riparian area to its native state, so negative effects would be temporary.

Detrimental effects to wetlands from projects occurring outside of wetlands would only arise if the herbicides or mechanical methods were being incorrectly applied or Noxious Weed Treatment Guidelines were not used.

Biological control

USDA APHIS has prohibited the distributed of the tamarisk beetle and halted their program in 2010 due to concerns over unauthorized transport and endangerment to the Southwest willow flycatcher. However, the beetle has been travelling on its own at an increasing rate. Most tribes in Utah and Nevada have the beetle in the tamarisk. It is not yet widespread in Arizona but has been noted in some riparian zones in northern Arizona.

Several studies have shown that the willow flycatcher goes back to nest in the willows, if the riparian zone is restored. Biological control in upland species is not known to affect wetlands.

4.3.3.3 Alternatives 2 and 3-Methods used in both alternatives

Fire

Fire has not been widely used as a weed control technique in riparian areas or wetlands in BIA Western Region, but more tribes are considering it with the desire to move away from chemical use. Effects would depend on timing of the burn and the burn could be timed to reduce effects. Prescribed burns would have fewer negative effects than wildfires. Wetland areas usually have high vegetation density and fuel loads may be high. Large trees, including cottonwoods, may be killed in high intensity fires. Vegetation composition and hydrology could be altered by the fire. Invasive vegetation such as red brome, giant reed, and tamarisk may re-establish after a fire unless area is re-vegetated with native plants. The invasive plants increase fire risk.

Mechanical

Mowing, disking and chopping are mechanical treatments that may be used in wetlands. Primarily the treatments would be on tamarisk and giant reed in wetlands and riparian areas. Aquatic weed harvesters have not been used widely. The harvesters can end up spreading the weeds further and cause damage to fish and aquatic organisms. Blading, tilling and grubbing and especially heavy equipment can disturb the soil and cause and compaction and erosion, resulting in degraded wetland habitat, especially in highly sloping areas. The use of tracks or low-pressure tires to distribute the weight of the vehicle over a larger area may reduce compaction. Using the equipment only during dry months can reduce damage to wetlands. The management plan calls for Noxious Weed Treatment Guidelines and confines the use of the soil-disturbing mechanical treatments to level areas and include re-seeding to reduce erosion. The mulching of plant material can reduce erosion and placing vegetated buffers adjacent to treatment areas and water will reduce sedimentation. Spills from fueling and maintenance can occur. Staging areas with protective matting and training employees in incident management response would reduce these effects.

4.4 *Cultural Resources*

4.4.1 Alternative 1-No Action

Untreated noxious weeds can reduce the quantity of culturally-significant plants available for spiritual ceremonies. They can reduce the quality of sacred ceremonial or traditional sites. Dense thickets of weeds or brush can limit access to the sites for ceremonies or collection of plants for spiritual purposes.

The No-Action alternative has the potential to increase invasive plants, such as cheatgrass and buffelgrass, which are known to be fuel for wildfires. The potential for wildland fire is increased under this alternative and wildfires can be destructive to culturally-significant plants and ancient artifacts.

4.4.2 Alternative 2-Integrated Weed Management

Table 8.15.5 in Appendix O outlines procedures to protect cultural resources using all integrative methods. Vegetation treatments under Alternative 2 can affect native and cultural plants in both positive and negative ways. The ultimate goal of most vegetative treatments is to return the site to the native state to encourage the growth of culturally-significant plants such as cottonwoods and willows or other native plants. Some cultural sites and/or plants can be disturbed during the treatment phase either by chemical or mechanical means. Some weeds have cultural significance to tribes but may be targeted by other governmental entities as noxious.

Chemical

Herbicides have the potential for degrading fossil material depending on the fossil type, minerals, surface exposure or degree of fossilization. Using wheeled equipment for spraying or driving across open country has the potential to crush fossils on the ground. The wheeled vehicles can also damage protective soil crusts and accelerate erosion and indirectly affect fossils.

It is more likely that chemical treatments would affect archeological field personnel than the fossils themselves. This is discussed further under effects to Public Health and Safety.

Some herbicides increase the acidity of the soil and cause deterioration of the artifacts. Coatings of herbicide and dyes can destroy the surface of artifact. Diesel fuel or kerosene in organic substances as inactive ingredients can contaminate soil and leach into the subsoil. The organic substances can interfere with radiocarbon dating techniques.

Herbicides can negatively affect traditional cultural practices of gathering traditional food or medicinal plants. Herbicides may leave a residue on non-target plants adjacent to treatment area or affected by drift, causing a health risk to those consuming the plants. Research has indicated that nearly half of the plant materials used by Native American basket weavers contained forestry herbicide residue within treatment areas. Only 3% contained residue outside of the treated areas. The residue remained for several months. (Segawa et al., 1997) Often plant parts are placed in the mouth for processing (cutting, splitting, softening) increasing the health risk for the Native American culturists.

A 2001 Department of Defense report prepared by ENSR International (as quoted in BLM 2005) stated that root plants such as lomatium or bitterroot on rangeland treated with two specific herbicides did not contain herbicide residue in roots within 2, 6 and 45 days after treatment, depending on the readiness of the herbicide to break down. BLM stated that plant or root gatherings are carried out on shallow soils with low forage and do not take place where treatments are commonly done. (BLM EIS 2005) This assertion seems anecdotal and may not apply to Indian lands. Treatment areas need to be fully evaluated for plant gathering use and potential before proceeding with the chemical treatments.

Biological and Cultural treatments

The use of grazing animals as cultural treatments can damage surface artifacts and disrupt surface and shallow subsurface cultural materials. Grazing animals should be excluded from sites containing plants and artifacts needing protection.

Due to the small size of insect pathogens, it is unlikely that authorized biological insects would damage cultural resources. Insects do have the unlikely potential to damage baskets and cordage and other native plants. Insect pathogens for thistles, identified under less precise procedures in the past, have been found to host on native thistles. Under more rigorous testing standards today, host transfer is less likely to happen.

4.4.3 Alternatives 2 and 3-Methods Used in Both Alternatives

Alternative 2 includes the above effects plus the use of the techniques below. Alternative 3 would only include the practices listed below.

Fire

Fire effects to cultural resources depend on temperature and duration of exposure to heat. Higher temperatures and longer duration of exposure to heat increase the potential damage to cultural resources. Temperature and duration are affected by:

- Fuel type
- Fuel load and distribution
- Moisture content of fuel
- Soil type and moisture
- Weather and terrain
  (Winthrop, n.d.):

Generally, fire does not affect buried cultural materials. Studies show that around ten centimeters of soil are sufficient to protect cultural materials (Oster, as quoted in Winthrop, n.d.). Heat can be carried below the surface under certain conditions and have the potential to damage cultural artifacts. Stumps, heavy duff, surface logs and roots that smolder and burn may expose subsurface materials to heat and have the potential to affect cultural materials. Fires that burn hot and fast through a site may not damage certain cultural materials as much as fires that smolder in duff, logs or roots. Fire management activities have the potential for affecting cultural resources. Fireline construction by hand or bulldozer can damage cultural plants, artifacts and historic sites.

Protection of cultural resources begins with fire management planning. Vulnerable cultural resources are identified and protection measures are devised. Prescribed fire can be controlled. Weed managers need to work with fire specialists to determine temperature and duration of a fire through an area, Burn plans may need to be modified to minimize effects to cultural resources. It contains both uncontrolled fire effects and the effects of fire suppression. Resource managers need to weigh potential effects of a prescribed burn with the risk of damage from an uncontrolled wildfire. Fire suppression activities during wildfires that can affect cultural resources include fireline construction, base camps and helicopter landings. The spraying of fire retardant can damage some historical materials and artifacts. See charts in Appendix J. (Bare Bones Guide to Fire Effects on Cultural Resources, Bureau of Land Management; Kate Winthrop, WO-24)

Consultation with SHPO, tribes, and other appropriate entities is an important part of the project planning process. Fire-specific protocols for identification and protection of potentially affected cultural resources can be identified during this process.

Mechanical

Chaining, plowing, drill seeding, moving, chipping, cutting, blading and grubbing could damage cultural resources and should be avoided in susceptible areas. Treatments that involve surface and subsurface disturbance could contaminate artifacts with organic matter and mix deposits, resulting in inaccurate dating of materials.

Cultural resources and traditionally-used plants should be identified and delineated before mechanical treatments are used. Practices to protect cultural resources during vegetation treatments are outlined in the management plan in Appendix 0, Table 8.15.5

4.5 *Socio-economic Conditions*

4.5.1 Alternative 1-No Action

4.5.1.1 Economic costs

Economic losses from noxious weeds include direct costs through production loss in agriculture, forestry, recreation and tourism. These effects will be discussed under Resource Use Patterns. In addition to these costs, noxious weed infestations can reduce the value of land for a variety of purposes. On production-oriented land, noxious weeds are usually considered in land appraisals. The presence of noxious weeds reduces carrying capacity for grazing and wildlife and lowers the value of the land for multi-purposes.

Invasive species impact the economy and cost billions of dollars every year. Economic impacts on Indian lands can expect to strain the already fragile economy on some reservations. On other reservations where oil and gas exploration is booming, additional roads and disturbance increase the spread of noxious weeds. The economy boost provided by oil and gas drilling will not last forever and steps to reduce the spread of noxious weeds and employ integrative management techniques is needed.

Some of the most damaging and widespread noxious weeds within Western Region include Russian knapweed, purple loosestrife and tamarisk. The latter two species are hardy invaders of wetlands and riparian areas on Indian lands in the west. These and other invasive plants impact agriculture, industry, human health and the protection of natural areas. Economic experts estimate that for every year we delay addressing the issue, the costs of controlling noxious weeds may increase two- to three-fold. The expansion of purple loosestrife acreage requires an annual cost of control of $45 million for habitat restoration and control methods. In addition to the ecological damage it causes, purple loosestrife also affects farmlands by clogging irrigation and drainage ditches and causing the degradation and loss of forage in lowland pastures.

The wildland-urban interface is a unique issue where uncontrolled weed invasions such as cheatgrass cause increased fire hazards and potential economic loss and danger to humans.

4.5.1.2 Economic opportunities

Some invasive weeds such as water hyacinth can be harvestable in certain quantities. Some species can be turned into fuel by methane digesters. These methods have not been employed widely since commercial enterprises have not been assured of reasonable profit with these techniques.

4.5.2 Alternative 2 Integrated Weed Management

Funding for the control of noxious weeds may allow tribes to hire additional or seasonal staff to carry out weed control projects. Ninety-eight percent of BIA noxious weed annual funding in Western Region goes to tribal departments, who carry out their own work. A small percentage of tribes hire outside contractors to do the work. BIA funding and other government grants for weed control facilitate the purchase of weed control equipment for land or lease holders to use at no charge. Several tribes sponsor volunteer weed pulls or clean-up days for residential lots, thus increasing the appeal of housing areas and giving a positive visual/social appearance.

BIA is under regulatory guidance to provide for the sustainable management of trust agricultural land and rangelands for the economic benefit of the tribe. The BIA is directed to operate and manage Indian ranges on the principle of sustained-yield management in accordance with 25 United States Code (USC) 466, U.S.C. 3701 et seq. (3701-3711) , 25 Code of Federal Regulations (CFR) 25 CFR 166.301-313. In light of the regulatory guidance, the goal of the BIA Noxious Weed Management Program is keep Indian agricultural lands sustainable and economic viable and restore degraded lands. This goal needs to be accomplished while minimizing adverse effects for the affected communities. Reducing the spread of noxious weeds will improve the productivity of grazing and agricultural lands for wildlife and domestic livestock. This economically benefits ranchers, farmers and hunting guides who make their living off the land.

4.5.3 *Alternative 3-Integrated Weed Management without chemical or biological treatments-*

The socio-economic effects would be similar to Alternative 2 as described above. Weed control projects will allow seasonal staff to be hired and equipment purchased. This alternative will also help restore degraded lands and improve rangeland and agriculture productivity. However, this alternative relies on the more labor intensive mechanical methods and fire and does not use low cost biological control methods. This alternative would not use chemical control methods which have moderately high costs but often said to be a cost-effective method.

4.6 *Resource Use Patterns*

4.6.1 Hunting, Fishing, Gathering

4.6.1.1 Alternative 1-No Action

Factors of the No Action Alternative affecting land and water resources, recreation, wildlife and vegetation, will also affect hunting, fishing and gathering. The influence of noxious weeds on game species has been detrimental. Research has indicated that elk will not browse in knapweed infested sites and spotted knapweed has not been found in elk diets (Beck, 1994) and thus not a food source. Additional studies indicated that elk would graze on knapweed but not preferentially. In other studies, spotted knapweed and leafy spurge were common on mule deer range, but the plant was not detected in their diets (Guenther, as cited by Beck, 1994). These findings indicate that noxious weeds have a detrimental effect on hunting by replacing forage for big game animals.

Purple loosestrife encroaches upon and displaces desirable food plants and waterfowl nesting sites (Beck, 1994). Cattails (*Typha latifolia*) were displaced by purple loosestrife competition and by selective feeding by muskrats. When the sites are dominated by purple loosestrife, the muskrats move out. Purple loosestrife infestations also make waterfowl broods more susceptible to predation because of the increased cover provided by tall purple loosestrife and the lack of a direct route from water to nesting sites. Waterfowl species, such as the canvasback duck and black tern prefer to nest on open sites such as abandoned muskrat nests built from cattails. With purple loosestrife encroachment and displacement of cattails and other native riparian vegetation, suitable nesting sites are decreased.

Aquatic invasive species can lead to eutrophic, oxygen-depleted waterways. They disrupt fish habitat and make boating difficult. Terrestrial weeds can increase erosion and decrease water quality, vegetation and many other factors that affect the traditional practices of hunting, fishing and gathering.

4.6.1.2 Alternative 2-Integrated Weed Management

Treatment of noxious weeds could affect traditional hunting, fishing and gathering of the indigenous people in the region. Some of the effects would be the same as described under vegetation and wildlife sections. The use of chemicals in the treatment of invasive vegetation needs to be done judiciously and other methods incorporated into treatment to reduce negative chemical effects on all living organisms, especially those culturally significant to native people.

Table 3.14 lists the various traditional materials used by several cultural groups in Western Region. Knowledge of the uses of specific plants and materials will help them to be protected. Since most of the weed grants go directly to tribal departments and are carried out by tribal employees, it is expected (but not guaranteed) that preservation for these native plants and materials will be of utmost importance.

Biological and Cultural treatments

Intensive management of grazing animals for weed control can have short term detrimental effects on soil, vegetation, water resources and wildlife, as described in those sections. If these resources are negatively impacted by grazing animals, then traditional hunting, fishing and gathering would be impacted. However, the goal of the treatments is to ultimately return or maintain the land in a healthy, natural state. This is a value to most tribes when carrying out the weed treatment projects.

The use of insect pathogens is not expected to have a detrimental effect on cultural species or affect traditional practices of hunting, fishing and gathering. Many tribes have embraced this method in order to reduce chemical use or more expensive labor- intensive mechanical practices. However, some tribes remain cautious about using any non-native species on their lands. The insect pathogens have been thoroughly researched to make sure they are host specific but some errors were made in older studies, specifically with the thistles. These effects are described under the vegetation effects section. (4.1.1.2)

4.6.1.3 Alternative 3-Integrated Weed Management without chemical or biological treatments

The use of fire as a vegetation management strategy of American Indians was used prior to the arrival of European settlers. In agrarian communities, burning was done after seed harvest. It was also used to drive game animals for hunting. Fires have been set by native cultures in pine forests to promote wild seed growth or clear forest of debris. Burning was also done to promote tobacco growth. Some California tribes burned palms to control insects.

In southwest cultures, cultural and mechanical methods including irrigation, terraces, field borders and check dams were used. (Plog, 1979) Fire, mechanical and cultural techniques can be used to benefit traditional hunting, fishing, gathering and farming methods.

Present day mechanical removal practices include mowing, grubbing and heavy equipment removal of invasive species. Woody species and cacti are most susceptible since they take longer to recover. Cultural species such as pinyon pine, juniper, mesquite, cacti and many of the native fruit bearing shrubs are examples.

Specific protection goals of the treatment methods should be at the forefront when carrying out the practices because fire and mechanical means can also harm traditional materials if their preservation is not outlined in the treatment plan.

4.6.2 Timber Harvesting

4.6.2.1 Alternative 1-No Action

Implementing the No Action alternative would leave noxious weeds in place and change forest ecology and negatively affect the timber industry. Although most severe effects are due to insect or plant pathogens, noxious weeds can compete with tree seedlings and prevent healthy forest growth.

4.6.2.2 Alternative 2-Integrated Weed Management

Most weed management practices will not take place in timber areas. If invasive species are treated in forest areas, it is usually in conjunction with a forest management plan. All western region reservations with woodlands or timber have a forest management plan. About one third of the land in Western Region is forested but less than half that land is accessible and productive. Only three large reservations have significant timber production and harvest. However, most treatments would be expected to benefit native ecosystems in or near timber areas and keep invasive species from altering the system and reducing timber production.

Chemical

Most chemical weed treatments would not take place in timber areas, although some treatments may take place adjacent to them. Herbicides are an efficient way of managing unwanted vegetation. Effects would vary depending on a variety of environmental factors such as soil, slope and weather and wind conditions. The size of a buffer zone between the treatment area and the timber area is also important. Certain herbicides target specific plants such as broadleaf species; a variety of herbicides should be included in the treatment plan to avoid the dominance of weedy annual grasses by the use of picloram or clopyralid.

4.6.2.3 Alternative 2 & 3-Integrated Weed Management Techniques without the use of chemical or biological control

Fire

Prescribed burning may be used by some tribes to control noxious weeds in forested areas. Fire in coniferous forests would benefit from low intensity prescribed fires. This would reduce understory shrubs and make timber harvest easier. If areas have high fuel accumulations, fuel reductions may be necessary to reduce high intensity fires. Incremental burning may be the best approach in these areas. Fire control favors the growth of evergreen trees over aspen stands. Low severity fires would benefit declining aspen stands although most forests are managed for the evergreen species for commercial harvest.

Mechanical

Mechanical treatments in forests would occur to remove invasive understory such as Himalayan blackberry. Removal of woody invasive species in Evergreen forest would benefit timber production. Manual and mechanical are more labor intensive than chemical methods.

4.6.3 Agriculture and Range

4.6.3.1 Alternative 1-No Action

4.6.3.1.1 Agriculture

Noxious weeds cause an overall reduction in yield. Forage loss from noxious weeds on pastures amounts has been documented to reach one billion dollars in the United States. Freshwater emergent noxious weeds can impact agriculture when costly control measures are required to keep irrigation ways clear and open.

Weeds may serve some useful purposes in agriculture. Deep-rooted weeds can bring nutrients from the subsoil to the topsoil. Weeds can provide habitat for beneficial insects and provide an alternative food source for pest species. Invasive plant species can serve as a source of biomass in the for biogas uses. (Pimentel, et al., 2005)

4.6.3.1.2 Range

The No Action alternative would allow noxious weeds to be spread by grazing animals through foraging, trampling and seeds attaching to the animal's coats as they travel across the rangeland. Many noxious weeds and other invasive plants reduce the carrying capacity of the land for livestock. The value of invasive plants as forage is limited. Areas infested with noxious weeds often require supplemental feeding for cattle and other domestic animals. Introduced weeds in rangeland and pastures compete with native forage plants and can be toxic (e.g., leafy spurge, *Euphorbia esula*) to young cattle or unpalatable because of thorns and spines (e.g., yellow starthistle).

Past grazing practices, altered fire regimes, and introduced species have resulted in rangelands dominated by invasive annual grasses. The removal of livestock will not completely correct the situation. Grazing management can be used, with weed control techniques and revegetation to restore the range.

Agricultural economists have determined the direct impacts caused by leafy spurge on grazing lands and wildlands on western states' economies. Direct annual losses from leafy spurge in one state included reduced personal income for cattle producers by around $9 million and an additional $15 million reduction in lost cash outlays due to reduced livestock production. Leafy spurge infestations reduced cattle carrying capacity by approximately 580,000 animal unit months (AUMs) or forage for 63,100 cows for 7.5 months. Indirect grazing land losses caused by leafy spurge infestations totaled $53.2 million by businesses outside of livestock production but caused by reduced income and expenditures from the cattle industry. Annual direct losses due to leafy spurge on one state's wildland totaled $2.9 million because of reduced wildlife-associated recreation.

An additional direct wildland loss was estimated from reduced soil and water conservation caused by leafy spurge infestations. Indirect annual losses to wildland from leafy spurge were caused by reduced expenditures within their economy. Total direct and indirect annual losses to grazing land and wildland caused by leafy spurge were valued at around $90 million. Additionally, infestations cause a reduction in over 1,000 jobs per year in North Dakota. (Leistritz, as cited in Beck, 1994) With the economy of several tribes and tribal members depending on cattle grazing, it is important to protect this resource from spreading noxious weeds.

4.6.3.2 Alternative 2-Integrated Weed Management

4.6.3.2.1 Agriculture

Chemical

Herbicides are often an effective and efficient weed control method to use on cropland. Negative impacts can occur from herbicide runoff into irrigation systems and streams but most effects on agriculture would be positive and improve yields. Some herbicides can interfere with beneficial insects and increase pesticide infestations. There can be negative effects on agriculture workers and people living near or downstream from treatment areas. These effects will be document in Section 4.2.7.3, Public Health and Safety.

Biological

The costs of controlling noxious weeds in agricultural settings using conventional pesticides is likely to increase and widely-used pesticides may be found unacceptable due to environmental or health and food safety considerations. Biological control has been used to provide cost-effective and environmentally benign long-term control of pests.

Many new additional noxious weed species become established each year. Eradication of some of these species is not always feasible, due to either the rapidly expanding distribution or constraints of the tools. Many exotic plants cause significant economic damage to agriculture on Indian reservations. Conventional pesticide treatments are not always practical and alternative methods to chemical treatment of exotic and other noxious pest species must be employed to protect the agricultural economy, native people and the natural environment. Establishment of natural enemies of exotic weed pests can provide a permanent reduction in pest population densities and substantially reduce their economic impact. (California Department of Agriculture, 2001/2001)

4.6.3.2.2 Range

Chemical

Chemical spraying poses risks to livestock but the risks can be minimized by following safe standard practices outlined in Section 5, Integrated Noxious Weed Management Plan, Tables 5.4 and 5.5.

The spraying of herbicides can cause disturbances to rangeland communities when non-target plants are killed. Disturbances can encourage the spread of noxious weeds and keep the land in a degraded state, if treatments are not carried out correctly. Treatments can cause rangeland closures and affect the health of the animals.

Biological and Cultural

The managed use of sheep or goats to control Russian knapweed and leafy spurge has been shown to be an effective treatment on rangeland and will open up sites for grass regrowth.

Insect pathogens would not likely affect livestock. The use of approved biological control agents can keep noxious weed populations down and improve forage quality. In some situations, cattle may have to be excluded from grazing area for a period of time.

4.6.3.3 Alternative 3-Integrated Weed Management without chemical or biological treatments

Prescribed burning and mechanical methods can successfully be used in controlling noxious weeds on cropland and rangeland but need to be timed correctly and used in combination with other methods to be successful. Only a few studies have measured the impact of prescribed burning on long term changes in plant communities, impacts to endangered plant species, effects on wildlife and insect populations, and alterations in soil biology, including nutrition, mycorrhizae, and hydrology.

4.6.3.3.1 Agriculture

Fire is used in croplands as a technique to remove dead plant material left after harvesting to facilitate soil work (e.g., disking, plowing), suppress overwintering pathogenic fungal spores, or reduce the seed banks of crop competitors. Cropland fuels are typically dried crop stubble and weeds and the fire type is usually surface.

Although the effects of burning on cropland itself may be beneficial, the future of cropland burning may be uncertain. Air quality regulations, loss of cropland by development, and the farming of areas further north due to climate change, provide a less favorable environment for this type of weed control. Suggested alternatives include leaving crop or weed residues on the soil but this technique does not work with weeds that have gone to seed or ones that propagate vegetatively, such as Russian knapweed. Plowing would involve more soil and land disturbance and can distribute seeds and propagating vegetative parts. (McCarty, J. 2011)

4.6.3.3.2 Range

Fire

Generally, prescribed burns increase perennial grass production and forage availability. Burning would have a short term effect on livestock. Livestock would need to be removed from the burn area and kept out of the area until it has had a chance to recover. This could be from two to four growing seasons. Burning would not be an effective treatment for the Bromus spp. (cheatgrass, red brome, downy brome) without reseeding, because fires increase the competitive advantage of this invasive grass.

Mechanical

When competitive invasive vegetation is successfully removed, grass production will be enhanced. However, there can be short-term effects on livestock forage by mechanical removal of invasive vegetation. The effects would be greater when the plants are bulldozed or chained than when cut off at the base. Either method is short term since the plants will regrow after treatments.

Mechanical removal methods can uproot desirable vegetation, compact the soils and create bare disturbed ground increasing weed opportunities unless re-seeded.

Manual

Manual treatments would not likely have a negative effect on livestock forage since they target the removal of the undesirable species only or minimally disturb the ground or adjacent vegetation when carried out without mechanical equipment or transportation.

4.6.4 Mining

4.6.4.1 Alternative 1- No Action

Under the No Action alternative, no weed control would take place in and around mining areas. Oil pad construction, new roads and mining disturbance are areas where noxious weeds are easily spread. New invaders can get a start here and would soon become major disturbances in the natural ecosystem. Weeds can, and will spread to locations off of well pads and other construction/development areas to other leases or adjacent tribal, private or government lands.

4.6.4.2 Alternative 2- Integrated Weed Management

All integrative weed control techniques would be used under this alternative, including monitoring for new invaders in mining areas. If noxious weed control is carried out near mining sites or oil and gas development, a coordination plan between all entities involved, including various operators and agencies, should be developed.

Chemical

Chemical control consists of selective and non-selective herbicides. When done properly, chemical control can provide rapid and effective results. Drift, runoff and worker safety are issues of concern when applying herbicides in mining or oil and gas development areas.

Biological

Biological control can be used in mining areas successfully and consists of pest specific insects and pathogens, intensive grazing methods, and maintaining desirable competitive vegetation. This is an effective control with little or no effect on mining activities. It is gaining in popularity due to potential environmental side effects associated with chemical control and disturbances created by conventional tillage methods. This method of control utilizes pest-specific insects and pathogens to adequately control noxious weeds. Many weed species have been introduced from foreign lands where natural enemies were left behind. Recently, many of these natural predators have been introduced into this country in an attempt to reduce unchecked weed infestations.

The use of animals (primarily sheep and goats) to graze noxious weeds that are unpalatable to cattle and wildlife is another biological method. This performs the same function as mowing and should be done before flowering to prevent the formation of seeds. Like mowing, this method will not eliminate tough perennial weeds. A management strategy to include with biological methods is to establish competitive desirable vegetation before noxious weeds have a chance to become established and especially after a stand of noxious weeds has been treated. (Colorado Division of Reclamation, Mining and Safety, undated)

4.6.4.3 Alternative 3 - Integrated Weed Management without chemical or biological treatments

Reclamation

Mining and oil exploration activities can incur damages to the natural environment if areas are not reclaimed. Reclamation may include removal of hazardous substances and contaminated soil, and new soil and vegetation is brought in. This process will help keep noxious weeds at bay, control erosion and keep hazardous chemicals from entering the water supply. There may be an economic cost to reclaiming the sites and removing weeds but the benefits to natural habitat, water supply and nearby populations far exceed this cost. (McKinley, Michael J, Undated)

Mechanical

Mechanical methods of weed control would have minimal impact on mining activities and would benefit reclamation efforts. Mechanical methods to use in mined areas are below:

- Mowing weeds in newly re-vegetated areas during the first season of establishment, prior to seed formation of the weeds in the re-vegetated area.
- Provide proper watering and oversight of plants to ensure seed formation and growth of new native plants.
- Hand pulling and removing weedy plants in newly seeded areas and where sensitive species are found.

Cultural

Cultural methods will prevent new infestations of noxious weeds in and around the project area(s). Recommended cultural control methods on BLM oil pad leases are:

- Use only certified weed-free hay, straw and/or any other materials used for erosion control and other reclamation activities
- Use only certified weed-free gravel and earthen materials for road surfacing and maintenance.
- Cleaning of equipment and vehicles used in the construction drilling or reclamation activities prior to entering or leaving a management area. (Pressure washing or other means in a designated area).
- Reseed all areas immediately following construction, drilling or other restoration activities. (Reclamation to occur within 30 days after the last well drilling.)
- Use only certified weed-free seed for the reclamation/restoration of areas disturbed by related development activities.(BLM, WY, Undated)

These methods take more time and expense to implement but are important to prevent the spread of noxious weeds caused by the mining disturbance and should be standard policy.

It is time-consuming and expensive to use only mechanical and cultural methods but still can be effective in reclaiming mining or well-pad sites. Inventory, monitoring and reclamation are included in this alternative and with mechanical and cultural control methods of existing infestations, including affected areas off .the oil pad or lease, this alternative should have a positive effect on the mined area.

4.6.5 Recreation

4.6.5.1 Alternative 1 - No Action

The No-Action Alternative can impact recreational activities, such as fishing, hunting, hiking, wildlife viewing, and water-based recreation. Uncontrolled aquatic weeds negatively affect water quality and quantity, plant and animal diversity, and species abundance. Eurasian Water milfoil (*Myriophyllum spicatum*) causes lakes to be overgrown with vegetation, making fishing and boating difficult. Little research has been done to estimate the economic losses within regions, states, and watersheds.

4.6.5.2 Alternative 2 - Integrated Weed Management

Chemical

On most reservations, there is not heavy recreational use but some recreational use occurs at the San Carlos, White Mountain Apache and Pyramid Lake reservations. Limited recreation also occurs at Uintah and Ouray, Tohono, O' odham, the Colorado River and Fort Yuma tribes and a few others. The treatments can be timed when the recreational season is not in full swing. Treatments can be carried out in sections, closing off some areas to users and leaving other areas open.

There would be short term effects to the scenic value of recreational sites on Indian lands. Spray drift can cause health hazards to recreationists. There may be noise and distractions to users by spray equipment or vehicles.

Indirect effects on recreational activities such as fishing, hunting and wildlife viewing, may occur when herbicide treatments negatively affect fish and wildlife.

Cultural and Biological

Goats or sheep have been used in riparian areas on Indian lands to graze knapweed or consume tamarisk. No tribes are currently using this method, but it may be part of future strategies. For managed grazing, the animals are fenced for short duration, high intensity grazing. Recreational use would not be compatible with the grazing treatments during these periods. The fences, trampled vegetation and manure may cause sites to be unappealing in the short term.

The use of biological control agents such as insects or other pathogens would have limited effect on recreational use of sites. In some areas where the populations of *Diorhabda elongata* (tamarisk leaf beetle) are prevalent, there may be some impact on recreation. The insect may be annoying, but they do not cause any bites or other damage to human skin. There have been known recreational sites where the brownness of the tamarisk trees destroyed by the insects has been disturbing to users.

4.6.5.3 Alternative 3 - Integrated Weed Management without chemical or biological treatments

Fire

Prescribed burns would necessitate the closure of burn areas to recreational visitors for up to one year. Off-road vehicle use would be restricted to minimize damage to sites as they recover. Smoke may blow into adjacent areas and reduce visibility and cause health hazards to visitors. Scenic views in some areas will be hampered due to the blackened condition of the soil and vegetation. Visitor use would decrease in the short term but increase as the habitat recovers.

Mechanical

Mechanical treatments such as mowers, trenchers and graders in developed recreational areas and along roads would have a minimal effect on recreational activities. Mowing and clearing may improve the visual scenery and make sites more accessible.

Visitors to recreational sites may be excluded from treated sites for several days to up to several years depending on the recreational use, the amount of vegetation removed and recovery of native vegetation.

In less developed areas, the most common mechanical treatment on reservations would be tamarisk removal along rivers or riparian areas. These projects would occasionally take place near recreational or swimming areas. Some tribes may choose to carry out the projects in a season when swimmers or boaters are less likely to be using the site or decide not to do treatments and preserve the site for recreational use. Nearby recreationists may hear chainsaws or heavy equipment during the treatment. Stacks of slash piles and resulting barren vegetation may be unsightly in the short term; but in the long term, a native willow or cottonwood habitat has a higher aesthetic and shade value for recreational use.

4.6.6 Transportation

4.6.6.1 Alternative 1- No Action

Control of hazardous vegetation along public roads is a requirement of the Highway Safety Act of 1966 and other Federal safety standards. The No-Action alternative would allow noxious weeds to grow along transportation networks and continue to spread infestations throughout Indian lands. Some invasive plants have greater fire and erosion potential. Some invasive weeds grow within the roadway or shoulder, reducing visibility or causing damage to roads.

4.6.6.2 Alternative 2 - Integrated Weed Management

Many of the proposed projects include some weed control efforts along highways and roads since roads and trails are often the way invasive weeds are spread. Tribal and BIA Transportation and Natural Resource programs have a vested interest in vegetation management programs to provide safe highway travel to protect human lives and property. Tribes and BIA also have the desire and duty to protect the natural resources along highway corridors.

Implementation of right-of-way vegetation management practices are recommended to:

- protect roadbed and pavement integrity;
- preserve visibility of highway facilities, and wildlife;
- promote road system drainage;
- inhibit ignition and spread of fire;
- maintain designed vehicle recovery areas;

- allow clearance for large vehicles and snowplows;
- promote melting of ice and snow on the road surface by removing trees which shade the road;
- minimize soil erosion and slope instability;
- suppress noxious weeds;
- eliminate damaged vegetation that may fall onto the road surface;
- maintain an attractive roadside appearance; and
- protect landscape planting

(United States Forest Service, June 2003)

Weed control along roads would primarily be beneficial for roads and travelers. The removal of noxious weeds would allow the natural, scenic vegetation to grow. Removing overgrown brush and weeds would increase visibility.

Chemical

With herbicide use, there may be brief disruption of traffic during spraying. If heavy rains occur, roads can be conduits for herbicide runoff and reach unintended targets, wetlands and other vegetation. Most reservations in Western Region are not located in heavily populated areas but several are located in the metropolitan Phoenix area and others are adjacent to busy highway corridors in Nevada and Utah.

Biological and Cultural

The use of grazing animals, such as goats or sheep, would have limited use along on highway rights-of-way because of the danger of animals entering the travel lanes. However, they could be used in low traffic areas, backroads or trails.

Highway corridors may be ideal locations for release of biological pathogens for control of heavy infestations adjacent to the roads or trails. There would be very few negative effects. Their use on woody species, such as tamarisk, would require the manual removal of dead limbs and debris.

4.6.6.3 Alternative 3 - Integrated Weed Management without chemical or biological treatments

Manual

Manual vegetation control involves the use of weed eaters, chain saws, small power mowers, as well as hand tools like hoes, shovels, and pruning shears. Hand pulling of weeds is also a manual control method. Manual control can be effective for shallow-rooted weeds, but this approach is ineffective for deep-rooted species. An advantage of manual control is that it can be performed selectively to remove target weeds, while preserving desirable plants. Disadvantages of manual methods are that they are labor-intensive and expensive.

Cultural

Cultural control refers to the use of organic mulches, such as wood chips, and material coatings, like plastic, to prevent vegetation emergence. Mulching can be effective for controlling herbaceous annual plants, but it is not effective against aggressive woody perennials. Mulching is most effective in landscape areas, but may not be an economical alternative for vegetation control along roadways.

4.7 *Other Values*

4.7.1 Wilderness

4.7.1.1 Alternative 1- No Action

Without weed management strategies on Indian lands adjacent to wilderness areas, weed populations can quickly grow in these pristine areas. The weed seeds can travel by wind, water and air. Backpackers and horse packers passing through infested areas may inadvertently spread invader plants into wilderness areas. Seeds on clothing, packs, animals, or in contaminated hay brought into the wilderness or excreted by domestic animals are sources of infestations.

Musk thistle can spread rapidly in wilderness areas because of the plant's biology and reduced weed management strategies in wilderness areas. Canada thistle infestations started along horse and foot trails of wilderness areas and has spread into native plant communities (Beck, 1994)

4.7.1.2 Alternative 2 - Integrated Weed Management

Each reservation is different in respect to its location and the existence of special protected areas or adjacent designated wilderness. Generally, remote or protected wildlife areas on reservations do not have as many weeds as those with a network of roads and trails. There are some instances where weed control work needs to be carried out on reservations and there are designated wilderness areas adjacent to the reservation. Special permissions would be required or weed control efforts need to be done without vehicles.

Some land management agencies may rarely create access roads and use vehicles for weed control in their wilderness areas for short term projects. It is not likely that special access roads would be built on reservations for weed control work, but little-used trails or roads might be accessed. This would increase disturbance within the protected area, especially if the project is long term. Consultation with adjacent landowners such as BLM and Forest Service, who manage most wilderness areas, is encouraged within the BIA Noxious Weed Program and this EA process.

Noxious Weed Treatment Guidelines for weed control work adjacent or within wilderness or special protected areas are in Table 8.15.7 in Appendix O, (BLM 2005).

Chemical
The use of herbicides to treat noxious weeds near or within protected areas can affect the native state by potentially killing non-target vegetation by misapplication or drift. Spot applications using backpack sprayers are less likely to cause damage than aerial or vehicle-mounted applications. Treatments could improve the natural condition of these areas and reduce noxious weeds and the risk of wildfires. The effects of the treatments on wilderness values would outweigh the minor detrimental effects.

Biological and Cultural
The introduction of a non-native grazing animal into pristine environments would not be a preferred treatment. The intensive grazing could alter the landscape and add new effects to vegetation and wildlife. In less pristine areas where grazing has been part of the landscape history, the use of grazing animals could be compatible and less intrusive than other methods.

The use of insects for protected or wilderness areas may be preferable since they can be spread into remote areas with minimal disturbance. The risk of affecting native species with the insect pathogen is a slim, but potential risk.

4.7.1.3 Alternative 3-Integrated Weed Management without chemical or biological treatments

Fire

Fires are a natural part of wilderness ecosystems and a goal of many resource managers is to return fire to this natural role. Fire management within or near these areas would allow natural fires, while reducing fire risks within the ecosystem to protect wildlife, cultural resources or the human population. Each potential treatment area should be evaluated for unique characteristics before prescribed burns are used. As a general rule, minimal disturbance by fire is best within these areas.

Mechanical

As provided by the Wilderness Act, the use of motorized equipment is permissible to meet administration goals in Wilderness areas, but federal land managers have strict guidelines in this regard and mechanized equipment must meet certain criteria and standards to reduce disturbance to those using wilderness areas. If mechanized equipment is used, work should be done in the off-season, during weekdays and before evening hours to minimize disturbance to hikers and campers.

For the most part mechanized equipment in or near wilderness areas is discouraged because it can affect the intact wilderness setting. Mechanical treatments in areas where there are limited treatment options, such as with tamarisk removal, may be carried out with considerations to minimize disturbance in these areas.

Alternative 3 is a viable alternative for special management areas but limits the tools available to accomplish weed control goals and reduces the chance of success.

4.7.2 Air and Noise

4.7.2.1 Air Quality

4.7.2.1.1 - Alternative 1 - No Action

Invasive weeds, especially early annuals, can affect air quality indirectly by increasing the chance of damaging wildfires. The most common air pollutants in smoke are CO, $CO_{2,}$ $PM_{10,}$ and PM $_{25.}$ Carbon dioxide is not a regulated air pollutant but is included in climate change assessments. The BLM Vegetation Treatment EIS identifies particulate matter as the most serious air pollutant emitted from wildfires. The particles are carried by winds over long distances and can affect National Air Quality Standards. Volatile organic compounds (VOC) are toxic air pollutants that affect human health and make up 1% of the mass emitted from fires. Large wildfires greatly influence regional air quality standards. Air Quality Emissions of particulate matter larger than 10 microns (PM_{10}) would increase in proportion to the acreages of wildfire. Total emissions are expected to increase over time due to projected increase in wildfire acres.

4.7.2.1.2 - Alternative 2 - Integrated Weed Management

Dust and exhaust emission would result from ground and air vehicles as well as motorized watercraft when carrying out herbicide treatments.

Spray drift has the potential to directly impact air quality emissions when herbicides are used. Several of the Noxious Weed Treatment Guidelines listed in Appendix O will reduce the effect of this impact.

4.7.2.1.3 - Alternatives 2 and 3 - Methods used in both alternatives

Mechanical

Particulate matter associated with the operation of mechanical and hand-held equipment, including driving on unpaved roads to and from the treatment site, would emit pollutants with Ambient Air Standards (CO, SO2, NO2 and VOC) and other minor pollutants, but the emissions would primarily be small, localized and temporary. (BLM, 2005)

Fire

Prescribed burning would increase air quality emissions of particulate matter larger than 10 microns (PM_{10}). Alternative 3 would be more dependent on mechanical methods and prescribed burns and would result in an increase of particulate matter from the burns but on a smaller scale than the wildfires.

Alternatives 2 and 3 should result in a reduction in total emissions as a result of wildfire reduction. Although Alternatives 2 and 3 would involve larger acreages of prescribed burning than under Alternative 1, Alternatives 2 and 3 would result in the lower total PM_{10}. This is due primarily to the smaller acreage burned by wildfire and mechanical treatments used to reduce fuel loadings. Alternative 2, which incorporates chemical methods as well as mechanical and other integrated methods could yield slightly lower PM10 emissions than Alternative 3.

4.7.2.2 Noise

4.7.2.2.1 Alternative 1 - No Action

The No-Action Alternative would not cause noise pollution unless wildfires occur due to invasive weeds. Aircraft, vehicles and heavy equipment could increase noise levels, as part of the fire control effort.

4.7.2.2.2 Alternatives 2 and 3 - Methods used in both alternatives

Using all integrative weed control techniques could increase the noise levels temporarily during treatments. Mechanical methods using heavy equipment would increase noise levels as would the use of four wheelers and trucks for chemical control. Most treatment areas are not near residential areas and this would not be a major concern. The use of grazing animals to selectively graze weeds could increase noise by vehicles transporting the animals and noise made by the animals in the treatment area. Biological control methods using insect pathogens would have the lowest impact and would involve driving to some areas to distribute the insects.

4.7.2.2.3 Alternative 3 - Integrated Weed Management without chemical or biological treatments

Not having access to chemical or biological methods would increase the dependence on mechanical methods such as chainsaws, plows and heavy equipment and would result in slightly more noise pollution.

4.7.3 Public Health and Safety

4.7.3.1 Alternative 1 - No Action

Pollen-producing weeds have the potential of affecting hay fever sufferers. Native or non-native plants can cause significant problems for those with respiratory allergies. Kochia (*Kochia scoparia*) and Russian thistle (*Salsola iberica* and *S. collina*) are two weed species that cause problems for those with hay fever. Latex in leafy spurge can cause irritation to broken skin, eyes, or a dermal rash.

This alternative would increase the chance of wildfires and the danger to human health is greater from wildfires than from prescribed burning. The health effects of fire are described in Sec 4.7.3.3, Public Health and Safety.

4.7.3.2 Alternative 2 - Integrated Weed Management

This alternative makes use of all Integrated Weed Management (IWM) techniques (fire, mechanical, chemical, and biological control) to manage noxious weeds.

Chemical

Of all of the integrative techniques, herbicide use has the greatest potential to cause harm to human health and safety. Harm can occur to workers applying the herbicide and those living near the treatment area through drift or runoff. It can affect human health indirectly by contaminated water supplies. The BIA and tribes are cognizant of the dangers of herbicide use and adherence to pesticide safety, certification and reporting is part of the program requirements.

Herbicides need to be recognized for their potential health effects and used safely, cautiously and in moderation. Used in this manner, they can have the positive effect of reducing hazardous fuels and restoring native vegetation and natural ecosystems. When used as part of an Integrated Weed Management system, the overall effect is positive. Appendix I outlines the characteristics and effects of commonly used herbicides.

Biological and Cultural

There is a risk of human injury when using grazing animals for intensive vegetation treatments. If many animals are concentrated in a small area for feeding, there will be fecal droppings with potential health effects by direct contact or by spreading fecal coliforms into waters and streams.

There is minimal risk to humans when distributing insect pathogens. They may be injured in vehicles or when walking to distribute the insects. The insects are host specific and will not affect those harvesting vegetation for cultural use.

4.7.3.3 Alternative 3 - Integrated Weed Management without chemical or biological treatments

Alternative 3 relies more on mechanical and cultural methods, including prescribed burning.

Fire

Occasionally prescribed burns are carried out for restoration projects in riparian areas or to encourage grass production for grazing but due to the sensitive nature of most desert ecosystems, fire will not be used widely.

Fire treatments include risks to ground crews and nearby residential communities. Workers can be burned during treatments and the public can be exposed to danger if fire escapes.

Smoke causes danger to fire crews and residents. Particulate matter can affect lung function and aggravate sensitive individuals. In some areas, it can be linked to premature death. Firefighters holding the fireline or those downwind of active burns are exposed to greater levels of smoke pollution. Long term effects of smoke exposure by firefighters have not been documented but some evidence has shown that cardiopulmonary disease and premature death is higher than in the general population.

Gases in smoke include carbon dioxide (CO) and nitrogen oxides. Most will diffuse into the atmosphere but workers on firelines may be exposed to higher levels of CO. Wood smoke contains Polynuclear aromatic hydrocarbons (PAH) which contain several carcinogenic compounds. Older studies cited in the BLM EIS stating that fire fighters are not at increased risk for cancer due to PAH compounds no longer seem valid. (Gabbert, B., 2010)

Many studies in the last five to ten years show that firefighters have increased risk of five cancers and decreased lung function. Most studies were not conducted on wildland fire fighters. (Gabbert, B., 2011)

A 2004 study did assess the health risks of chronic smoke exposure for wildland firefighters. (Reinhardt, et al., as cited by Gabbert, 2011) Fifteen substances of potential concern in wildland fire smoke including aldehydes, polycyclic aromatic hydrocarbons, carbon monoxide, benzene, and respirable particulate matter were evaluated. Only benzene and formaldehyde were found to pose a cancer risk greater than 1 per million. Two other substances, acrolein and respirable particulate matter resulted in hazard indices greater than 1.0. The estimated cancer risks ranged from 1.4 to 220 excess cancers per million. Noncancerous hazard indicators were higher (9 to 360) depending on the exposure group.

Smoke can reduce visibility along roads and increase the danger of accidents, although this is not a major issue in most of the areas where treatments are carried out. The benefits of using prescribed burning include reducing the larger effects of unplanned fires. Wildfires can threaten public health and welfare and reduce air and water quality. The biggest impact of wildfires is damage to homes and property that also affect mental and physical health.

Wildfires are more damaging to firefighters than non-wildland fires. A study of deaths due to wildland firefighting during the years 1999-2008 indicated that from 8 to 26 firefighters were killed each year.

Some of the firefighters died in what was planned as a prescribed fire, but then got out of hand. Other prescribed burns never went out of control, but fatalities occurred when lighting the fire, while the fire was burning, or after the fire was extinguished. From 1999 through 2008, there were 169 deaths associated with 124 wildfires and 11 deaths associated with nine prescribed fires.

Most (three fifths) of all wildland firefighter deaths (103) occurred during fire suppression activities and another 66 occurred when firefighters were responding to or returning from the fires. The remainder died in vehicular accidents (helicopters or ATVs) while lighting prescribed fires, traveling to or from prescribed burns, or creating fire lines. A few died in their sleep at base camp. (Fahy, 2009)

Mechanical

Mechanical methods are used by nearly all tribal noxious weed grant recipients. The methods include mowing, cutting, crushing, plowing, shredding and mulching. Workers using tractors and heavy equipment are susceptible to injuries common to users of this type of equipment. Injuries can be reduced by adhering to safety standards. Low accident rates have been indicated by the BLM in the Vegetation Treatment EIS and none have been documented within the BIA Western Region. No official survey of injuries has been conducted.

There is a risk of workers coming into contact with and cutting blades on saws, mulchers, shredders, drills resulting in injury. Injury of workers can occur while operating equipment on steeps slopes or otherwise losing control of their equipment. Rocks and debris can be kicked up by equipment and cause injury. High noise levels could cause hearing impairments and workers should wear ear protection while operating machinery. Equipment operators in ROWs need to take care not to come into contact with electrical power lines.

The public could suffer injury if debris from vegetation removal is flung from equipment. Maintaining a safety buffer should be a standard practice. Accidental fuel and oil spills could contaminate water supplies and operators should avoid operating vehicles near waterways when possible and never refuel near water bodies.

Manual treatments involve the use of non-motorized equipment to pull or cut vegetation. There are hazards of coming into contact with thorns and poisonous substances or irritants. Some workers can suffer allergic reactions. Insects, ticks, snakes and large and small mammals can also be a problem. Dermal rashes have occurred from diffuse and spotted knapweeds during hand-pulling removal.

Workers carrying out manual treatments can suffer heatstroke, hypothermia and overexertion resulting in heart attacks or worsening existing health problems. The can injure themselves with blades and equipment. The remoteness of some of the weed treatments may increase the time for medical help to reach them, resulting in serious injury or death. Public injury from manual treatments would be rare but safety zones should still be maintained. Although, injury through mechanical and manual treatments could occur, very few incidents have been documented.

The treatments would contribute to overall vegetation enhancement and reduce allergens and other hazardous contacts with noxious weeds.

4.8 *Environmental Justice, Climate Change and Adaptive Management*

4.8.1 Environmental Justice Analysis

In determining effects on Environmental Justice (EJ) population from the alternatives, we need to ask the following questions.

Would adverse effects be:

a) Predominantly borne by the EJ population?

b) Appreciably more severe or greater in magnitude on the EJ population as compared to the non-EJ population?
c) Does the project impact a resource that is especially important to an EJ population (i.e., does the project impact tribal treaty rights (usual/accustomed fishing/hunting grounds), or other land or resource that serves a significant social, religious or cultural function? (WsDOT, 2013)

4.8.1.1 Alternative 1 - No Action

This is the status quo where no weed control projects are carried out on Indian lands. This would adversely affect the residents by allowing noxious weeds to flourish in and around their community, housing areas, pastures, rangelands and forests. This alternative would impact the EJ population by negating aesthetics of the community and impacting economic ventures of cattle ranching, recreation, forestry and farming. It could also impact business enterprises such as hotels, casinos, and shops, if areas around businesses are unsightly with weeds.

4.8.1.2 Alternative 2 - Integrated Weed Management

Although the tribal communities near to where the projects are carried out may be considered an EJ population, the effects of the alternatives would not be so adverse as to disproportionately affect the residents. Nearly all noxious weed management projects are carried out by tribes in order to improve the environmental soundness of their land. The majority of tribes have policies in place to evaluate projects for impacts on cultural resources or other sacred places. This EA includes a process and an optional form to be used in this evaluation on a project by project basis and the governing body of the tribe has the right to reject any project affecting important resources.

The use of herbicides is normally approved by tribal resolution and all BIA Noxious Weed Grants under the Self-Determination process must have a tribal resolution authorizing the use of funds for the purpose of combating noxious weeds as outlined in the grant proposals. Some tribes, residents, and tribal land assignment holders are wary of the use of chemicals on their land and some reject this option. They have every right to do so and pursue other options. Tribal departments have been educating residents of the importance of weed control to some success. Where herbicides are not wanted, other integrative methods can be used.

4.8.1.3 Alternative 3 - Integrated Weed Management without chemical or biological treatments

Cultural or mechanical weed control methods would not disproportionately affect EJ populations. Any impacts caused by vegetation removal would be temporary and the ultimate effects of the treatments would be to enhance the land and the tribal community.

4.8.2 Climate Change

4.8.2.1 Alternative 1 - No Action

The No-Action alternative would leave some areas disturbed and allow for the increased infestations due to climate impacts. The No-action alternative would increase the chances of important species and habitats being irreversibly altered.

4.8.2.2 Alternative 2 and 3 - Integrated Weed Management with no biological or chemical control

Weed control project management techniques are not expected to increase the impact of climate change or cause severe weather events. However, climate change is expected to increase the impact of noxious weed species. Warmer weather will likely mean an expansion of noxious weeds into different latitudes and altitudes. The removal of vegetation will increase carbon emissions temporarily but revegetation effort will offset this effect.

4.8.2.3 Alternative 2 - Integrated Weed Management

There is no indication that biological and chemical control methods as part of an integrative weed management program would impact global climate change, other than in a very temporary sense. When vegetation is removed, more carbon is released into the atmosphere. Since the ultimate goal of most weed projects is to have a flourishing native plant community, effects on climate change would be ultimately positive.

4.8.2.4 Alternative 3 - Integrated Weed Management without chemical or biological treatments

Mechanical means of vegetation removal may have a greater impact on climate change due to increased ground disturbance and increasing carbon emissions. It is generally accepted that the greater the ground disturbance or erosion, the more carbon is released into the atmosphere. The effect would be temporary, if revegetation efforts are included in the project plans.

4.8.3 Adaptive Management

An Adaptive Management strategy, as applied to weed control, is inherent in the weed control process. As weed treatments are completed, they are evaluated for effectiveness and new techniques are employed, if existing control methods do not seem to be working. Early detection, early response is advocated in the grant process, as well as inventory and monitoring.

Since 2010, the BIA Range and Agriculture program has been conducting program assessments for managing natural resources. Self-assessments are used to determine the level of agriculture resource management and conservation plans and practices. In 2012, assessments were conducted for tribal and agency Noxious Weed Programs.

Adaptive Management strategies are outlined in the Regional Noxious Weed Management Plan and will be incorporated into templates for the individual management plans.

5 Integrated Noxious Weed Management Plan

In Section 3 of this document, the broad physical and economic conditions of the reservations within BIA Western Region were described, along with some of the major problems and noxious weeds. Each of the reservations needs a specific plan for weed control on their land. This Regional Integrated Noxious Weed Management Plan will describe the integrated weed management (IWM) strategies advocated for an integrated approach and the individual tribes can select which practices work best for them. A sample plan or template is included at the end of the plan. The IWM approach combines strategies for weed management to improve results based on one strategy alone. Successful integrated weed management starts with a set plan. An IWM plan should include objectives to create an integrated weed management strategy for weeds of concern within the local area.

BIA Western Region Integrated Noxious Weed Management Plan strategies include:

- ❖ Preventing noxious weed problems.
- ❖ Monitoring for the presence of noxious weeds and weed damage.
- ❖ Treating noxious weed problems to reduce populations using strategies that may include biological, cultural, mechanical, and chemical control methods considering human health, ecological impact, feasibility, and cost-effectiveness.
- ❖ Minimizing the use of chemical pesticides by offering information on alternative control methods and educating tribes and individuals who choose to use chemical controls on their correct use.
- ❖ Evaluating the effects and proficiency of noxious weed control treatments.

5.1 *Integrated Weed Management Practices*

5.1.1 Adaptive Management

Most successful weed management programs use an adaptive management strategy outlined in the seven steps below:

1) First, establish and record the goals for the site.
2) Identify species that keep goals from being reached and assign priorities based on the severity of their impacts.
3) Consider methods for controlling priority species to diminish their impacts and, if needed, re-order priorities based on likely impacts on target and non-target species.
4) Develop weed control plans based on the information obtained.
5) Implement the plan and monitor results of management actions.
6) Evaluate the effectiveness of our methods in light of the site goals, and use this information to modify and improve control priorities, methods and plans.
7) Start the cycle again by establishing new/modified goals.

5.1.2 Integrative methods

Integrative weed management methods have developed during the growth of weed science as discipline. An important part of a weed program is an understanding of weed biology, plant growth and survival patterns. Weed control methods differ for plants with different growth patterns and it is vital to the success of the program to recognize this. Determine if the weed is classified as annual, biennial or perennial. (See Glossary) and how it propagates.

A significant concept is weed allelopathy. Allelopathy is a mechanism of plants to have an adverse or depressive effect on other plants by releasing toxic substances into the environment. Allelopathy occurs widely in the natural ecosystem and may serve as a source of natural herbicides. Plant rotations and crop management systems may also harness the concept of allelopathy. Integrative methods reduce the dependence on using one strategy and herbicide resistance over the years also points to the importance of using integrative methods.

The key components of the integrative method are listed below:

1. **Inventory and Monitoring-**Knowing type and extent of weed infestation**.**
2. **Prevention**- Keeping weeds out in the first place.
3. **Chemical**- Using chemicals such as herbicides that control or retard the growth of weeds.
4. **Biological Control**- Using beneficial creatures such as insects or fungi that damage the weeds.
5. **Mechanical**- Tilling (plowing) or hand pulling the weeds.
6. **Controlled Burning**- Safely burning the weeds.
7. **Grazing**- Using grazing animals such as sheep or goats that will eat the weeds.
8. **Revegetation**- Reseeding a disturbed site to block or choke out the weeds.

5.1.3 Four Main Categories of Weed Management Practices

5.1.3.1 Cultural Methods

5.1.3.1.1 No Action

Before any choices are considered, determine the appropriate action. Sometimes no action is the best solution. No action may be the right option if the following conditions are true:

- The problem may disappear without any action being done.
- Laws and/or policies will not allow action.
- The tribal community opposes action.
- Threatened or endangered species or protected habitat are in project area and are unable to be mitigated.
- Aquatic protection or other site factors prohibit action.

5.1.3.1.2 Inventory and Monitoring

Inventory and monitoring are part of prevention but are important enough to warrant special emphasis. This is the backbone of a weed program. An inventory is needed to determine what weed species exist and the extent of the weed problem. Once the basics are identified, appropriate control measures can be devised. Monitoring is part of ongoing prevention measures and an essential part of any weed management program.

5.1.3.1.3 Prevention

- Determine activities occurring on the reservation that might be a source of weed introduction.
- Establish preventative policies and laws, including local quarantine and closure.
- Incorporate education and awareness programs on new and/or invading species

- Implement specific preventative measures, such as weed-free seed and hay, routine washing of vehicle equipment tires and screens on irrigation laterals and feeding channels. *

5.1.3.1.4 Livestock Manipulation

- Determine if changes in livestock's grazing habits will affect the target weeds.
- Evaluate if livestock grazing can be used to reduce seed production of target weed species, such as sheep on leafy spurge. Other changes, such as lowering stocking levels could allow for increased competition from beneficial vegetation and slow spread of noxious weeds.
- Determine if moving the grazing animals or changing the type of livestock could reduce or contain the infestation. An example of this would be to contain the spreading of the seeds carried in or on the animals.
- Evaluate livestock prior to introduction into a weed free area to prevent new infestations

Table 5.1 Integrated Pest Management Matrix (IPM)

Table 5.1 IPM Matrix rates the methods based on effectiveness and safety criteria. This was modified from a chart developed for Montana War on Weeds educational project. http://mtwow.org/IPM-chart.htm. *Ratings altered from the original are highlighted in yellow based on interpretation of scientific data*

IPM CHART	FAST ACTING	LONG LASTING	ENVIRONMENTAL SAFETY	PERSONAL SAFETY	EFFECTIVENESS
PREVENTION	+	+	+	+	+
CHEMICAL	+	0	-	-	+
BIOLOGICAL	-	+	+	+	+
MECHANICAL	+	0	+	+	+
CONTROLLED BURNING	+	-	-	-	0
GRAZING	+	-	+	+	0
REVEGETATION	-	+	+	+	+

0 = Neutral (mixed)   + = Positive   - = Negative

As compared to the other methods.

Based on this matrix, prevention and revegetation would have the most positive effects with a balanced approach of the other methods. A matrix could be developed for each individual species to determine the best methods to incorporate in weed control projects.

5.1.3.1.5 Wildlife Manipulation

- Determine if wildlife or wildlife feeding programs can help manage the weeds.
- Determine if management changes to the wildlife's movement or feeding habits will limit the spread of the weeds through the animal's fur or digestive tract.

5.1.3.1.6 Seed Disturbance Activities

- Re-vegetate bare soil following disturbances.
- Select plant species to reduce the spread of noxious weeds
- Defer soil disturbance if possible until weeds are under management or controlled.
- Work with your local road department for revegetation of borrow pits and disturbed roadways.

5.1.3.1.7 Land Use and Project Planning

- Determine most feasible land use to prevent and reduce infestations.
- Incorporate public awareness of weed control measures into tribal or community projects
- Determine if quarantine is a possibility and how it could affect the weed infestation.

5.1.3.2 Physical Methods

5.1.3.2.1 Manual Control

Removing weeds by hand or tool is a labor-intensive alternative to chemical weed removers. In dry conditions, use a stirrup hoe (NMSU, Jan 2005) to loosen the soil. A variety of new weed-pulling tools offer extra leverage for removing weeds with well-established tap roots. Use hand or tool weed removal method near valuable plants to control the level of soil disturbance. Disadvantages of hand removal include soil compaction and the slow, laborious process this method requires. (Lee, A. Undated) It is important to determine if grubbing, hoeing or hand-pulling weeds will increase or reduce the infestation.

5.1.3.2.2 Mechanical Control

Mechanical methods are a vital part of integrated weed management and can increase effectiveness of other methods. Mechanical methods include mowing, tilling and removal of trees and shrubs with heavy equipment.

Mowing

Mowing is a method of weed control that removes the top growth of the weed to prevent seed production and stress the underground part of the plant. Mowing can sometimes encourage the plant to grow more vigorously. This method can be used in combination with herbicides to reduce the amount of herbicide needed. Mowing is a desirable method when soil erosion is a concern. Mowing is ineffective against prostrate or short weeds. Inspect terrain to determine if mowing is an acceptable option to reduce spread of the seeds.

Tillage

The effectiveness of tillage as a method of weed control is determined by the type of weeds to be controlled. Annual weeds or biennial weeds without a well-developed taproot can be controlled by tilling. Young plants that have not gone to seeds are best controlled by this method. Determine if the use of cultivation or heavy equipment and could be utilized cost-effectively. Conservation tillage is used in conjunction with herbicides to reduce the amount of tillage used to conserve soil moisture and prevent erosion. Other methods include interrow cultivation and ecofallow systems which leave crop residue in place and reduces the amount of herbicide used. (Rao, 2000)

5.1.3.2.3 Barriers

5.1.3.2.3.1 **Weed mats or fabric**

Weed mats can be used to control weed growth under paths and graveled areas. Mats are semi-permeable barriers made from recycled synthetic materials, such as plastic bottles, that kill weed growth excluding access to sunlight. Some fabric-like mats come on rolls in black or grayish-green colors. Mats are a long-lasting solution for weed control. Light doesn't disintegrate this tough fabric, but mats are an expensive for large project areas. Very large mats may interfere with the movements of wildlife. This might be an option in smaller vacant lots near community buildings.

5.1.3.2.3.2 **Mulching**

Mulching is the distribution of substances like wood chips and wood bark around cultivated plants. Mulch kills weeds by forming a barrier that blocks weeds from receiving the sunlight and rainfall that weed seeds need to thrive. It slows the evaporation rate from the soil. Too much mulch will allow rot or fungi to grow. Optimally, keep mulch six inches away from plants, use two to four inches of hardwood bark mulch and apply it in early spring or fall. (Lee, A. Undated)

5.1.3.2.4 Steaming

Although not in widespread use, agriculture steamers are gaining favor with organic farmers. They have not been used as part of general weed control on Indian lands in Western Region, but may in the future as some tribes seek organic certification or move away from chemical control methods. Thermal weed control systems using steam or flame treatments of crop and non-cropland weeds may offer significant benefits over existing weed control methods. Research at Colorado State University indicates that timely applications of flame can reduce weed populations in organic crops such as alfalfa. The use of steam over flaming could have some safety and environmental advantages. Steam treatments eliminate fire risks and flame damage to sensitive environments. No smoke is produced when weeds are steamed rather than flamed. The use of steam eliminates the potential of human or wildlife exposure to pesticide residues and does not contaminate water, soil, or air.

Treating with steam using propane as the fuel source could help address weed, insect and disease concerns of western growers. A trend towards sustainable agriculture has encouraged research into effective, environmentally safe and economical alternatives to pesticides. Studies conducted under a one year grant at Colorado State University in specialty crops such as peaches, strawberries, raspberries and vegetables, alfalfa hay and non-cropland found that flaming was the most effective treatment. Steaming and herbicide applications of imazethapyr and ammonium salt were not effective. The researchers attributed some of the ineffectiveness to the drought. (Gourd, T., 2002)

Advocates of this technology say that the steamer can pay for itself on a 200 acre farm or ranch in 4 years and on a 500 acre farm or ranch in 2 years. Steamers mounted on trailers have been improved upon the last several years with technology introduced from Australia in 2005 for a Stinger Steam Weed Control machines. (Propane Education and Research Council, Jan 2006)

5.1.3.2.5 Soil Solarization

Solarization is an organic weed control method used in areas of sufficient solar radiation. The soil is irrigated and then covered with clear plastic for 4 to 6 weeks during the hot summer period. The effectiveness depends mainly on the heat that can be generated under the plastic during a certain period. Soil solarization can reduce populations of weed seed in the soil, as well as provide partial control of nematode and soil fungal pathogens. For further information, contact your local farm advisor or see UC ANR Publication #21377, Soil Solarization: A Nonpesticidal Method for Controlling Diseases, Nematodes, and Weeds

5.1.3.2.6 Fire

Fire management techniques for vegetation management have been evaluated for most tribes within Western Region through individual tribal fire management plans funded through the Division of Forestry, Fire and Fuels programs. This method is primarily used to reduce fuels that cause wildfires. Fire, as a weed management technique will be described briefly, as part of integrated weed management practices. In cropping and non-cropping systems, it is useful to burn off accumulated vegetation and kill growing weeds when cultivation is not possible. The tops of mature weeds, propagating parts and seeds can be destroyed by this process. (Rao, 2000)

5.1.3.2.6.1 **Flaming**

Burning or searing weeds employs a portable gas-powered tool, or "flamer." Propane flamers can burn or scorch weeds to remove them. They shoot a hot column of air which extends beyond the visible flame and scorches, rather than burns weeds. Seared broadleaf weeds are less likely to re-sprout, but flaming can stimulate re-growth in grasses. Flaming is most effective on weeds less than four inches high. Extreme care must be taken when flaming to avoid igniting flammable substances such as wood chips and starting fires. This method is best carried out on wet or damp ground. Flamers can be small hand tools or large propane tanks mounted on a trailer. (Lee, A. Undated) Studies conducted under a one year grant at Colorado State University in fruit and vegetable specialty crops, alfalfa hay and non-cropland found that flaming was the most effective treatment. (Gourd, T., 2002)

5.1.3.2.6.2 **Spot-Burning**

Spot-burning using a propane torch is part of the concept of flaming using a hand-held torch. It has been used successfully to kill most seedlings/saplings of a woody invasive plant called buckthorn (*Rhamnus* spp.), where the adult plants have already been removed. It takes less time and labor than hand-pulling the seedlings. Burn the seedlings early in the first growing season after adult removal. Repeat burn treatments to kill sprouts from leftover seeds in soil are usually required only on small patches.

5.1.3.2.6.3 **Prescribed Burns**

The timing of a burn can strongly affect the fire's impact. Warm-season prescribed burning (late-spring and fall) was most effective for reducing abundance of Mediterranean annual grasses in California.

Timing is a key element in controlling smooth brome and encouraging the growth of native grasses. Timing prescribed burns so that they occurred at the time of above ground lateral stem (tillers) elongation, yielded a reduction in both tiller density and biomass of smooth brome. Prescribed burns have helped stop the spread of invasive medusahead. Some projects have obtained good success with >95% mortality of medusahead and yellow starthistle following prescribed burns in California. Fire has been used to control tree-of-heaven. Repeated burns may be required, for full effectiveness. See Table 5.2

Fire is not always the answer for weed control and in some cases can even increase weeds and damage native plants. When fires become too intense, crown-fires and death of native plants that typically survive fires can result. If temperatures are too hot, soil organisms and seeds, even those of species that require fire stratification for germination, may perish, and valuable soil nutrients may be lost.

5.1.3.2.6.4 **Fire and Herbicide combinations**

Some noxious weeds are effectively controlled using the combination of fire and herbicides. Reed canarygrass was controlled by burning the surrounding thatch, and then applying glyphosate herbicide. The spread of leafy spurge was slowed by burning the litter layer, and stimulating the seeds to germinate, therefore reducing the seed bank. Then herbicide is applied. Purple loosestrife was successfully controlled by burning, then applying glyphosate (Rodeo®).Fire was tried to control cogongrass but better results were achieved when herbicide was applied following burns. More examples of invasive weeds that have been controlled by prescribed fire, and the effects of burning on them, are presented in Table 5.2

Table 5.2 Effects of Prescribed Fire on Specific Weeds

Common Name	**Effects of Burning**	Reference
Wild parsnip	Fire removes ground litter and standing litter, providing favorable conditions for the development of parsnip rosettes • periodic burning may help maintain the vigor of native plants to allow them to better compete with parsnip	Eckardt 1987 Kenney & Fell 1992b
Reed canarygrass	Growing season fires may reduce vigor and help control the spread.	Apfelbaum & Sams
	Growing season burns may give native species a competitive advantage	1987 Henderson 1990
Phragmites	Burning will not reduce growth unless the roots burn	Beall 1984
	Burning removes phragmites leaf litter, allowing seeds of other species to germinate • burning in conjunction with chemical control has been found effective • burn with caution, since spot fires can occur up to 100 feet from burning phragmites	Marks 1986
Cattail	Fire provides little or no control unless the roots are burned. Drawdown followed by burning and then flooding to a depth of 8 – 18” will provide control	Apfelbaum 1985 Nelson & Dietz 1966
Smooth brome	Burning at time of tiller elongation, yields an instant and persistent reduction in tiller density and biomass	Willson 1990, Willson & Stubbendieck 2000
Spotted knapweed	Repeated burning will reduce spotted knapweed, but is difficult to get burn to carry through dense knapweed patches.	Mauer 1985
	Burning is only effective where regrowth of native species is vigorous.	Watson & Renney 1974
Canada thistle	Fewer thistles were seen in years following a burn than before or year of the burn	Evans 1984
	Late spring burns (May-June) are detrimental – thistles may increase the first year following a May burn but will decline in two years.	Hutchinson 1992
	Immediate reductions in thistles occur following a June burn. During first 3 years of control efforts, burning should be done annually.	Sather 1988
	Early spring burns can increase sprouting and reproduction.	Smith 1985
Leafy spurge	Fire stimulates vegetative growth. Fire followed by herbicide treatment has been effective.	Biersboer & Koukkari 1990

5.1.3.3 Chemical Methods

5.1.3.3.1 Fertilization

Fertilization can be used as a weed control method in specific situations. When weed densities are low, increased nitrogen application can provide an advantage for crops. However, when weed densities are high, added nutrients can favor weed growth. Two studies showed that increased nitrogen favored weed conditions (nutsedge) in rice and mustards in a barley-pea cropping system. When planning fertilization needs, determine if using fertilizers will reduce the amount of weeds by increasing the competition of important plant species or if increasing nitrogen by fertilizers or manure will increase infestations. (Rao, 2000) Consult weed or crop specialists or research strategies, such as banding and timing of fertilizer applications and using specific fertilizer formulations to target specific weeds.

5.1.3.3.2 Herbicides

5.1.3.3.2.1 **Background and History**

Herbicide use constitutes a major component of most weed control programs. Between 1896 and 1910, many salts and acids were discovered to have the capacity to kill unwanted plants. Sulfuric acid, iron sulfates, copper nitrates and ammonium and potassium salts were used, among others. Very few herbicide developments were made until the 1940's when 2, 4-D was discovered. Fifty-five years later, over 400 herbicides have been developed and registered worldwide. Herbicides make up 55% of the pesticide market.

5.1.3.3.2.2 **Chemical Action**

Most herbicides are organic chemicals consisting mainly of a carbon (C) and hydrogen-(H) atoms that form linking chains. Herbicides may contain salt forming elements (halogens), alcohols, acids and esters that influence water solubility, electrical charges and volatility. The active ingredient is the ingredient that can interact with the biological environment. Some active ingredients are more water soluble than others. Others are soluble in oil or solvents and produce volatile vapors. Herbicides can be applied to the soil or foliage. Most herbicide applications in BIA Western Region are to the foliage or woody stems. Herbicide activity applies to the phytotoxic effects the chemical has on the plant. It is active if it hinders or prevents the growth process. Herbicide selectivity refers to the degree in which an herbicide kills an unwanted plant without harming other plants.

An important factor affecting the activity of the herbicide is the stage of plant development. The label will describe the plant stage the herbicide should be applied. Other key factors are cultivation practices, environmental conditions (rain, sun, and soil factors), herbicide adsorption and translocation and physiological tolerance of the plant species.

Adjuvants are added to herbicides to improve the performance of the herbicide formulation. There are special purpose adjuvants and activator adjuvants, including surfactants. Special purpose adjuvants may alter physical characteristics of the spray and widen the range of conditions the herbicide will be useful. They may include buffering, anti-foam and drift control agents. Activator adjuvants enhance or extend herbicide performance and increase herbicide absorption into plant tissue. Surfactants are activator adjuvants that reduce the surface tension between the spray and the leaf and are present in most post-emergent herbicides. Crop oil concentrates are petroleum-based oils used as surfactants. (Curran, et al, 1999) Crop oil or other adjuvants may sound benign, but they are not. Although in some cases, they can increase the effectiveness and safety of the herbicide, they can also increase the mobility of the herbicide and allow the chemical to enter the aquatic or human environment more readily and otherwise jeopardize human health and safety.

5.1.3.3.2.3 ***Herbicide Application Methods*:**

1. Basal bark treatments are made on individual trees or shrubs by using herbicide mixed with oil and adjustable nozzles to deliver a mist to bark base and up to 6 inches. This method should not be used on old thick bark and is best done in the winter in cold climates.
2. Broadcast applications consist of applying a spray solution uniformly over the entire treated area. The kinds of herbicides used are usually selective, such as aminopyralid. When herbicides are applied according to label directions and the equipment is operated properly, broadcast applications can be an effective method for weed control in certain environments.
3. Cut-Stump treatments involve cutting trees and shrubs as close to the ground as possible with hand tools or chainsaws and applying herbicide to the stump.
4. Dip & Clip is a method of applying herbicide where clippers are dipped in concentrated herbicide, and then used to clip the TIPS stems and/or other plant parts.
5. Directed Spray is accomplished by a wand with a regulated nozzle to direct spray within 1 to 2 feet of the target vegetation. This spraying is done at an angle to reduce overspray. Plants that are three feet tall are left standing. Taller plants are will need to be cut or bent to insure that spray is within three feet of the ground.
6. Spot spraying permits application of the chemical just to target species. For most herbicide applications in natural areas, spot spraying is preferred. Foliar application with a low-pressure (20-50 psi) backpack sprayer equipped with a wand applicator is used. A sprayer nozzle which creates a flat or cone-shaped pattern is preferable. For best results the herbicide should be allowed to dry for at least two hours to ensure adequate absorption and not sprayed when rainfall is possible. Addition of a nonionic surfactant to the mixture helps ensure complete leaf coverage and increases the rate of absorption. The herbicide should thoroughly cover the foliage but not to the point of run-off. Personnel applying herbicide must be properly trained and knowledgeable about the native vegetation.
7. Wicking and Wiping is a method of applying herbicide with an herbicide reservoir attached to a wiper made of absorbent material such as cotton rope, carpet, or sponge, similar to a self-filling paint roller. It is used to apply highly concentrated herbicide solution (10% to 100% of product) by wiping it directly onto plant surfaces.

Commonly used herbicides and adjuvants used on BIA-funded weed control projects in Western Region, and their characteristics and effects, are outlined in Appendix I. Take into account these potential effects when considering a weed control strategy. Include the steps below in the decision process:

Table 5.3 Herbicide Treatment Evaluation

Table 5. 3 Herbicide Treatment Evaluation
Determine if herbicides are needed to control the infestation of the weeds after evaluating and incorporating other methods
Check herbicide labels for use on that specific weed and area
Determine the most effective application techniques
Determine cost-efficiency of the use of different spraying equipment
Properly certify and train personnel to apply herbicides

5.1.3.4 Biological Methods

Biological control is the deliberate use of naturally-occurring organisms to reduce the distribution and numbers of a target invasive species. *Classical Biological Control* involves locating natural enemies of the invasive plant in its native range and testing them thoroughly for host-specificity before importing and releasing the insects. The testing and permitting process can take up to five years or more. Organisms such as insects, mites, nematodes and fungi are potential biological control agents sometimes referred to as biocontrol agents or bioagents. Plant-eating insects or other organisms can kill weeds directly by weakening the plant or destroying, seeds, roots or stems. Secondary infections from pathogens may occur after the feeding organism has damaged the plant. Table 5.4, List of Western Region Weeds with Biocontrol Agent Available, is below.

Table 5.4 List of Western Region Weeds with Biocontrol Agent Available

Scientific Name	Common name	Comments	Scientific Name	Common name	Comments
Cirsium arvense	Canada thistle	No longer permitted	*Linaria genistifolia ssp. dalmatica*	Dalmatian toadflax	
Cirsium vulgare	bull thistle	No longer permitted	*Linaria vulgaris*	yellow toadflax	
Conium maculatum	poison hemlock		*Lythrum salicaria*	purple loosestrife	
Convolvulus arvensis	field bindweed		*Salsola australis = S. kali, S. iberica*	Russian thistle	
Cyperus esculentus	yellow nutgrass		*Salvia aethiopsis*	Mediterranean sage	
Cytisus scoparius	Scotch broom		*Senecio jacobaea*	tansy ragwort	
Eichhornia crassipes	water hyacinth		*Silybum marianum*	milk thistle	
Euphorbia esula	leafy spurge		*Sonchus arvensis*	perennial sow-thistle	
Halogeton glomeratus	halogeton		*Tamarix spp.*	tamarisk	Movement no longer permitted
Hydrilla verticillata	hydrilla		*Tribulus terrestris*	puncturevine	
Hypericum perforatum	St. John's wort		*Verbascum thapsus*	woolly mullein	

Biological control methods, with carefully selected biocontrol agents have the least impact on the natural environment and provide inexpensive long-term control. Biological control works best on large infestations where the natural enemies of the weed do not occur. Common species where biocontrol agents have been studied and are available are knapweeds, leafy spurge, rush skeletonweed, purple loosestrife, and others. Recent USDA regulations have restricted the movement of the Diorhabda beetle for the use on tamarisk due to habitat concerns for the southern willow flycatcher. Distribution of biocontrol agents for thistles is no longer made due to the biocontrol agent movement to native thistles in some areas. (Wilson and Randall, 2007)

BIA has a partnership with the University of Idaho to supplement the research and in turn the University provides technical transfer workshops and insects for release on reservations.

5.2 *Weed Management Zones*

5.2.1 Roads and Transmission Corridors

Roads and trails have been the principal routes for long-distance weed dispersal throughout the Region (Cousens and Mortimer 1995). The greatest expenditures for weed control and revegetation are related to roads. The most important step in stopping the spread of weeds is to wash wheels and under vehicles, especially after driving on roads with high densities of weeds along the edges or after driving off-road or trail.

Road and corridor construction can damage native plants (Vasek et al. 1975a, 1975b) and provide habitat for colonizing weeds. Below are steps to include in transportation project planning and implementation:

1. Include weed prevention, control, and restoration in plans and assessments for new roads and transmission corridors.
2. Include analyses of potential weed introductions, damage to soil and biological crusts and fire occurrence into road repair and construction projects.
3. Include appropriate weed prevention, restoration and fire control in project specifications.
4. Restore original communities by replanting native plants.
5. Thoroughly evaluate the construction of roads in sensitive areas and if unavoidable, include special conditions to protect native community.
6. Close or fence existing roads in sensitive areas. Closure of roads in high-priority areas is necessary while treated sites are restored to native vegetation cover.
7. Educate community residents and road project stakeholders on the importance of weed control methods including the importance of limiting access to prevent soil, plant and animal life disturbance, and the spread of habitat-destroying weeds.
8. Avoid highway locations that require numerous river or wetland crossings.
9. Coordinate erosion and sediment controls with the Federal Highway Administration (FHWA), the American Association of State Transportation Officials (AASHTO), and state departments of transportation.
10. Collect and remove road debris and repair potholes.

5.2.2 Recreation and Trails

Lands used for recreation are susceptible to weed invasions and steps should be taken to limit trails and recreational use to areas that would be easily monitored for impacts. Access to weed-free areas should be limited. Off-road or off-trail riding and walking should be discouraged by marking off closed areas. When appropriate, educational signs, identifying prominent weeds and illustrating the effects of noxious weeds on the land are recommended. Not many people are aware of the role of biological crusts in protecting the soil and education about soil crusts is recommended. Some areas with biological crusts have low resilience and should be avoided for recreational use. When sites show sign of overuse with disturbed soil and weeds, they should be closed and treated and allowed to regenerate. Noxious Weed Treatment Guidelines for Recreation are in Appendix O, Table 8.15.11.

5.2.3 Agriculture Management Zones

5.2.3.1 Cotton, lettuce, cash crops

Weeds common in agricultural areas are field bindweed, prickly lettuce, yellow sweet clover, Russian thistle and Amaranthus species (pigweed). The heavily irrigated conditions needed to produce cotton and vegetable crops also increase competition from weeds and can cause from 50-85% yield reduction. It is difficult to till in wet conditions, especially in heavy soils and non-organic farmers rely heavily on herbicides. However, farm managers are facing increasing challenges due to herbicide-resistant weeds and concerns about herbicide residues in foods. Integrated methods are necessary. (Rao, 2000) Many consumers are opting for organically-grown vegetable and fibers.

Vegetables are poor competitors against weeds, due to their short height and slow growth. Weeds can also increase disease in vegetable crops by harboring pathogens. Manual weeding is commonly used in developing countries, due to high cash returns. (Rao, 2000) It is also used by organic farmers. Pre-emergent herbicides are used more often in the United States. Pre-plant irrigation is used to stimulate weed growth in addition to flushing salts from the root zone. The sprouting weeds can be killed by shallow cultivation, flaming, or applications of regular or organic herbicides. Cover crops and soil solarization (In Sec 5.2.3.2-Pysical Methods) are other techniques used to reduce weeds in agricultural fields. Hand hoeing is often necessary in organic lettuce. Lettuce is thinned and weeded 30 to 40 days after seeding. The lettuce plants are tender, and careful weeding is necessary to safeguard the crop. (Smith, R. et al, UC Davis, Lettuce, Weed Management for Organic Lettuce Production, Oct 2009)

5.2.3.2 Control Methods for Agricultural Areas

Cultural and mechanical:

- Remove light or spotty infestations of weeds by hand hoeing or spot cultivation to prevent spreading weed seed, rhizomes or roots. This is of particular importance with perennial weeds because of the way they propagate (by seed and root tissue). When plowing perennial weeds, make sure that you don't spread plant parts to other areas of the field.
- Use weed-free planting seed to protect against weed infestations in the row and the introduction of new weed species.

- Thoroughly clean harvesting equipment before moving from one field to the next, or require it of the custom harvester before he enters your fields.
- Use mechanical tillage to remove initial weed flushes prior to planting, thereby eliminating or at least reducing the potential for continued infestation.
- Consider the economics of using mechanical cultivation alone for weed control in the crop, especially where only light infestations of annual weeds are present.
- Practice rotation to crops which physically out-compete certain weeds, resulting in their gradual decline.
- Consider purchasing or leasing steaming or flaming equipment to limit herbicide use or consider contract services to implement this method.

Table 5.5 Common Crop/Lettuce Weeds

Common name & Scientific name- With Link to California Weed Photo Gallery		
barnyardgrass *Echinochloa crus-galli*	bluegrass, annual *Poa annua*	burclover, California *Medicago polymorpha*
canarygrasses *Phalaris* spp.	chickweed, common *Stellaria media*	cupgrasses *Eriochloa* spp.
fiddlenecks *Amsinckia* spp.	goosefoot, nettleleaf *Chenopodium murale*	groundcherries *Physalis* spp.
groundsel, common *Senecio vulgaris*	henbit *Lamium amplexicaule*	junglerice *Echinochloa colona*
knotweed, common *Polygonum arenastrum*	lambsquarters, common *Chenopodium album*	lettuce, prickly *Lactuca serriola*
mallows *Malva* spp.	mustards *Brassica* spp.	nettle, burning *Urtica urens*
nightshade, hairy *Solanum sarrachoides*	nutsedge, purple *Cyperus rotundus*	nutsedge, yellow *Cyperus esculentus*
oat, wild *Avena fatua*	pigweeds *Amaranthus* spp.	purslane, common *Portulaca oleracea*
rocket, London *Sisymbrium irio*	shepherd's-purse *Capsella bursa-pastoris*	sowthistles *Sonchus* spp.
sweetclovers *Melilotis* spp.	swinecress, creeping *Coronopus squamatus*	crabgrasses *Digitaria* spp.

5.2.3.3 Abandoned lots, farms or leases

Weeds in vacant areas are unsightly and undesirable. They can be fire hazards when dry and many weeds are poisonous and cause allergies. Knapweeds, field bindweed and yellow star thistle are problems on many abandoned farms and leases. Sahara mustard is another invading weed. Woody species such as Russian olive, tamarisk and can also take over some abandoned areas and are only reclaimed at great expense. Prevent seed bed growth by destroying existing plant before flowering. Soil applied herbicides can reduce germination. Many of the widely-used herbicides in Western region such as 2, 4-D, picloram, dicamba and glyphosate are effective in these areas. Triclopyr has been effective on woody species. Bromacil, imazapyr and others commonly used herbicides bring good results. Combinations of petroleum oils and phenol herbicides are also used. (Rao, 2000)

Some of these oil adjuvants increase the effectiveness but can also cause harm to non-target, plants, animals and humans. (See Appendix I)

Tribes who do not want to use herbicides may use cultivation or mow or cut weeds, but these methods are not always effective and each weed species should be identified and the best way to control it identified. Some weeds such as knapweeds increase when cultivated, because it spreads the underground roots around, which readily re-sprout.

Section 5.3 contains Weed Management Strategies for Specific Weeds. If the weed pest is not listed, consult the county agricultural agent or do web searches for the best method.

5.2.4 Rangelands

Many weeds have invaded grazing lands in the west and the type of weed depends on the ecoregion where the reservation is. Buffelgrass is a bigger problem in the Sonoran Desert Region and Madrean Archipelago Ecoregion where the Tohono O'Odham is located. Sahara mustard is a problem in the Sonoran Desert Region on reservations in southern Arizona and along the Colorado River. Many of the weeds occurring in the Great Basin are also problems throughout the region. They include knapweeds, perennial pepperweed, whitetop, thistles, tamarisk and invasive brome species such as cheatgrass. Himalayan blackberry and medusahead eradication/control projects have recently been undertaken in the Northern and Central Basin and Range, in order to keep this recent invader on reservations from gaining a stronghold.

Managed grazing can occur in harmony with natural rangeland landscapes but unmanaged grazing with high numbers of animals concentrated in areas can disturb the soil and allow weed invasions to flourish.

5.2.4.1 Disturbances caused by grazing that contribute to weed infestations:

- Cattle transporting weed seeds into weed-free sites on their coats;
- Preferentially grazing of native plant species over weed species;
- Grazing animals causing patches of bare and disturbed soils that act as weed seedbeds;
- Trampling of microbiotic crusts that stabilize soils and inhibit weed seed germination;
- Animal waste creates patches of nitrogen-rich soils, which favor nitrogen-loving weed species;
- Heavy grazing reduces concentrations of soil mycorrhizae needed by native species;
- Intense grazing can accelerate soil erosion, bury weed seeds and facilitate germination. (Belsky and Gelbard 2000: pg. 3).

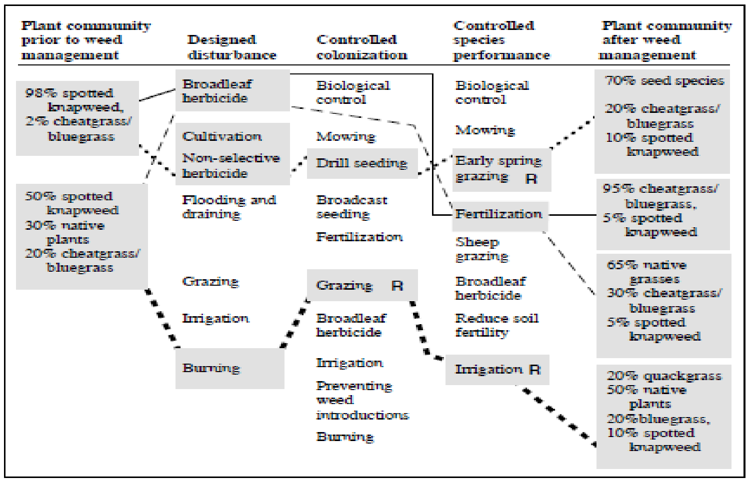
5.2.4.2 Rangeland Weed Management

Land-use objectives on rangeland must be developed before weed management decisions can be made. An integrated weed management plan can be designed once the land use is decided. Weed management decisions need to be based on environmental and ecological principles as well as economic ones.

A healthy, weed-resistant plant community consists of a diverse group of species occupying all the niches (sites) and using all the resources in the system, keeping them from weed invasions.

Killing weeds is an inadequate objective, especially for large-scale infestations. The main objective should be to develop a weed-resistant healthy plant community while meeting other land-use objectives, including forage production, wildlife habitat development, recreational land maintenance or natural area.

Principles based on plant succession and managed "disturbance" can be used to obtain the desired land use result.



This chart lists the various choices that could be made in devising a strategy to manage spotted knapweed infestations. Follow the track from hypothetical situations in the left hand column through treatment options that design disturbance, control colonization and control species performance to find the expected results in the right hand column. "R" refers to repeated aplications.

Figure 5.1 Spotted knapweed management strategies

Healthy Plant Communities: Ecologically-based Rangeland Weed Management by Roger L. Sheley, Tony J. Svejcar, Bruce D. Maxwell, and James S. Jacobs

5.2.5 Riparian Corridors and Wetlands

At least half of the BIA-funded weed control projects are in riparian corridors for the control of tamarisk. Tamarisk, purple loosestrife, whitetop, giant salvinia, giant reed and fountaingrass are problem weeds in riparian corridors in wetlands.

Riparian areas and wetlands require special consideration because weed control efforts can increase erosion and contamination in waterways. Noxious Weed Treatment Guidelines and choice of method and herbicide can influence the effects on many facets of the aquatic environment, such as fish and macro-invertebrates, erosion, water quality and human health.

The influence of flowing water is an important consideration in riparian weed management. Flooding may have contributed to weed infestations by carrying weed seed downstream. Flowing water not only carries weed seeds, but also sediment and can affect how deeply incised the riparian zones are. When planning revegetation measures, it is important to note that the existing water regime may have been altered and choose plant and management strategy accordingly. (Schaafsma, 2012)

Weeds can have a number of impacts within riparian areas, but it is essential to assess the impacts at a particular site rather than making assumptions based on generalizations.

5.2.5.1 Weed Management in Aquatic Systems

Aquatic weeds

Most weed management projects in Western Region do not take place in directly in the water, such as flowing rivers, ponds or deep water aquatic systems. A few aquatic weeds have been designated as problems such as Eurasian watermilfoil, giant salvinia, curly pondweed, and giant reed. Giant reed is the only aquatic weed control project (other than tamarisk) currently funded. Most giant reed (*Arundo spp*.) is not directly in the water but on adjacent banks. Tamarisk, arundo and phragmites, are called “marginal weeds” according to (Rao 2000). Marginal weeds can grow on saturated soil above the water on moist shorelines and shallow water.

Occasionally tribes want to remove cattails (Typha spp.), but the BIA Noxious Weed program does not support the removal of native species. Cattails sometimes hybridize with non-native cattails and other native plants such as willows can cause visual problems on roads. Native plant growth is encouraged by the BIA Noxious Weed Program and removal of native species is not funded. Control of submerged or floating aquatic weeds can be more complicated with multiple ownership considerations. Choice of herbicides is limited and Clean Water Act permits (Section 401 Water Quality Certification and possibly 404 permits are required. Herbicide application requires extra precision to reduce impacts to aquatic species and water quality.

Aquatic Weed Control methods

Weed control methods used in aquatic zones consist of dredging, drying, mowing, chaining, burning, manual cutting and cleaning and physical barriers. These can all significantly alter the aquatic environment. Many aquatic systems in the western United States are intermittent and dry for long periods of time. Weed control can take place during the dry season. Biological releases have the least impact on the aquatic environment. Insect pathogens are available for purple loosestrife and although the tamarisk beetle cannot be legally moved, it is moving on its own into deep reaches of reservations in Arizona, Utah and Nevada.

Giant salvinia

Giant salvinia (Salvinia molesta) was noted as a problem along the Colorado River system at the public scoping meeting for this PEA in Yuma, Arizona in August of 2010. Giant salvinia is a floating weed that propagates vegetatively. It spreads quickly, forming thick mats in the water, reducing sunlight for aquatic organisms. It was first noticed in the Lower Colorado River (LCR) in 1999, below Palo Verde Irrigation District drain near Blythe, CA. It is speculated that someone may have dumped a home aquarium or the aquatic weed was inadvertently imported to a commercial fish farm. Scientists believe the weed will not go above Palo Verde dam drain, unless moved accidentally by watercraft, and will not be a problem in Utah and Nevada since it could not survive cold winters. However, it has infested some Colorado River tributaries, the All American Canal and Mexicali Valley in Mexico. (Ball, 2013)

According to one source, fluridone was rated an excellent herbicide for giant salvinia control and diquat and glyphosate were rated good, if registered for use in the local area. Rodeo, Aquamaster, Eraser AQ, Touchdown Pro, and AquaNeat are liquid glyphosate formulations found to have been effective on salvinia. (Rao, 2000)

The Aquatic Ecosystem Restoration Foundation (AERF) gave fluridone herbicides only a fair rating for giant salvinia. During the 2012 growing season, the Bureau of Reclamation applied the pesticides, Diquat, AquaNeat, and Sylgard for salvinia control in the LCR Region. (Heatwole, 2013)

Mechanical methods are also effective but are more labor intensive and costly. (Rao, 2000) Barrier booms are used by the Bureau of Reclamation in the LCR confine giant salvinia in side drains and backwaters to prevent them from entering the main outfall and the LCR. (BOR, 2004) Salvinia can be removed by raking it from the pond's surface but has the potential to reestablish itself from remaining fragments and care must be taken to remove all plant material to an upland disposal site. (AERF, 2003) The BOR had previously used a mechanical harvester but it was removed in 2006 and will no longer be used. (Heatwole, 2013)

Biological control is an important component of any plan for management and integrated control of giant salvinia. Cyrtobagous salviniae, the salvinia weevil, has achieved good success along the Colorado River and tributaries. It was introduced in 2004 and by 2007, many of the plants were dead. APHIS and BOR have a cooperative agreement between their two agencies to monitor and control giant salvinia on the LCR and its tributaries. Quechan Tribal President Jackson gave written permission to the agencies to navigate and control giant salvinia in Quechan Tribal waters. The insect does not completely kill off the host salvinia, but is effective as a central component of integrated control. (Ball, 2012, 2013) (AERF, 2003)

Cyrtobagous salviniae is a small weevil ranging in length from 1.5 to 2.0 mm. The weevils prefer feeding on newly formed leaf buds. Larvae feed within the roots, rhizomes, and leaf buds. The weevil is cost effective And the level of suppression lasts for years without re-introduction. This significantly reduces the cost of an integrated control program. However, this management option may take years to achieve suitable levels of suppression and will not totally eradicate the target plant from a given area. (AERF, 2003) Research has found the weevil populations to be inconsistent in areas with fluctuating flow. USDA APHIS plans to use established weevil populations as harvest material to transfer to other locations. There are some stable populations on the LCR and the program will be continued. (Heatwole, 2013) The weevils will also move on their own to salvinia-infested areas. (Ball, 2013)

Feeder fish, such as grass carp or tilapia have been studied as a control method, but this method has not been implemented in the LCR region, possibly due to the invasive effects of the carp, themselves. (Texas A & M, 2013) Because giant salvinia is difficult to control once it has become established, prevention and early detection are important steps in stopping the plant from becoming a widespread problem. Human recreational activities contribute to the spread of non-native aquatic plants. Fragments of the aquatic plant cling to the propellers of boat motors or trailers and, if not removed, can start new populations when the boat is launched into another waterbody. (AERF, 2003)

5.2.6 Timber and Fire Management Zones

5.2.6.1 Timber Management Zones

Most BIA Western Region BIA-funded weed control projects are not in timber management zones, although a few tribes do manage for timber and may want to incorporate control measures adjacent to or in some of these zones. Some general guidelines are:

1. Treat weeds on timber sale units especially on existing landings, skid trails, and helibases before activities commence.
2. Specify weed control in contract provisions and train contract administrators to identify noxious weeds and select lower risk sites for landings and skid trails.
3. Encourage operators to maintain weed-free equipment, parking, and staging areas.

4. Prevent weed germination and establishment by
    a. Retaining native vegetation in and around project activity.
    b. Minimizing soil disturbance to no more than needed to meet project goals.
5. Utilize logging practices to reduce soil disturbance such as:
    a. Over-snow logging
    b. Skyline or helicopter logging
    c. Reuse of landings, skid trails and helibases when they are weed free.
6. Minimize the time from preparation, revegetation, and contract closure.

Table 5.6 Top Ten Weeds on Forested Land

Common and Scientific Name
1. Canada thistle-Cirsium arvense L.
2. Spotted knapweed-Centaurea maculosa L.
3. Leafy spurge-Euphorbia esula L.
4. Dalmatian toadflax-Linaria dalmatica
5. Yellow toadflax-Linaria vulgaris Mill.
6. Musk thistle-Carduus nutans L.
Common and Scientific Name
7. St. John's wort or Klamath weed-Hypericum perforatum L.
8. Rush skeletonweed-Chondrilla juncea L.
9. Houndstongue-Cynoglossum officinale
10. Yellow starthistle-Centaurea solstitialis L.

(Markin, 1996)

Dalmatian and yellow toadflax have been identified in national forests and wildlands as problem weeds in the Arizona and Colorado Plateau Ecoregions. These weeds are potential problems on the White Mountain, Hualapai, Hopi and Uintah and Ouray Reservations.

5.2.6.2 Fire Management Zones

Fire management techniques for vegetation management have been described for most tribes within Western Region through individual tribal fire management plans funded through the Division of Forestry Fire and Fuels program. Burned Area Emergency Response (BAER) Teams routinely include weed control measures in their response plans.

Fire management has been used successfully on yellow star thistle, medusahead, barb goatgrass, and several bromes. Timely burning of a few invasive biennial broadleaves (e.g., sweet clover and garlic mustard), perennial grasses (e.g., bluegrasses and smooth brome), and woody species (e.g., brooms) also has been successful. Timing is important to controlling plants and seeds. Medusahead seed heads from the canopy can be killed by the heat of a prescribed burn. A study at UC Davis found that burning before seed dehiscence (drying out) is one of the most effective controls for medusahead in California's Central Valley region.

Fire drastically alters the desert ecosystem and should only be used with great caution in managing invasive weed infestations. Wildfires do the most damage by creating disturbance that allows weed seeds to get a competitive advantage. In recent years, the severity and intensity of wildfires in the West has increased dramatically from levels in the 1970s and 1980s. There has been a fourfold increase in invasive weed populations since 1985. Wildfires, drought, and invasive weeds are causing a steady degradation of soils, water quality and quantity, native plant communities, wildlife habitat, wilderness values, recreational opportunities, and livestock forage (BLM 2007).

Table 5.7 Variable Comparison for the Use of Fire to Control Weeds

Variable	Croplands	Wildlands
Timing of Fires	Pre or Post harvest	Varies with target species and ecosystem
Fuel Types	Crop residual, with a simple fuel structure	Fine and coarse debris, with a complex fuel structure
Fire Types	Surface fire	Surface or crown fire
Other Integrated Treatment	Fire preceded by chemical or mechanical treatments, followed by a cover c	Followed by chemical or mechanical treatments, or revegetation with competitive species
Type of Invasive Targeted	Typically herbaceous	Varies-grasses, herbs, shrubs and trees
Ecological Complexity	Low	High

Most vegetation types can regenerate after fire if the dominant plants are unharmed or if there is sufficient time for them to reestablish in the burned area. Longer recovery intervals occur in the Sonoran Desert where the vegetation is dominated by fire-intolerant species such as saguaro (*Carnegiea gigantea*) and palo verde (Parkinsonia spp.) (Rogers 1985, Schmid and Rogers, 1988)

Burning has little effect on many herbaceous species and may cause an increase in many noxious weeds. Moderate and low-intensity fire has not been observed to kill noxious weeds" (Singleton 2003: 14). In the Sonoran Desert, most native shrubs and trees are killed by fire, and recovery is slow (Rogers and Steele 1980, Tellman 2002). Adaptations to fire are weak and difficult to justify in most situations. Bureau of Land Management policies call for fire suppression throughout the Sonoran Desert (BLM 2008: 623).

There are major differences in how fire is used to control weeds between cropland and wildland settings, including the timing of fires, fuel types, fire types, pre and post treatments and the types of noxious weeds targeted (Table 5.7). (DiTomaso, J.M. and D.W. Johnson (eds.) 2006: Brooks, M. contributor)

5.2.7 Areas Known to be Occupied by Threatened and Endangered Species

Areas known to be occupied by Threatened or Endangered Species (TES) require special weed management techniques. There is a legal framework within the Endangered Species Act (ESA) that must be followed to protect the species. TES can occur across all weed management zones, along roads and transmission lines, in rangeland and riparian areas and in timber and fire management zones. Endangered species have been identified in Chapter 3.1 for each ecological region and also listed in Appendix P for most reservations or counties where reservations are located.

The USFWS has a planning tool called IPaC, Information, Planning and Conservation System. http://ecos.fws.gov/ipac/ The species list in Appendix P was derived from the IPaC system. Setting the location of the project area is the first step in defining ESA responsibilities in the IPaC system. Step 2 involves specifying the activity to be carried out (Invasive Species Control) and a Trust Resource List is generated in Step 3. This list will include listed endangered, threatened or candidate species, critical habitat and often a list, type and acres of affected wetlands. Eventually USFWS will be providing online conservation measures (Step 4) to implement when carrying out specific projects and locations determined in Steps 2 and 3. Until that occurs, conservation measures or mitigation will be determined in consultation with the USFWS. The species list obtained from the IPaC system is not an official list, but there is a link to request an official one from USFWS for the project area.

Almost all reservations will have at least one TES to manage, although not all projects will contain, or potentially affect a species. The first and foremost step is to know if the species is located or could be located in the project area. The IPaC system or the ESA website http://www.fws.gov/endangered/ can provide maps and information about the species. Conservation measures are specific to each species but there are some general measures to protect species and habitat listed in Appendix O, Table 8.15.10, Noxious Weed Treatment Guidelines to Minimize Impacts to Wildlife and Endangered Species.

Additional conservation measures to expect from USFWS during consultation are listed in Appendix O, Section 8.15.2.

5.3 *Weed Management Strategies for Specific Weeds*

Included are some of the most common weeds in Western Region. Most of BIA Western Region Noxious Weed Program funds are being spent on these weeds. A few weeds common to agricultural areas or abandoned fields or pastures are priority species for some of the funded tribes and are also included.

There are many resources for weed control guidelines and the latest control recommendations. One resource is University of Wyoming Weed Management Handbook for Montana, Utah and Wyoming. The University of Arizona and University of Nevada offer similar fact sheets and guidelines. The local agricultural extension agent/weed specialist can advise on current practices.

List of sources used in the preparation of this section are:

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5.3.1 Bull thistle, Cirsium vulgare

5.3.1.1 Description

Bull thistle is native to Europe, Asia, and Africa and is now found on every continent except Antarctica. It came to western North America in the late 1800s and early 1900s. Bull thistle is now considered the most common rangeland thistle in western North America.

Ohio State Weed Lab Archive, the Ohio State University

Similar Species: Lobes of Canada thistle (Cirsium arvense) leaves end in small spines and the upper leaf surface is smooth while lobes of bull thistle leaves end in large spines and the upper leaf surface is rough. Also, Canada thistle has creeping roots and rhizomes that spread great distances while bull thistle forms a taproot. Bull thistle grows as a rosette during its first year while Canada thistle rarely forms only basal leaves

Bull thistle is a biennial forb. Plants form a rosette with a taproot up to 28 inches long in the first year. During the second year, stems grow 1 to 6 feet tall with spreading branches. Seed viability is generally high. Pocket gophers consume taproots from below and their digging provides sites for further thistle establishment. The younger stems and roots of bull thistle are edible, and American Indians used them for food. Bull thistle is a problem in repeatedly disturbed areas such as pastures, overgrazed rangelands, burned areas, and along roads, ditches, and fences. Bull thistle competes with desirable forage and has no significant value for livestock. Plants are usually avoided by grazing animals because of their spines. Bull thistle litter may inhibit the growth of other plants.

5.3.1.2 Control Measures

Introduced weevils have been effective biological control agents, but rare native thistles are also affected. Transport of these agents is no longer allowed. Chemical control is most effective when plants are in the rosette stage and least effective when thistles are flowering. Refer to the Weed Management Handbook on the University of Wyoming Extension website for current herbicide information. Close mowing or cutting two times per season will usually prevent seed production. More success is gained when desirable species are planted following removal of noxious weeds.

5.3.2 Canada thistle, Cirsium arvense

5.3.2.1 Description

Canada thistle is a native of southeastern Eurasia. It was introduced to Canada as a contaminant of crop seed as early as the 1600s. Canada thistle is a colony-forming perennial from deep horizontal roots. Stems are 1 to 4 feet tall.

Canada thistle differs from other thistles in that there are separate male and female plants. Purple flowers of 1/2 to 3/4 inch in diameter are produced during July or August

Ohio State Weed Lab Archive, the Ohio State University

Similar Species: Just below the flower heads of most thistle-like plants (Carduus species, Centaurea (knapweed) species, and Cirsium species) are bracts with spines, but Canada thistle flower heads have bracts that lack spines. It is difficult to separate Canada thistle and bull thistle (Cirsium vulgare). Bull thistle is a biennial that forms a leafy rosette during its first year of growth and a flowering stem in the second while Canada thistle is a perennial with a creeping root system that gives rise to new stems. Also, bull thistle stems have spiny wings that are absent in Canada thistle.

Canada thistle has a reputation for producing few viable seeds. However, a single Canada thistle plant can produce up to 375 feet of roots after only 18 weeks. Canada thistle grows best with 16 to 30 inches of precipitation per year. In the Great Basin, Canada thistle is often restricted to swales or other areas of deep, moist soils. Canada thistle has been used in the northeastern United States in remedies for worms, as a mouthwash, and a tonic for gastrointestinal ailments.

Its extensive root system gives it the ability to survive where other plants can't. Canada thistle decreases forage and livestock production on rangelands and reduces aesthetics in recreation areas. Canada thistle invades areas impacted by disturbance as well as those undergoing restoration efforts. Canada thistle may produce toxins that inhibit growth of other plants. Hiking and horse-back trails are major invasion pathways for Canada thistle. This species often establishes after fire, disking, and herbicide treatments that have reduced cover of other plants.

5.3.2.2 Control Measures

Because Canada thistle has large root reserves, it recovers from most types of stress, including many control methods. Breaking up the roots by plowing only serves to increase the number of plants. Herbicides can be effective if properly timed and given repeated application. The Weed Management Handbook on the University of Wyoming Extension website offers current herbicide use information. To date, biological control of Canada thistle has not been successful, although it may be effective when combined with other control methods.

Maintaining a healthy native community is the best defense against Canada thistle. Canada thistle should be removed from lightly infested areas when first observed, because it is hard to control once established.

5.3.3 Cheatgrass, Bromus tectorum

5.3.3.1 Description

Cheatgrass is a winter annual introduced from Eurasia. The plant communities most affected by cheatgrass invasion are those below 6000 feet in elevation but it can be found up to 13,000 feet. Affected plant communities include the pinyon/juniper woodland, sagebrush, and salt-desert shrub community types. Cheatgrass is a considerable problem in Western Region due to short life cycle and prolific seed production. Because cheatgrass stands dry out by mid-June, fires are more likely to occur earlier in the season. With every reoccurring fire, cheatgrass becomes more dominant and expands its range further. Cheatgrass is low priority species in Western Region due to its prevalence and difficulty to control. Control measures have been limited to after fire with BAER funding. Not many tribes have applied for traditional BIA noxious weed program funding for this species.

5.3.3.2 Control Measures

Eradication of cheatgrass from large areas is not a reasonable goal. Efforts should focus on reducing cheatgrass dominance and increasing perennial vegetation. Increased livestock grazing in early spring helps lower seed production and reduce fuel for fires, but this alone will not help restore more productive species. It is important to remove grazing pressure as native plants begin to flower. Herbicides easily kill cheatgrass, but are not often cost effective. (Schupp, 2006) Some herbicides damage desirable species as well. For small-scale control, refer to the Weed Management Handbook on the University of Wyoming Extension website.

Fire intervals have increased from every 60-110 years in sagebrush dominated systems to less than 5 years under cheatgrass dominance. Reducing the frequency of burns in an area is essential for native plants to produce seed and increase vigor. Because it is difficult to establish native plants under cheatgrass dominance, re-vegetating with competitive, introduced species like crested wheatgrass and forage kochia may help reduce fire frequency and aide eventual native plant establishment. Also, the process of green stripping [establishing patterns of fire resilient vegetation to reduce wildfire occurrence and size (USDI-BLM, 1987) may be used to trim down large expanses of cheatgrass to smaller parcels.

5.3.4 Field Bindweed, Convolvulus arvensis

5.3.4.1 Description

Photo by Steven Dewey, Utah State University Extension

Field bindweed is a deep-rooted perennial vine with twining stems that can reach six feet in length. Flowers are trumpet-shaped, and range in color from light pink to white.

5.3.4.2 Control Measures

Established field bindweed is difficult to control. An effective control program should prevent seed production, kill roots and root buds, and prevent infestation by seedlings. This plant is very persistent and a successful control program must be more persistent. The best control of field bindweed is obtained with a combination of cultivation, selective herbicides, and competitive crops. Control methods should be used throughout several growing seasons and requires the prevention of seeds, competition from more desirable vegetation and removing new growth. Below are descriptions of possible control methods.

Prevention

Monitoring and destroying new plants before seed production is the ideal control strategy.

Mechanical

Mechanical methods include hand-pulling, digging, cutting, mowing and tilling. Intensive cultivation controls newly emerged seedlings, may kill young field bindweed infestations, and contributes to control of established stands. Timely cultivations deplete the root reserves of established plants and stimulate dormant seeds to germinate.
Field bindweed can be controlled when tilled eight to 12 days after each emergence throughout the growing season. This could end up being 12 to 16 tillage operations for two years, at two- to three-week intervals. In some areas, cultivation with sweeps at two-week intervals at early emergence and at three-week intervals later in growing season eliminated more than 95 percent of the established stands in one year. Intensive cultivation alone usually is not practical because crops cannot be grown during the tillage period, and repeated tillage exposes the soil to erosion.

Cultural

Cultural methods including livestock grazing and revegetation practices can be successful.

Biological

Biological control agents are available to be used on reservations in Western Region.

Chemical

Selective herbicides based on the plant and the specific locations are best. Check weed fact sheets for specific chemical control recommendations.All methods are effective throughout the growing season except for spraying in summer after flowering.

Field Bindweed-Photo by Steven Dewey, Utah State University Extension

5.3.5 Hoary Cress, Lepidium draba

Image from-www.usu.edu/weeds

5.3.5.1 Description

*W*hitetop, or hoary cress, was introduced from Asia and first found in California in 1876. Hoary cress was first found in California in 1876. This is an aggressive perennial forb that is tolerant of salty soil, and grows up to 2 feet tall. Plants establish where extra water is available in swales, infrequently cultivated irrigated fields, and riparian areas. New stands are established when seeds are transported by water, vehicles, farm machinery, or contaminated hay and crop seeds. The foliage becomes coarse and bitter, and nutritive value decreases as plants mature. Hoary cress and perennial pepperweed are both sometimes called whitetop. They both have white, four petal flowers indicative of the mustard family. But unlike the taller perennial pepperweed, hoary cress stems are less than three feet tall and have leaves that clasp the stem and lack an obvious petiole (small stem). Hoary cress has shorter, more fragile stems that, unlike perennial pepperweed, do not remain standing all season long.

5.3.5.2 Control Measures

Mechanical

Small infestations can be controlled by digging and completely removing the plant, including the roots, within a few days after emergence. This must be continued until no new seedlings emerge, at least 4 to 6 years or more. <u>Do not till or mow an established plant stand.</u> This stimulates the rhizomes to grow new plants. Mowing followed by an herbicide application on regrowth is a feasible method of control.

Cultural

Finding and controlling hoary cress during its first year is the best management strategy. Cleaning equipment and using weed-free hay limits the number of infestations. Cattle and sheep will graze but not control hoary cress. Moderate grazing by sheep or goats in the rosette stage provides some control by lowering hoary cress density and preventing flowering. Do not graze later in the season, since this will stimulate vegetative growth. Hoary cress may be toxic to cattle. Flooding an area for two months can eliminate infestations but since hoary cress must be completely submerged for weeks to kill it, this may not be practical in some areas of the arid west. Flooding may also kill desirable vegetation and leach or erode valuable nutrients from the soil. Planting competitive legumes such as alfalfa or clover can reduce an infestation. Where possible, shrub establishment may provide long-term suppression of hoary cress colonies.

Fire

Fire is not a viable control method. Fire will not kill perennial plants, and seedlings can grow quickly following burns.

Chemical

The most effective treatment is a combination of herbicides and cultural controls. The use of metsulfuron or chlorsulfuron herbicides is not recommended since they remain active in alkaline soils for many years, making establishment and maintenance of competitive vegetation difficult after treatment. If the infestation is on highly alkaline soil, use repeated applications of 2,4-D and seed with competitive vegetation suited to alkaline soils. The Weed Management Handbook on the University of Wyoming Extension website offers current herbicide information. A long-term effort over many years is required to have any effect on an infestation. Missing one season of control reduces the effectiveness of years of control efforts. An intensive management process is required in heavily infested areas regardless of control method.

5.3.6 Halogeton, Halogeton glomeratus


Figure 5.2 Mature halogeton. (Whitson, 1987)

5.3.6.1 Description

Halogeton is an annual forb with small fleshy leaves. It was introduced from Russia and first collected in Nevada in 1934. Invaded sites are usually saline. Halogeton quickly invades disturbed or over-grazed lands. Palatability is low and the plant produces oxalates poisonous to sheep. Sheep losses through halogeton poisoning have occurred on ranges in Idaho, Nevada, and Utah. Halogeton changes the soil by pumping salt to the surface, slowing moisture infiltration and increasing evaporation. Local spread of halogeton is by the wind as plants break off when dry and tumble with the wind. Dry stems with seeds can be transported up to 2 miles.

5.3.6.2 Control Measures

The best defense against halogeton is a vigorous stand of perennial plants. Introduced perennials, such as forage kochia and crested wheatgrass have been successful at decreasing halogeton cover. A variety of crested wheatgrass,

called Hycrest, tolerates salty soils where halogeton is most common. There are no registered biocontrol agents for *halogeton* at this time.Sheep can safely eat halogeton after some of the oxalates are removed by rain or snow. Animals can adapt to eat more halogeton if fed to them in gradually increasing amounts.
Halogeton is listed as low priority on the BIA Western Region Noxious Weed list and not many tribes have applied for funding to control this weed. It is included here as a common poisonous weed on rangeland in Western Region.

5.3.7 Knapweeds, Centaurea spp. & Acroptilon repens

The knapweeds are a large group of over 400 species, many of which are considered invasive weeds. Knapweeds can impair wildlife habitat, decrease plant diversity, and increase soil erosion. They also can cause crop losses and reduce forage, decrease the appeal of recreational lands, and pose wildlife hazards. The problem knapweeds in western Region are diffuse (C. diffusa), spotted (C.stoebe) and Russian knapweed. There is also squarrose (C.squarrosa) knapweed in Utah and California.

Simple facts about knapweeds
Knapweeds grow 1-3 feet tall.
They are yellow, white, pink, or purple.
Knapweed flowers resemble small thistles growing at the end of clustered branches.

5.3.8 Diffuse Knapweed

5.3.8.1.1 Description

Diffuse knapweed originated in the steppes of the eastern Mediterranean and western Asia. It was introduced to North America as a contaminant of alfalfa seed in 1907. It is an annual or short-lived perennial forb growing 1 to 2 feet tall. White to purplish flowers bloom from July to September. The many-branched stems are rough to the touch, and its round shape tumbles with the wind when broken off at maturity. Mud on vehicles or shoes transports seeds to new areas. Disturbance allows diffuse knapweed to invade a wide range of habitats. It is adept at depleting soil moisture, and possesses allelopathic compounds. It is most competitive in areas receiving between 12 and 17 inches of annual precipitation. Flowers are usually white, but can range to light purple. Bracts on diffuse knapweed have a distinct, rigid terminal spine about one-quarter to one-third of an inch long with four to five pairs of shorter lateral spines. Bracts can have dark-colored tips but lack the dark fringe of spotted knapweed.

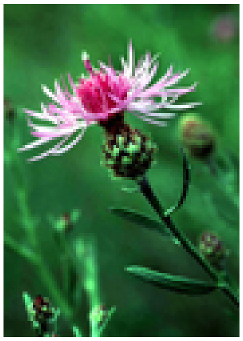
Rosettes are edible, but they are difficult for cattle to eat because they grow close to the ground. Mature plants are coarse and fibrous, and sharp spines can irritate or injure the mouths and digestive tracts of animals. Diffuse knapweed plants are browsed by deer and sheep and the rosettes are eaten by elk and cattle.

Diffuse knapweed infests roadsides, burned or plowed areas, and other disturbed sites. It is also capable of invading well-managed rangeland. Once it is established, it can form dense stands. Diffuse knapweed has a large, perennial taproot that can survive fire if the root crown is not killed. It also produces large quantities of seed that may survive fire. This species depletes soil moisture and replaces more desirable forage for livestock and wildlife.

5.3.8.1.2 Control Measures

To prevent infestation after disturbance, re-establish vegetation as soon as possible. Regulate human, pack animal, and livestock entry into burned areas where weed invasion is likely until desirable vegetation is established. Lasting control of diffuse knapweed requires proper land management to maintain desirable vegetation.

It is important to document where diffuse knapweed plants have been removed in order to monitor for emerging seedlings in following years. Early detection and public awareness are keys to successful containment of an infestation. Driving, walking, biking and riding animals through infested areas should be avoided. Use only certified weed-free hay for livestock and avoid grazing livestock on knapweed-infested sites during the seeding stage. If cattle have grazed in infested areas, they should be held for 7 days before moving to uninfested areas. Biological control agents including flies, beetles, and weevils, may weaken plants and make them more susceptible to herbicides, prescribed fires, and mechanical techniques. Crested wheatgrass has also had some success in competing with diffuse knapweed in revegetation projects.



5.3.8.2 Spotted Knapweed- Centaurea stoebe L. ssp. micranthos

5.3.8.2.1 Description

Spotted knapweed is a biennial or short-lived perennial. In its first year of growth, the plant produces a rosette of basal leaves that are deeply divided into numerous leaflets. Both upper and lower surfaces of leaflets are slightly wooly and covered with shiny specks and translucent dots. Several 3-foot-tall leafy stems emerge during the second year. At the ends of main stems and axillary branches are solitary rosy-purple flower heads surrounded by prickly bracts with a fringe of dark hairs at the tip. Spotted knapweed reproduces by seeds.

5.3.8.2.2 Control Measures

Mechanical methods involve seasonal mowing and tillage and hand-pulling and cutting with gloves.

Cultural
Seasonal grazing can sometimes be used to weaken plants.

Biological
Many biocontrol agents have been released for spotted knapweed. They include *Agapeta zoegana* (root-boring moth, *Bangasternus fausti* (seedhead weevil), *Chaetorellia acrolophi* (seed head fly), and *Cyphocleonus achates* (root-boring/gall weevil). *Larinus minutus* (seed head weevil) is available in limited quantities for redistribution. *Metzeria paucipunctella* (seed head moth), *Urophora affinis* (seed head gall fly), and *Urophora quadrifasciata* (seed head gall fly) are available for mass collections.

Herbicide
The following herbicides usually control spotted knapweed after annual applications of several years. Control of re-growth and of new seedlings is improved if a competitive crop or sod is established. A perennial grass is a good choice, except for glyphosate, since the herbicides listed here will not kill established grasses.

2,4-D can be applied at the early stage of flower stem elongation (late April to early May). Treatment will control only plants emerged at time of spraying. Aminopyralid (Milestone) should be applied to actively growing plants in fall or in spring from rosette to bolting growth stages. Clopyralid (Stinger or Transline) can be applied up to the bud stage of knapweeds. Clopyralid + 2,4-D amine (Curtail) is applied after most rosettes emerge but before flower stem elongates. Read label and use caution as several crops may be injured up to 4 years after application. Diflufenzopyr + dicamba (Overdrive) is applied to rosettes. Surfactant should be added to the spray mix. Avoid drift to sensitive crops. Overdrive will kill legumes. Glyphosate (Roundup) is applied to actively growing knapweed when most plants are at bud stage. Glyphosate kills many knapweed plants but also kills grass that might compete with new knapweed seedlings. Russian knapweed is not controlled. When using glyphosate, follow by seeding with a locally adapted grass.

For more detail, refer to the PNW Weed Management Handbook,

5.3.8.3 Russian knapweed- *Acroptilon repens*

5.3.8.3.1 Description

Russian knapweed is a creeping perennial weed native to Eurasia. Although Russian knapweed is closely related to the spotted and diffuse knapweeds, there are distinct differences and it is considered a different genus, Acroptilon repens. Instead of mass seed production like the other knapweeds, Russian knapweed has a deep and spreading root system. New plants shoot up from the roots, forming dense patches of cloned plants. Thus the plant is slower to establish, but more difficult to eradicate than the other knapweeds. The plants are long-lived perennials, known to live more than 75 years. It favors poorly drained and alkaline and saline soils, but does not do well in dense shade or severe drought. This species is difficult weed to control since it spreads by deep underground roots and puts out a chemical that inhibits other species from growing near it (allelopathy). It grows in pastures, rangeland, roadsides, waste areas, and on neglected agricultural land. Russian knapweed is toxic to some animals and must be handled carefully. Horses may become addicted to Russian knapweed if it is the primary food source in their pasture. In severe cases the animal may die. Cattle and sheep are not affected.

The pink to lavender cone-shaped flowers bloom from late May to September. The flowers look similar to spotted knapweed but do not have the spotted bracts or leaves. The root system and mode of reproduction differ. Young plants can be identified by their silvery green color, hairy leaves and shoots, wavy edged leaves growing in a “rosette”, and black scaly root. Vegetative growth is minimal during the summer but do translocate nutrients to the root system after bloom and into the fall. These nutrients help with the formation of the root buds that will produce new shoots in the spring.

5.3.8.3.2 Control Measures

Control measures should be aimed at stressing the plant over a period of time to deplete the stores of nutrients in the extensive root system. It may take several years for large stands may to be reduced to manageable levels. No single control strategy will work for Russian knapweed; a combination of cultural, mechanical and chemical controls is necessary.

Mechanical

Repeated mowing will stunt the growth of the plants but they will continue to flower at a shortened height. Mowing followed by spraying of regrowth is not as effective as spraying an herbicide on plants without mowing.

Tillage is not an effective control measure for Russian knapweed since it will cut up the root pieces and spread them to new areas. However, tillage may be used several weeks or months AFTER an herbicide treatment and before reseeding to allow the knapweeds’ own herbicidal chemical to dissipate.

Cultural

Reseeding with competitive plants and mechanical control are most effective once the knapweed has been stressed with herbicides or targeted grazing. Russian knapweed out-competes most other broadleaf plants and many grasses. It is often found in a dense, single species patch because it releases a chemical into the soil that prevents other species from germinating. Seeding with a competitive grass seed is recommended. Grasses are better than clovers or alfalfa because a broadleaf herbicide can be sprayed if the knapweed reappears. Some recommendations include several wheatgrasses and Russian wildrye. Contact local extension agent for native grass recommendations.

Biological

A new biological control agent has been approved for release against Russian knapweed. A partnership with APHIS, the State of Nevada and the University of Idaho will provide for release and monitoring of the insect, a gall forming midge (Jaapiella ivannikovi) on several reservations in 2012 and 2013. Fly populations as well as Russian knapweed density and other vegetation are being monitored on long-term plots where flies were released. This venture will yield valuable information on the impact of flies on Russian knapweed density, flowering, height, phenology and mortality as well as information on the recovery of native species and the status of other exotic species as Russian knapweed declines.

Chemical

There are two times when herbicides are effective: just before flowering (the “bud” stage, early to mid-June) and in the fall before the plants dry down (late August or early September). Fall applications are more effective as the plants are drawing nutrients into the root system for winter storage, and the herbicide will move more efficiently into the root system. Bud stage applications prevent flowering (and thus seed set) and are suggested for areas such as ditch banks and other waterways where seed may be transported downstream.

Pasture and range: Experiments have shown that the herbicide, Curtail (clopyralid), sprayed in the fall before the plants dry down, reduced the stand by 90% for up to 3 years. Some spot spraying is necessary to keep newly sprouted plants from maturing. Use 3 quarts per acre for broadcast spraying or a 2% solution for spot spraying. Curtail can be used close to desirable trees and shrubs but spray drift must be avoided to prevent injury to the plants. Care must be taken when applying Curtail in areas where there is a high water table or permeable soils.

Rodeo (glyphosate) is the only effective chemical for Russian knapweed that is labeled for use around aquatic systems. Apply in the bud stage or in the fall. Hand spray, preferably when the ditch is dry.

Curtail is labeled for use on non-crop areas as is Telar (chlorsulfuron) and may be applied during bud to bloom stage or in the fall. Telar should be applied during bloom to post-bloom stages. Application of Telar in the fall may damage grasses.

Tordon (picloram) is an effective herbicide for controlling Russian knapweed, but it is a restricted use pesticide and can only be purchased and applied by a certified applicator or someone under their supervision. It is labeled for use on range, permanent pasture, fallow cropland, non-crop areas, and Conservation Reserve Program acreage. Apply at bud to bloom stage or in the fall. EPA recently initiated new licensing requirements for applying Restricted Use Pesticides on Indian lands. Many tribes have stopped using Tordon the last few years.

5.3.9 Medusahead, Taeniatherum caput-medusae

Images from-www.usu.edu/weeds

COMMENTS: This grass can be confused with squirreltail or foxtail barley. It concentrates silica from the soil and cows will not graze it once it has flowered, thus reducing the carrying capacity of rangelands. It is a fire hazard and is extremely competitive, particularly with cheatgrass (Bromus tectorum).

5.3.9.1 Description

Medusahead is a winter annual grass that came over with imported animals from Europe in the 1880's. Height ranges from 6 to 24 inches tall and it has a seed head with long awns that are stiff and barbed. Roots can grow at cold temperatures and seeds mature quickly. Medusahead plants are rich in silica, and its litter breaks down more slowly than most other grass species. The dense litter cover causes most other annuals to fail to grow under the accumulated thatch. Medusahead is useless as a forage species and has been estimated to reduce the carrying capacity of infested rangeland by 75 percent for domestic livestock. On disturbed sites with clay soils, medusahead can out-compete cheatgrass to become the dominant vegetation. Medusahead has been identified as a problem on some northern Nevada reservations and a few tribes have applied for BIA funding to control this species.

5.3.9.2 Control Measures

Fire, herbicides, disking, and intensive early grazing can all reduce medusahead infestations, but revegetation with desirable species is vital to prevent medusahead from regaining dominance after control treatments.

Mechanical
Mow, disk or plow before seed set. Then use fire methods.

Cultural
Graze intensively early in the growing season. Spring grazing by sheep can reduce medusahead cover. Fertilize with nitrogen to increase competition from other grasses and forbs.

Fire
A slow hot fire after medusahead seeds ripen, but before they drop, can reduce medusahead up to 90 percent the following year.

Biological
Biological methods are not currently available**.**

Chemical
Apply sulfometuron (Oust) at 1/3 ounce per acre. Check label for your area. It will also kill other grasses and is only for use in non-crop lands or firebreaks. The use of glyphosate (Roundup) on early growth may not be cost-effective on rangelands.

5.3.10 Perennial pepperweed- Lepidium latifolium

5.3.10.1 Description

Perennial pepperweed is native to Europe and Asia but is now found in many parts of the United States. It has been declared a noxious weed in many western states. Other names are tall whitetop and Virginia pepperweed. Perennial pepperweed persists as a rosette for several weeks before stems grow. It grows 1 to 3 feet tall with bright green leaves. Flowers are white, in dense clusters near the top in summer to fall. Roots as deep as 9 feet make this weed difficult to control. Each mature plant can produce thousands of seeds each year but commonly reproduces through laterally creeping roots. Roots and seeds float and can be transported long distances by water to establish new populations. Perennial pepperweed is a problem invasive in riparian areas and wetlands but will also invade adjacent areas once established. Perennial pepperweed stands can grow more than 50 stems per square yard, making it too thick for waterfowl nesting to occur. This is a high priority weed in Western Region and many tribes have applied for funding to help control this weed.

The Weed Science Society of America has designated perennial pepperweed as the official common name for *Lepidium latifolium* L. Throughout much of the western United States the plant is known as tall whitetop. Another weed commonly called “whitetop” *Lepidium draba* (Formerly *Cardaria draba*) is widely distributed on rangelands. The accepted common name is hoary cress. If the term “whitetop” is used, it is necessary to determine the exact species that is being referred to as the problem. In the field, it is generally easy to distinguish between *Lepidium latifolium* and *Lepidium draba*.

Whitetop (hoary cress) flowers for only a month and then leaves dry, fragile 1- to 1.5-foot-tall stems which later disappear. Tall whitetop (perennial pepperweed) plants will reach heights of 6 feet or more and the stems are semi-woody at the base. Tall whitetop forms thickets that are visible all seasons of the year and the dead plant material persists for several years.

5.3.10.2 Control Measures

Eradication of perennial pepperweed is no longer an option in western North America, and control efforts for perennial pepperweed have been largely unsuccessful. Perennial pepperweed can store large amounts of resources in its roots and can sprout stems following cutting, grazing, or herbicide treatments. Therefore, early detection and quick removal of perennial pepperweed populations increases the probability of successful control

Mechanical
Control of perennial pepperweed through tillage is not a valid weed control option because virtually every cut section of root will produce new plants.

Cultural
Grazing with goats and sheep is most effective in long term suppression of perennial pepperweed if started before all perennial grasses are lost from the community. Grazing animals do not prefer the herbage of perennial pepperweed —especially after the flower stalks have begun to elongate. Goats can be forced to consume perennial pepperweed plants before flowering stalk elongation occurs, but this extreme level of utilization has no lasting weed control influence and do not enhance conditions for herbicide applications.

Chemical
Repeated applications of an amine form of 2, 4-dichlorophenoxyacetic acid (2, 4-D) at the rate of 2 pounds of the active ingredient per acre will suppress perennial pepperweed and allow the establishment of seedlings of perennial grasses. In the seedling year of the perennial grasses, 0.5 pounds per acre of 2, 4-D can be applied over the grass seedlings after they reach the first true leaf stage of growth.

Revegetation
On highly saline, alkaline desert soils, tall wheatgrass may be the only perennial that will establish on the sites. Tall wheatgrass is an introduced grass, like crested wheatgrass, but is less drought-tolerant. The presence of basin wildrye is a good indicator of where tall wheatgrass will grow.

5.3.11 Purple loosestrife, Lythrum salicaria L

5.3.11.1 Description

Photos and text source http://www.mtweed.org/purple-loosestrife/
Purple loosestrife is an erect, perennial herb that grows from 0.5 to 3 meters It has a square, wooded stem and opposite or whorled leaves that are mainly lance-shaped and stalkless. At the base of the plant the leaves are heart-shaped or rounded. The length of the leaves varies from 3 to 10 cm. Leaves at the base and inside of flower spikes tend to be smaller and attached alternately.
In the summer the plants produce lush magenta-colored flowers. They are practically stalkless, 5 to 7 petal flowers. Mature plants can have 30 to 50 stems coming from a single rootstock.

5.3.11.2 Control Measures

Mechanical, biological and chemical removal options exist. The size and location of the invasion determine the control methods. Digging manages small invasions of a few plants, especially when they are only a few years old. Larger infestations require herbicidal and/or biological control agents.

Mechanical
Eliminating all the roots and underground stems of the plant by digging is mechanical removal, which is most effective with small, young invasions. After the initial digging, the area should be monitored over several seasons to

ensure the plant's eradication. Drying and burning or composting in an enclosed area will dispose of the plants efficiently. Caution should be taken during every step of the process because small pieces of stem can root and reestablish the invasion. This also means, be careful of clothing worn and equipment used during the removal process.

Chemical

Herbicides chemically control purple loosestrife in areas too large to manage by digging. They can be applied to individual plants so as not to harm desirable plants nearby. Specialized equipment and treatment by professionals might be needed for removal along streams or in marshy areas. Some effective herbicides are Glyphosate and Garlon (triclopyr).

Biological control

The use of insect pathogens is considered the most effective control method for large invasions and long-term treatment. Galerucella pusilla and Galerucella calmariensis are two bio-control insect species that have been successful in the treatment of purple loosestrife. The adult and larvae of these leaf-feeding beetles eat the purple loosestrife leaves and flowers and have successfully reduced invasions over several seasons.

5.3.12 Russian thistle-*Salsola tragus (Salsola iberica, Salsola kali)*

5.3.12.1 Description

Contaminated flax seed from Russia to South Dakota in 1873 is thought to be the source of Russian thistle in the United States. It has become one of the most common weeds of the American West. It spread by contaminated seed, threshing crews, railroad cars, and by windblown tumbleweeds. Russian thistle is a bushy annual forb that grows 6 to 36 inches tall and reproduces from seed. Stems are usually red or purple striped. Flowers are green and hard to see.

Photo source: http://www.usu.edu/weeds/plant_species/weedspecies/weed_images/russian_thistle/Russ_thistle2.jpeg

One plant typically produces about 250,000 seeds, which may remain viable for one year. Germination and seedling establishment occur with limited amounts of precipitation. It is often found in agriculture fields and disturbed and overgrazed rangeland.

Cattle and sheep eat Russian-thistle, and it is a minor component in mule deer and elk diets until it becomes spiny. It is an important prairie dog food, and pronghorn eat it readily. Russian-thistle seeds are eaten by birds, including scaled and Gambel's quail, as well as small mammals.

Livestock ranges, deteriorated from drought or overgrazing, are frequently invaded and dominated by Russian-thistle. The tendency of dead plants to blow and collect along fence lines and buildings creates a fire hazard. During a fire, ignited plants can blow across fire lines and make fighting fire more difficult.

5.3.12.2 Control Measures

Prescribed burning will not control Russian thistle since it thrives on disturbed sites, and seeds are easily spread from unburned areas by tumbling weeds. Some herbicides are effective against Russian thistle, and current herbicide information can be found in the Weed Management Handbook on the University of Wyoming Extension website. Revegetation of infested areas, along with the removal of disturbing factors like overgrazing and fire, is the best way to repair lands infested with this weed.

5.3.13 Tamarisk, Tamarix spp.

5.3.13.1 Description

Photo by Steve Dewey

Tamarisk or saltcedar is deciduous shrub or tree usually 15 feet in height but can be 5 to 30 feet tall. The trees form dense thickets. Leaves are small, scale-like, gray-green in color, and overlap along the stem. The bark is smooth and reddish on younger plants, turning brown, gray and furrowed. Flowers are pale pink to white dense plumes that bloom from early spring to late fall. Fruit capsules contain numerous tiny (1/25 inch diameter) seeds. Reproduction is by root expansion, re-sprouts and seeds that disperse through the air. The several species introduced to North America are Tamarix chinensis, T. ramosissima, T. pentandra, T. parviflora, and T. gallica. Since they are similar in appearance and are hybridizing, distinguishing among them is difficult. The hybrid populations are the most invasive. Tamarisk invades stream banks, sandbars, lake margins, wetlands, moist rangelands, and saline environments. Tamarisk is native to Eurasia and Africa and was introduced into the western United States as an ornamental in the early 1800s. It occurs throughout the western and central United States.

Another species of Tamarix, the athel tree (Tamarix aphylla) is a large evergreen tree to 50 feet tall and wide with tiny scale-like leaves) and inconspicuous white flowers. It does not reproduce as prolifically as other species and is only mildly invasive. It has been at Lake Mead and the Moapa Reservation for more than 30 years. It is reproducing from seed and starting to hybridize with the deciduous tamarisks.

5.3.13.2 Control Measures

There are four methods to control tamarisk — mechanical, biological, competition, and chemical. Complete success of any management program depends on the integration of all methods.

Mechanical
Mechanical methods include hand-pulling, digging, use of weed eaters, axes, machetes, bulldozers. This method may be labor intensive but is almost always necessary to remove dead or dying debris after chemical and biological controls. Mechanical removal involves the use of heavy equipment to physically remove the woody trees and shrubs of the *Tamarix* genus.

Manual cutting is effective in mixed vegetation stands without killing other desirable plants. This method is best used in rough terrain that is not accessible by mechanical equipment. Cut biomass must be stacked and burned, chipped, or left in piles for wildlife habitat. Some spot herbicide re-application will be necessary. This method is appropriate for canyons, washes, irrigation ditches, and along steep river banks.

Cultural
Goats will be most effective at controlling young stands of T*amarix* that do not contain other native woody vegetation. Using goats may be an effective maintenance technique after an initial kill from introduced insects.

Chemical
Control with herbicides is an important part in the control of tamarisk. The chemical method allows regeneration and/or re-population of natives or revegetation with native species. The cut stump method is used most often in Western Region. Most commonly *Tamarix* is removed using chainsaws, after which the remaining stumps are treated with the systemic herbicide, triclopyr. The herbicide must be applied within approximately 15 minutes of cutting. A solution of triclopyr systemic herbicide mixed in vegetable crop oil is applied to the cut stump. The chainsaw method for the cut-stump approach is a relatively successful method of controlling tamarisk. Approximately 15 percent regrowth requires retreatment. Seedlings or smaller plants with smooth bark and a stems less than one inch in diameter can be treated by spraying the bark on the bottom 12-18 inches of the stem (basal bark treatment). Basal bark sprays can be used in conjunction with cut-stump method but are not as effective. Use this method when terrain or labor constraints make it difficult to do the cut-stump method. Foliar sprays with aerial applications of imazapyr have not been used in Western Region.

Biological
Investigations into biological control of *Tamarisk* using insects began in the 1980s using *Diorhabda*, a beetle from the Xinjiang Province of northwest China. Both the adults and the larvae of this beetle feed on the *Tamarisk* foliage, causing foliage to dry out. This beetle has been released and has defoliated tamarisk trees prolifically in Utah and Nevada. Due to concerns about the Willow Fly Catcher habitat, it is now prohibited from any further releases. It has not been released in Arizona. However, the beetle has been documented at the border of Arizona and will very likely move into Arizona in the near future.

Using *Diorhabda* as a control technique reduces the costs of *Tamarix* control to a small fraction of any herbicide and/or mechanical approach (less than $10/acre). Once the trees are killed, skeleton trees still must be removed from moderate to heavy infested areas, and these areas must be re-vegetated so these costs must also be included.

Tamarix trees die after three successive years of defoliation by *Diorhabda elongata.* Biological control by Diorhabda is applicable to all levels of infestation, is not constrained by access conditions, and could be used in both riparian zones and upland zones.

Extensive research on *Diorhabda elongata* suggests a lack of threat to other plant species; however there is always risk with introducing an alien species.

Dead Tamarisk Removal

Dead tamarisk trees must be removed, and the area must be re-vegetated. The removal of dead tamarisk plants is important after mechanical root crown removal, bio-control, or aerial herbicide control has been successful, because it reduces the potential for wildfires and facilitates vegetation establishment. Dead trees can be removed by fire or by mechanical mulching equipment that transforms dead woody biomass into mulch.

Costs of removal after defoliation

The costs of controlled burns are approximately $50 to $150 per acre, and the costs of mechanical mulching range from $200/acre in lightly infested areas to $200/acre in moderately infested areas.

Revegetation

Revegetation is critical to successful long-term control of *Tamarix*. Costs of revegetation can include labor, seeds, plant materials, fertilizer, equipment rental, weed control and water. For narrow widths less than 50 feet, natural revegetation may occur. Moderate costs may be incurred due to soil disturbance and for weed control. For broader widths (greater than 50 feet) costs will higher. (McGinley, M., 2013)

5.3.14 Yellow Star thistle, Centaurea solstitialis

5.3.14.1 Description

Yellow starthistle is related to the knapweeds and came to America (California) from Europe around 1849 in shipments of alfalfa seed. Road building, development, and expansion in the ranching industry contributed to the rapid and long-range establishment of new satellite populations.

This winter annual stands about 3 feet tall when mature and has yellow flowers and spiny flower heads. As many as 10,000 seeds can be produced by each plant. These hitchhike by jabbing sharp spines into passing hide, clothing or tires. Once in the soil, these seeds can lie dormant for more than 10 years until conditions are right to sprout. A rosette forms in the fall or early spring and then a flowering stalk bolts in early summer. Dense stands develop that are nearly impossible to walk through because of their spiked flower heads. Yellow starthistle has an advantage over native plants because it matures earlier in the season. Its roots rapidly grow as far as 3 feet down into the soil taking water and nutrients that the native plants need to survive the hot summer. Yellow starthistle degrades wildlife habitat and chokes out desirable species. ‘Chewing disease’ results when horses eat yellow starthistle. This disease affects their nervous system and is usually fatal.

5.3.14.2 Control Measures

Mechanical

Mowing is effective during the early flowering stage or when most buds have produced spines. It is only successful when no leaves are present below the level of the cut.

Cultural

Prevent the spread of yellow starthistle by inspecting vehicles and clothing after you have passed through an infested area. Using certified weed-free feed is a must to prevent its establishment in pastures. Sheep, goats, and cattle can graze on yellow starthistle in early spring, before the flower's spines develop. Goats will also graze plants in the spiny or flowering stages. Grazing reduces biomass and seed production.

Biological

Six biological control insects attack the seedhead of yellow starthistle, effectively limiting the number of seeds the plants are able to produce. Sheep, goats, and cattle can graze on yellow starthistle in early spring before the spines develop, and may reduce seed production. Prescribed burning can kill yellow starthistle, but requires careful timing and may affect biological control insects.

Fire

Prescribed burning has primarily been used as a tool for the control of invasive late-season annual broadleaf and grass species including yellow starthistle. The effectiveness of prescribed burning can be enhanced when incorporated into an integrated vegetation management program. Although there are some excellent examples of successful use of prescribed burning for the control of invasive species, a limited number of species have been evaluated

Chemical

Application of herbicide during the winter is safer for associated desirable plants and kills fall rosettes of yellow starthistle. Refer to the Weed Management Handbook on the University of Wyoming Extension website for up-to-date herbicide information. Application of the systemic herbicides clopyralid or picloram between December and April seems to be the most effective. Application during the winter encourages the growth of other, more desirable, plants.

5.4 *Integrated Weed Management Plan for Individual Reservations Template*

Integrated Weed Management Plan Template
BIA Noxious Weed Program-Western Region
Revised: Patricia Wright
(Based on The Nature Conservancy Site Weed Management Plan)

INTEGRATED WEED MANAGEMENT PLAN

FOR

(***NAME of RESERVATION)***
(***TOWN, STATE***)

(Date and/or coverage period)

PREPARED BY (*Authors, Contributors*) (*Program*)

Table of Contents

1. INTRODUCTION

A. Description and purpose of the Weed Management Areas and Zones

What Cooperative Weed Management Area or Zones are the projects affiliated with?

Are there distinctive biological communities, habitat types, land-use histories, or valued species?

What are conservation targets and goals, or major threats to achieving those targets and goals?

Describe special features of any smaller management units.

*State what you **want** on the site.*

Such as:

a biological community and the processes (e.g., fire, flooding) that maintain it;

a species or suite of species that are rare or otherwise valued;

a corridor or a migratory stopover.

B. Description of how weeds interfere with management goals

1) Project justification- Personalize the impact on your particular situation or goals.

2) Briefly describe how these species degrade the site, or could do so if allowed to proliferate. You can copy and paste from the Regional Plan or just cite it.

3) If you determine the impacts of certain species are not as damaging as had been thought and need not be controlled, you can use this section to explain that too.

C. Inventory of plant species that interfere with management goals

Inventory populations of weeds located on and near the site.

Map these populations, estimate (It is better to GPS) the area(s) they cover, and note whether they are increasing, stable or decreasing.

Make one map with locations of all weed species populations shown and separate maps for each weed species.

2. OVERVIEW OF WEED MANAGEMENT PLAN

General Management Philosophy

Weed control techniques as part of the overall site management and restoration program. Focus on desired plant communities, rather than on eliminating weeds.

Preventative steps to keep the site free of weed species that are not yet established

Priorities for the control or elimination of weeds that have already established on the site according to impacts on native species and communities.

Actions to take when leaving the weed unchecked will result in more damage than controlling it with available methods.

Adaptive management

Establish and record the goals and priorities for the site.

Identify species that keep goals from reached and assign priorities based on the severity of their impacts. Act to prevent new infestations and assign highest priority to existing infestations that are the fastest growing, most disruptive, and affect the most highly valued area(s) of the site.

Consider methods for controlling identify priority species to diminish their impacts and, if needed, re-order priorities based on likely impacts on target and non-target species.

Fourth, develop weed control plans based on this information.

Implement the plan and monitor results of management actions.

Evaluate the effectiveness of our methods in light of the site goals, and use this information to modify and improve control priorities, methods and plans.

Start the cycle again by establishing new/modified goals.

Consider the difficulty of control, giving higher priority to infestations you think you are most likely to control with available technology and resources.

Add more detailed information on how you set priorities. You may use Table 1 in the weed template excel worksheet to list your priorities.

Setting Priorities

The priority-setting process can be difficult because you need to consider many factors. It helps to group these factors into four categories to be used as filters to screen out the worst weeds:

8. *current extent of the species on or near the site;*

II. *current and potential impacts of the species;*

III. *value of the habitats/areas that the species infests or may infest; and*

IV. *difficulty of control.*

If a species is described by more than one of the criteria in a given category, assign it the highest priority it qualifies for.

You may assign priority in a ranking system (1, 2, 3..., n) or by class (e.g., A = worst weeds, B = bad weeds, C = minor pests).

8. ***Current extent of the species:*** *Assign priorities in the following sequence:*

1. Species not yet on the site but present nearby. Pay special attention to species known to be pests elsewhere in the weed management area.

2. Species present as new populations or outliers of larger infestations, especially if they are expanding rapidly.

3. Species present in large infestations that continue to expand.

4. Species present in large infestations that are not expanding.

II. Current and potential impacts of the species: *Order priorities based on the management goals for your site.*

III. Value of the habitats/areas the species infests or could infest: *Assign priorities in the following order:*

1. Infestations that occur in the most highly valued habitats or areas of the site — especially areas that contain rare or highly valued species or communities.

2. Infestations that occur in less valued portions of the site. Areas already badly infested with other weeds may be given low priority unless the weeds will make the situation significantly worse.

IV. Difficulty of control and establishing replacement species:

B. Summary of Specific Actions Planned

Briefly (1-3 paragraphs) describe or outline your weed control plan. Note which species you plan to control, where and over what period you plan to do so, the methods you plan to use, which species you plan to monitor and, how you plan to do so. You may also briefly explain why you do not plan to control certain species.

C. Tables

Open the Excel spreadsheet "WeedTabl.xls" and enter data into its tables. You may make hard copies of the tables, but you will not benefit from the automatic calculations in the computer version.

Table 1. Prioritized List of Weed Species

Set ranks or categories using Section 2B for guidelines.

Table 2. Weed Management Plan Implementation Schedule

Schedule the planning, surveying, and treatment for each target weed for at least the next year.

Table 3. Projected Resource Costs to Implement Weed Management Plan

Revise this table annually after comparing estimated to actual costs (obtained from Table 5).

Table 4. Itemized Actual Annual Cost and Labor Worksheet(s) for Each Target Weed

Enter data for each project or target weed to account for yearly costs and labor.

Table 5. Projected and Actual Resource Uses

After each year, examine the difference between actual and estimated resource costs. Use these

results to estimate new resource costs for the upcoming year(s).

(Copy this page and the next page for additional species, or use (cut and paste or refer to) information from BIA Western Region Integrated Noxious Weed Management, Sec 5.4 Weed Management Strategies for Specific Weeds)

3. SPECIFIC CONTROL PLANS FOR HIGH PRIORITY WEED SPECIES

***Scientific name:*__________________ *Common name*:______________________**

Updated _________

8. **PRIORITY _____**

B. DESCRIPTION

(In 2-3 lines list habit, life history, native range, and other outstanding characteristics)

C. CURRENT DISTRIBUTION ON THE SITE

(Refer to maps, Section 1C)

D. DAMAGE & THREATS

(Outline damage caused and threats posed by the species. Refer to Section 1B)

E. GOALS

(Outline long-term goals for this species. For example, you may want to reduce numbers of this species so that it no longer threatens populations of a rare species or so that it does not affect fire frequencies on the site).

F. OBJECTIVES (Measurable)

*(Establish **measurable** objectives for the planned control activities. Include:*

> ***1**. the **impact** on numbers, density, cover, etc. that you want to achieve;*
>
> ***2.** the **size** of the area in which you hope to achieve this;*
>
> ***3**. the **period** in which you hope to achieve it.*

For example you may state your objectives in terms of reducing percent cover of the species by 50% over an area of 5 acres within 3 years. Another possible objective would be eliminating the species from the site within 2 years.)

G. MANAGEMENT OPTIONS

Viable control options are:

> (1) *No treatment;*
>
> (2) *(Treatment alternative 1);*
>
> (3) *(Treatment alternative n); etc.*

(Briefly discuss the alternatives, indicate which are preferred and the conditions (size of area treated, location, phenology, total anticipated cost, etc.) under which they may be used. Build in restricted flexibility to allow those carrying out the plan options; conditions in the field may differ from those you anticipated. State who the field-staff should contact when none of the listed alternatives can be carried out.)

H. ACTIONS PLANNED (Treatments and monitoring)

(Briefly describe the locations to be treated, materials and methods to be used, and an approximate schedule for control and monitoring activities. If several methods are to be tested, outline the design of the planned experiment or demonstration.)

Scientific name:_________________ Common name:____________________

Updated ________

8. **HOW ACTIONS WILL BE EVALUATED (Criteria for success)**

(Outline the methods that will be used to monitor control activities and the criteria that will be used to evaluate success or failure of the program. The criteria for success should be based on the program's objectives and goals. If you develop forms to be used when collecting monitoring data, include copies as Appendix 6)

J. RESOURCE NEEDS

(Estimate the amount of time [for staff, interns and volunteers] and money that will be required to carry out the planned control, monitoring and evaluation for this species.)

K. RESULTS OF EVALUATION

(This section is to be filled in later, preferably within 1 year, when monitoring data has been taken and evaluated, at least preliminarily. The evaluation should be used to determine whether any of the sections B-K above should be modified.)

4. REFERENCES

List references cited or used.

5. APPENDICES

Appendix 1- EMERGENCY INFORMATION: DIRECTIONS AND MAP TO NEARBY HOSPITALS OR CLINICS

Be sure that phone numbers and directions are current.

Appendix 2-BLANK MAPS/SAMPLE MAPS

Attach copies of the blank map(s) of the preserve/site, and of (overlaid) maps depicting the extent of the target weed(s) on the site here.

Appendix 3-FORMS USED IN COLLECTING MONITORING DATA

Attach copies of data collection sheets here.

Use the following 3 appendices if herbicides are to be used.

Appendix 4-HERBICIDE USE PROTOCOLS

Note which herbicide(s) will be used and roughly how much will be used, outline any state and local requirements for applicator licensing and/or posting of treated areas. {Pesticide Use Proposal (PUP)}

How the herbicide(s) will be stored, mixed and transported.

Describe how excess herbicide and any equipment or clothing that has become contaminated will be disposed of.

Describe emergency first aid procedures and plans for responding to spills or contamination.

List who may apply the herbicide(s), and what protective gear will be available for them.

Appendix 5-HERBICIDE USE RECORD FORMS

When using herbicides, the BIA Noxious Weed Program requires detailed records of all relevant pesticide use information. These are the Pesticide Use Record (PUR. A sample PUR is in the Western Region Integrated Noxious Weed Management Plan and Programmatic Environmental Assessment for

Weed Control Projects on Indian Lands, Appendix K . You may use spreadsheets if that is a format you already use.

In addition, it would be helpful to include:

Condition of the site prior to herbicide application,

The type of species present and percent cover of invasive and native species prior to application,

Detailed notes of the type and concentration of the herbicide, the amount, location, and method of application, weather conditions, and any other observations made during the course of application.

This information is important in evaluating the project's success, improving methodology, and identifying mistakes. It also documents the procedure for future program managers.

Appendix 6-HERBICIDE LABELS

Attach copies of the herbicide label(s) here.

6 List of Acronyms and Glossary

6.1.1 Acronyms

Acronyms

ADEQ: Arizona Department of Environmental Quality

AI: Active ingredient

BA/BE: Biological Assessment/ Biological Evaluation

BMP: Best Management Practice

BIA-Bureau of Indian Affairs

CWE: Cumulative Watershed Effects

DOI: Department of Interior

EA: Environmental assessment

EDRR: Early Detection Rapid Response

EJ: Environmental Justice

EMS: Environmental Management System

EPA: Environmental Protection Agency

ESA: Endangered Species Act

GIS: Geographic Information System

IPaC: Information, Planning and Conservation System

IWM: Integrated Weed Management

LCR: Lower Colorado Region

LCT: Lahontan cutthroat trout

LD50: Lethal dose for 50% of population

mg/kg: milligrams per kilogram

Mg/L: Milligrams per liter

NAWQA: National Water-Quality Assessment

NEPA: National Environmental Policy Act

NF: National forest

NFS: National Forest System

NHPA: The National Historic Preservation Act of 1966

NPS: National Park Service

NTTC-National Tribal Toxics Committee

pH: Concentration of hydrogen ion on a scale of 1-14 , designating degree of acidity (low) alkalinity (high).

PPB: Parts per billion

PPE: Personal Protective Equipment

PPM: Parts per million

ROD: Record of Decision

RUP: Restricted Use Pesticides

TES: Threatened and Endangered Species

TOC: Threshold of concern

USDA: United States Department of Agriculture

USFS: United States Forest Service

USGS: United States Geological Survey

USFWS: United States Fish and Wildlife Service

6.1.2 Glossary

Absorption: The process by which the agent is able to pass through the body membranes and enter the bloodstream. The main routes by which toxic agents are absorbed are the gastrointestinal tract, lungs, and skin.

Acidic: Chemical property of a substance forming and acid in solution; having a pH less than 7.

Acrolein: A colorless, flammable, poisonous liquid aldehyde, CH2CHCHO, having an acrid odor and vapors irritating to the eyes**,** found in smoke of fires or tobacco**.**

Active ingredient: The main ingredient produces the desired effect**.**

Adaptive management: Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs.

Adjuvant(s): Formulation factors used to enhance the pharmacological or toxic agent effect of the active ingredient.

Adsorption: The tendency of one herbicide to adhere to another material.

Affected Environment: These are the elements of the physical, biological, social, and economic environment where human activity is proposed and could be affected by the activity.

Alien species: A species (including its seeds, eggs, spores, or other biological material capable of propagating that species) that is not native to a particular ecosystem.

Allelopathic effects: In plant pathology, the term is used to describe the release of substances from one plant that may have an adverse effect on another plant.

Alternative: In project planning, a given combination of resource uses and mix of management practices that achieve a desired management direction, goal, or emphasis.

Alluvium: Loose, unconsolidated soil or sediments, which have been eroded, reshaped by water and redeposited. Alluvium is made up of a variety of materials, including fine particles of silt and clay and larger particles of sand and gravel.

Annuals are plants that propagate by seed and complete their life cycle in one year or less**.** They can be broadleaf plants or grasses.

Aquatic ecosystems: The stream channel, lake, or estuary bed, water, biotic communities, and habitat features that occur therein.

Associated areas: Government and individually-owned land and rights-of-way where weed control on adjacent Indian lands would jointly take place.

Available water: Water that can be used by plants.

Biennials-are plants with a lifespan of two years. They germinate in spring or summer with a rosette or vegetative stage; they store nutrients in a tuberous root and flower in the second year.

Bioagents: Shortened form for of the term biological agents; in this context, for biological control of weeds.

Biocontrol is a shortened form of the term, biological control**.**

Biological Control involves the introduction of a pest's natural enemies to a new locale where they do not occur naturally.

Biological Soil Crusts are communities of specialized organisms within the soil surface layer in arid and semiarid regions. They are a complex mosaic of bacteria, algae, lichens, mosses and microfungi that provide a variety of functions such as retaining soil moisture, protecting the soil from wind and water erosion and discourage weed growth. Microbiotic crust, soil crusts and biological crusts are synonymous terms.

Aquatic invasive plants are introduced plants that have adapted to living in, on, or next to water, and that grow either submerged or partially submerged in water.

Best Management Practices (BMPs): A practice, or combination of practices, that is determined by the state to be the most effective, practicable (including technological, economic, and institutional considerations) means of preventing, or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.

Biodiversity: The distribution and abundance of different plant and animal communities and species, habitats, seral stages, and special habitat components in an ecosystem.

Biologically sensitive: A term used to identify a group of individuals who, because of their developmental stage or some other biological condition, are more susceptible than the general population to an herbicide or biological agent in the environment.

Broadcast spray: Broadcast applications consist of applying a spray solution uniformly over the entire treated area. The kinds of herbicides used are usually selective, such as aminopyralid. When (1) herbicides are applied according to label directions and (2) the equipment is operated properly, broadcast applications are very effective for weed control and are safe on non-target plants.

Broadleaf weed: A non-woody dicotyledonous plant with wide bladed leaves designated as a pest species in gardens, farms, or forests.

Chemical treatments: in this NEPA decision, chemical refers to 'herbicide.'

Chronic exposure: Long-term exposure studies often used to determine the carcinogenic potential of chemicals. These studies are usually performed in rats, mice, or dogs and extend over the average lifetime of the species (for a rat, exposure is 2 years).

Contain: keep weed infestations within a pre-determined perimeter; similar to control.

Contaminants: For herbicides, it means impurities present in a commercial grade herbicide. For biological agents, it means other biological agents present in a commercial product.

Control: Process of limiting an invasive plant infestation to a desirable level; containment.

Cooperative Agreement: A written agreement between tribes, BIA or a county, State, or Federal agency.

Cumulative effects: Changes as a result of more than one action that may enhance or degrade a specific site.

Cumulative exposures: Exposures that may last for several days to several months or exposures resulting from program activities that are repeated more than once during a year or for several consecutive years

Cumulative watershed effects: environmental changes that are affected by more than one land-use activity and that are influenced by processes involving the generation or transport of water.

Chemigation is the application of a pesticide or a system maintenance compound through an irrigation system. Pesticides include herbicides, insecticides, fungicides, rodenticides, fumigants, spray adjuvants, and plant growth regulators. Disinfectants, sanitizers, buffering agents, desiccants, defoliants, and sprout inhibitors are also included under the pesticide definition.

Coniferous is a term applied to vegetation that is cone-bearing, needle-leaved, or scale-leaved evergreen trees often growing in higher elevations or cooler climates.

Dermal: Pertaining to the skin.

Dermal permeability refers to the degree to which an herbicide or herbicide in contact with the skin is able to penetrate the skin.

Dermatitis: Inflammation of the skin, due to either direct contact with an irritating substance, or an allergic reaction.

Dicot: Flowering plants whose seed contains two embryonic leaves. Examples include dandelion, potatoes, sulfur cinquefoil, perennial pepperweed/tall whitetop.

Dissected plateaus: A plateau is a flat, elevated landform that rises sharply above the surrounding They are one of the four major landforms, along with mountains, plains, and hills. Dissected plateaus are deeply eroded plateaus.

Draft Environmental Assessment: The statement of environmental effects required for major Federal actions under Section 102 of the National Environmental Policy Act (NEPA), and released to the public and other agencies for comment and review.

Drift: That portion of a sprayed herbicide that is moved by wind off a target site.

Early Detection Rapid Response: phrase for 'treating new infestations, expanding infestations, and new TIPS species"

Ecological Region denotes areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources

Ecofallow is a method of farming that diminishes weeds and conserves water by rotating crops and reducing or eliminating tillage.

Ecoregion is an abbreviated and more commonly used form of the term, ecological region, as defined above.

Ephemeral: A channel that holds water only during and immediately after rain events

Endangered Species: Any species listed in the Federal Register as being in danger of extinction throughout all or a significant portion of its range.

Environmental Assessment: The statement of environmental effects required for major Federal actions under Section 102 of the National Environmental Policy Act (NEPA).

Environmental Justice: The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Eradication: Elimination of all plants and plant parts of a certain species.

Exotic: Introduced from a foreign country or a different region. An exotic plant is one not native to the place where it is growing, such as Japanese honeysuckle, which has naturalized in the northeastern United States, or eucalyptus trees, which have naturalized on the west coast.

Formulation: A commercial preparation of an herbicide including any inert ingredients or contaminants. Pesticide formulations include substances or vehicles (usually a liquid) to be used as a medium for suspending or dissolving the active ingredient. Commonly used vehicles include water, acetone, and corn oil.

Geographic Range: The collection of all the habitat areas of a species.

Geohydrologic: 1) Pertaining to the branch of hydrology relating to subsurface or subterranean waters; that is, to all waters below the surface. Used interchangeably with hydrogeology 2) Hydrologic and geologic (land) interactions influencing the formation of watersheds.

Gross Acres: This is the entire land surface over which the noxious weeds are dispersed. The acres are defined by drawing a line around the general perimeter of the infestation, not the canopy cover of the plants. The gross acres may contain significant parcels of land that are not occupied by the weeds.

Groundwater: Water that collects or flows beneath the Earth's surface, filling the porous spaces in soil, sediment, and rocks. Groundwater originates from rain and from melting snow and ice and is the source of water for aquifers, springs, and wells. The upper surface of groundwater is the water table.

Habitat: A habitat is the actual location in the environment where an organism lives and consists of all the physical and biological resources available to a species.

Half-life: The time required for the concentration of the herbicide to degrade by one-half. The longer the half-life, the greater the persistence of the herbicide in the environment is.

Hazard identification: The process of identifying the array of potential effects that an agent may induce in an exposed human population.

Herbaceous: A plant, annual, biennial, or perennial, that does not develop persistent woody tissue above the ground, but whose aerial portion naturally dies back to the ground at the end of a growing season

Herbicide: A chemical used to control, suppress, or kill plants.

Hydrology: The science dealing with the occurrence, circulation, distribution, and properties of the waters of the earth and its atmosphere.

Indian Lands$_1$: Lands the title to which is held by the United States in trust for an Indian tribe or lands the title to which is held by an Indian tribe subject to a restriction by the United States against alienation (Public Law 106–179, 106th Congress, Revised Statute U.S.C. 81)

Indian Lands$_2$: Any land located within the boundaries of an Indian reservation, any land held in trust by the United States for the benefit of an Indian Tribe or individual Indian, any land owned by a tribe or individual Indian with restrictions against alienation by the laws of the United States. (Office of Indian Energy and Economic Development)

Impaired waters: A waterbody (i.e., stream reaches, lakes, waterbody segments) with chronic or recurring monitored violations of the applicable numeric and/or narrative water quality criteria.

Infested Acres: This means the same as Net Acres; actual area occupied noxious weeds. See also 'Gross acres.'

Intermittent: A stream that holds water during wet portions of the year

Intermontane Basin: A wide valley between mountain ranges that is partly filled with alluvium**.**

Inerts: Adjuvants and additives in commercial formulations of glyphosate or other herbicides that are not readily active with the other components of the mixture.

Integrated pest management (IPM): A process that determines an economic or environmental threshold for managing pest populations and prescribes the management technique to reach desired conditions. IPM includes four broad categories of techniques: biological, cultural, mechanical, and chemical. (National Strategy and Implementation Plan for Invasive Species Management FS-805 2004)

Integrated Weed Management (IWM): An IWM program is an interdisciplinary management approach for selecting methods for preventing, containing, and controlling noxious weeds in coordination with other resource management activities to achieve optimum management goals and objectives. Methods include: education, preventive measures, herbicide, cultural, physical or mechanical methods, biological control agents, and general land management practices, such as manipulation of livestock or wildlife grazing strategies that accomplish vegetation management objectives.

Introduced: A species is defined as introduced (also known as non-indigenous, alien or exotic) in a certain geographical area, if that area is outside the species' native distributional range, and the species has arrived there by human activity.

Invasive Species: A species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Invertebrate: An animal that does not have a spine (backbone).

Irritant effect: A reversible effect, compared with a corrosive effect.

Larva (pl. larvae): An insect in the earliest stage after hatching.

Lava plain (also lava field or lava bed) is a large expanse of nearly flat-lying lava flows. They are often composed of fluid basalt lava extending for miles across the terrain. Their dark, nearly black color dominates and contrasts sharply with the remaining landscape.

Lethal Concentration50 (LC50): A calculated concentration of an herbicide in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

Lethal Dose50 (LD50): The dose of a herbicide calculated to cause death in 50% of a defined experimental animal population over a specified observation period. The observation period is typically 14 days.

Limited Treatment is a type of weed treatment) such as a perimeter treatment to contain infestation.

Mechanism of action: How the herbicide kills weeds.

Microorganisms: A generic term for all organisms consisting only of a single cell, such as bacteria, viruses, and fungi.

Monitoring: This involves periodic or continuous sampling and measurement to determine the physical, chemical, and biological status of a particular medium, such as air, soil, water or vegetation. Monitoring is used to determine the effects of resource management options or treatments.

Monocots: Flowering plants whose seed contains only one embryonic leaf. Examples include grasses, sedges, rushes, lilies, onions.

MOU: Memorandum of Understanding.

National Environmental Policy Act (NEPA): The United States' basic national charter for protection of the environment. It establishes policy, sets goals, and provides means for carrying out the policy. The Act directs agencies to inform the public of projects, and that agencies consider public comment.

Native plant species: A plant species which occurs naturally in a particular region, state, ecosystem and habitat without direct or indirect human actions.

Niche: A niche refers to the way in which an organism fits into an ecological community or ecosystem. Through the process of natural selection, a niche is the evolutionary result of a species' morphological (morphology r Non-native plants: A plant grown outside of its natural range. Non-selective, broad spectrum herbicides will generally affect all plants that they come in contact with.

Nonattainment area: A locality where air pollution levels persistently exceed National Ambient Air Quality Standards or that contributes to ambient air quality in a nearby area that fails to meet standards.

Non-target: Any plant or animal that a treatment inadvertently or unavoidably harms.

Noxious weed: Those plant species designated as noxious weeds by the Secretary of Agriculture or by BIA Regions, tribes or the responsible State official, that possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being non-native or new to or not common to the United States or parts thereof.

Nuisance plant: A plant which causes offense, annoyance, trouble or injury.

Pathway: Any means or mechanism by which weeds may be dispersed, such as roads and trails, as the result of contaminated products, clothing, machinery, equipment etc.

Perennial plants have an indefinite life cycle. They propagate by a variety of methods including seeds, underground roots and stolon, bulbs and tubers. They are classified as simple, bulbous and creeping perennials.

Perennial stream: A stream that flows throughout the year.

Permeability: The property or condition of being permeable or the ability of a substance to allow another substance to pass through it, such as porous rock, sediment, or soil to transmit fluid through pores and cracks. It can also refer to membranes or skin. (See dermal permeability.)

Pesticide: A chemical used to control, repel, or destroy pests of any sort. Pesticides can be herbicides to kill plants, rodenticides to kill rodents, etc.

pH: The negative log of the hydrogen ion concentration. A high pH (>7) is alkaline or basic and a low pH (<7) is acidic.

Phenology: the study of periodic plant and animal life cycle events and how these are influenced by seasonal and inter-annual variations in climate.

Photosynthetic Pathway indicates the photosynthetic mechanism of the species and the method in which carbon is fixed. There are three types of pathways, C3, C4 and CAM. There are also intermediary plants using both C3 and C4. C3 plants thrive under cool moist conditions. C4 plants reach peak performance at high temperatures and are often drought tolerant. Most broadleaf weeds and cool season grass weeds like quackgrass have the C3 pathway. Most warm season grasses like barnyardgrass and yellow foxtail have the C4 pathway. A few broadleaf weeds, such as redroot pigweed and purslane have the C4 pathway.

Plant materials: Seeds, spores, parts of plants or whole plants.

Protected Activity Center (PAC): This refers to areas of delineation around habitat for a specific animal. Protected activity centers are designed to minimize land disturbance within the delineated area.

Respirable: Capable of being breathed in or small enough to be inhaled, such as an irritating particle.

Rehabilitation: Reparation of ecosystem processes, productivity and services based on functioning pre-existing or existing ecosystems, but allowing for adaptation of sites to specific current or future uses.

Residual: Length of time the herbicide will provide effective weed control.

Restoration: Assisting the recovery of an ecosystem that has been degraded, damaged or destroyed including the re-establishment of the pre-existing biotic integrity in terms of species composition and community structure.

Revegetation: Re-establishment of plants on a site.

Risk: Risk is an assessment of the potential for adverse effects that result from some activity. Almost anything can be toxic if the dose or level of exposure is high enough.

Saline soils contain high levels of sodium which has joined with chlorine to form a salt, NaCl. The presence of salt in the soils reduces the availability of water to plants and damage or destroy them at high rates.

Salinity is usually measured by Electrical Conductivity (EC) in *mmhos/cm*. Slightly saline soils have an EC of 2-4 and strongly saline soils have an EC greater than 16.

Saline-Sodic is the condition of being both saline and sodic at the same time. Sodicity problems may be masked by the salinity symptoms. Saline-sodic soils have a Sodium Adsorption Ration (SAR) of >13 and an EC > 4.

Seasonally flowing stream: Any non-permanent flowing drainage feature having a definable channel and evidence of annual scour and deposition, including ephemeral and intermittent streams with a definable channel and evidence of annual scour or deposition

Sedimentation: The process of sediment deposition, usually resulting from erosion.

Seed bank: Unsprouted seeds in the soil remaining after herbicide or other weed treatment methods. They can remain viable for many years.

Seral stages are ecological process of change in a plant community after disturbance, eventually leading to the potential natural community.

Selective herbicides will affect only some plants.

Seasonally Flowing Stream (includes intermittent and ephemeral streams): 150 feet on each side of the stream, measured from the bank full edge of the stream.

Solarization is an organic weed control method used in areas of sufficient solar radiation. A plastic covering is used to increase the temperature of the soil to reduce weed seed viability and control soil pathogens.

Special Aquatic Features includes lakes, wet meadows, bogs, fens, wetlands, vernal pools, and springs.

Sodic- In sodic soils, chlorine ions (CL-) attached to sodium ions in saline soils have been washed away, leaving behind the sodium ions attached to clay particles in the soil. Soils are considered sodic when their SAR is $\geq$ 13. When wet, the clays in sodic soils lose their ability to stick together, leading to unstable soils which readily erode and become impermeable to both water and plant roots. They often have a severe surface crust.

Soil Moisture Regimes Soil moisture regimes are primarily based on regional climate and its effect on groundwater levels and the presence or absence of available water. Aquic moisture regimes are based on the length of the period that the soil was saturated.

Soil moisture regime classes	
Aquic (or Perudic)	Saturated with water long enough to cause oxygen depletion.
Udic	Humid or subhumid climate.
Ustic	Semiarid climate.
Aridic (or Torric)	Arid climate.
Xeric	Mediterranean climate (moist, cool winters and dry, warm summers)

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Soil Orders are the most general level of classification in the USDA system of Soil Taxonomy. There are 12 soil orders defined by dominant characteristic affecting soils, such as vegetation, parent material, climate and soil development or weathering.

Soil Orders and General Descriptions			
Type	**Description**	**Type**	**Description**
Entisols	Little, if any horizon development	Inceptisols	Beginning of horizon development
Aridisols	Soils located in arid climates	Mollisols	Soft, grassland soils with deep dark surface layer
Alfisols	Deciduous forests or shrub land, light-colored or shallow dark surface, subsurface clay layer.	Spodosols	Acidic, coniferous forest soils
Ultisols	Extensively weathered soils	Oxisols	Extremely weathered, tropical soils
Gelisols	Soils containing permafrost	Histosols	Soils formed in organic material
Andisols	Soil formed in volcanic material	Vertisols	Shrinking and swelling clay soils

Tim Kettler, University of Nebraska-Lincoln and Bill Zanner, University of Minnesota, St. Paul, Minnesota, Plant and Soil Sciences elibrary, Soil Genesis and Development, Lesson 5 — Soil Classification and Geography.(slightly modified)

Soil Quality Standards (SQS): Threshold values that indicate when changes in soil properties and soil conditions would result in significant change or impairment of productivity potential, hydrologic function, or buffering capacity of the soil. Detrimental soil disturbance is the resulting condition when threshold values are exceeded.

Soil Temperature Regimes-A system in soil taxonomy, based on mean annual soil temperatures at a depth of 50 cm from the soil surface, using the Celsius (centigrade) scale.

Soil Temperature Class	Temperature Range
Frigid	Lower than 8° C
Mesic	8° C to 15° C
Thermic	15° C to 22° C
Hyperthermic	22° C or higher

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Spot spray: For most herbicide applications in natural areas, spot spraying is preferred. This permits application of the chemical just to target species. Foliar application should be made with a low-pressure (20-50 psi) backpack sprayer equipped with a wand applicator. A sprayer nozzle which creates a flat or cone-shaped pattern is preferable. The herbicide should be allowed to dry for at least two hours to ensure adequate absorption. (Do not spray when rainfall is threatened.) Addition of a nonionic surfactant to the mixture helps ensure complete leaf coverage and increases the rate of absorption. The herbicide should thoroughly cover the foliage but not to the point of run-off. Personnel applying herbicide must be properly trained and knowledgeable about the native vegetation.

Surfactant: Short for 'SURFace ACTive AgeNT' – a surfactant is a molecule/compound that reduces the surface tension of water, thereby permitting it to penetrate a material more easily or to spread over the surface. For aquatic labeled herbicides, if the label states that surfactants are needed, then one (or more) should be added. Make sure to use only an aquatic registered surfactant for aquatic herbicides.

Systemic herbicides are capable of killing the entire plant, vs. contact herbicides which kill only that part of the plant that comes in contact with the herbicide.

Systemic toxicity: Effects that require absorption and distribution of a toxic agent to a site distant from its entry point at which point effects are produced.

Systemic effects are the obverse of local effects.

Terrestrial: Anything that lives on land as opposed to living in an aquatic environment.

Tablelands: A flat, elevated region; a plateau or mesa.

Threatened and Endangered Species (TES): A plant or animal species identified, defined, and recorded in the Federal Register, as being in danger of extinction throughout all or a significant portion of its range, in accordance with the Endangered Species Act of 1976.

Threshold: The maximum dose or concentration level of an herbicide or biological agent that will not cause an effect in the organism.

Toxicity: The inherent ability of an agent to affect living organisms adversely.

Tribal Land includes:

Fee land purchased by tribes **-** The tribe acquires legal title under specific statutory authority. Fee land owned by a tribe outside the boundaries of a reservation is not subject to legal restrictions against alienation or encumbrance, absent any special circumstance.

Restricted fee land **-**The tribe holds legal title but with legal restrictions against alienation or encumbrance

Trust land **-**The federal government holds legal title but the beneficial interest remains with the tribe

Tribally-owned lands: Land that is owned by a group of Indians recognized by the federal government as an Indian tribe. Tribal lands are held in Trust by the U.S. Government on behalf of the tribes.

Undesirable Plants: Plant species that are classified as undesirable, noxious, harmful, exotic, injurious, or poisonous pursuant to State or Federal laws. Species listed as threatened or endangered by the Secretary of the Interior according to the Endangered Species Act of 1973 are not classified as undesirable plants.

Upland: Any natural plant habitat that does not qualify as a wetland because the hydrologic regime is not sufficiently wet to elicit development of vegetation, soils, or hydrologic characteristics associated with wetlands**.**

Upland vegetation: Plant species that are consistently found in upland areas.

Vertebrate: An animal that has a spinal column (backbone).

Volatile: Referring to compounds or substances that have a tendency to vaporize. A material that will evaporate quickly (also volatility-state of being volatile)

Watershed: Area that drains or contributes water to a particular point, stream, river, lake, or ocean. Larger watersheds are also referred to as basins. Watersheds range in size from a few acres for a small stream to large areas of the country.

Waters of the United States applies to the jurisdictional limits of the authority of the Corps of Engineers under the Clean Water Act. (Further defined in Section 3.2.4)

Weed. A plant that is considered to be a nuisance, applied to unwanted plants in human-made or natural settings such as gardens, lawns, agricultural areas, parks, woods or other natural areas. It refers to native or nonnative plants that grow and reproduce aggressively.

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8 Appendices

8.1 *Appendix A Weed Survey Responses*

Survey Questions and Responses

Tribe or Agency	Major Invasive Species	Estimated Infested Acres	Common Control Methods	Tribal Restriction on Control Methods	Unique Features of Reservation affecting weed management	Primary Concern for Invasive Species Management
Duckwater Shoshone Tribe	Russian knapweed, Perennial pepperweed, hoary cress, salt cedar, foxtail, cockle bur	1000	Integrated (Chemical, cultural, mechanical, goats) Would use biological but not available.	None	Critical habitat for Railroad Valley Springfish. Tribe has worked to restore this species. Extensive coordination with USFWS and NDOW .	Adverse impacts to our agricultural and ranching business, the threat of losing native habitat esp. around geothermal springs, invasives crowding out and creating mono-cultures where native plants once were. The plants are critical to local cultural and spiritual practices of the tribal people,. The Tribe implements an integrated noxious/invasive weed control program to bring environmental health back to our lands and improve our economy based on natural resources.
Moapa Band of Paiutes	Tamarisk, yellow star thistle, R. knapweed, whitetop, bindweed, puncture vine	500	Chemical, mechanical, integrated.	None	(Prior to implementing weed control projects) Tamarisk and other invasives were taking over the Moapa Paiute Reservation.	Over 800 acres of crop fields, pastures and range forage for cattle need to be managed for full utilization. Native habitat needs to be restored near the Muddy river and in vacant lots taken over by hazardous fuel vegetation. The native willow species have been used for baskets by the Tribe's culture for centuries as well as other edible and medicinal plants in the Moapa Valley.
Uintah and Ouray Agency	R. knapweed, P. pepperweed, R. olive	30,000	Chemical, mechanical	No ATV's for weed control	Size of reservation is problem for one weed man.	Primary concern is to stop the spread of invasive weeds and locate and spray small infestations.
Tohono O'odham Nation	Buffelgrass, red brome, Lehmann's lovegrass	Unknown- several thousand.	Mechanical	None		Restoration of native habitat is an important factor on our reservation, but the potential for buffelgrass-fueled wildfire is a much more immediate concern and can have greater impacts on native habitats especially in Sonoran desert where most of vegetation is not fire-adapted and will not recover quickly.

			integrated			to a more natural condition. One of the reasons, but not the only, the tribe wants to restore the area is to insure that there are enough plants for cultural use.
Colorado Indian Tribe/Agency	Salt cedar	200-300 along Co River, 200 or more irrigation drainage systems.	Mechanical in Irrigation Project, chemical and cultural by CRIT BAER rehab efforts after fire.	Restrictions on type of chemical that can be applied. BAER plan herbicides were accepted.	It has been suggested that salt cedar is somehow habitat for Willow Fly Catcher and should not be eradicated. We find it odd that a destructive plant could be considered appropriate habitat for an ES native to the area being invaded by salt cedar. We believe the fly catcher will move to native groves whenever they are available.	
Hopi Tribe	Tamarisk, R. Olive, R. Thistle	79% of 1.7 mil acres	None, some chemical	1968 Resolution not to use chemicals on land base.	Will address this later in the consultation process after we see the draft EA.	Use by the tribe varies. Cultural practices play a big part in who we are as a tribe. Plant species used for ceremonial purposes is decreasing due to overgrazing, drought and being replaced by invasive plants.
Hopi Agency	Camelthorn, R.knapweed, scotch-musk-bull thistle, Yellow Star thistle, dalamation toadflax, leafy spurge, diffuse and spotted knapweed.	Hopi Natural Resources has acres	Mechanical, some herbicides	Not aware of resolutions/practices.	None	Reduce spread of noxious and invasive weeds.
Eastern Nevada Agency	Whitetop, thistle, leafy spurge	Approx 500 on S.Fork	Chemical	Unaware of any.	There are a lot of affected areas along major river arteries.	
The 5 Southern Paiute Tribes of UT, NV &AZ	Salt cedar, Scotch thistle, yellow star thistle	Don't know	Chemical	None, that I am aware of.	Kaibab is mostly rangeland with <200 acres of center pivot and inactive orchard. Moapa has complicated water adjudication and irrigation issues.	Salt cedar is a problem at both Kaibab and Moapa. They do not actively farm at this time. I am not aware if there are particular practices associated with cultural plants to protect and promote them.

San Carlos Apache Tribe	Salt cedar, spotted knapweed	Thousands	Mechanical and chemical	No aerial spraying		The removal of salt cedar is to restore riparian areas along with preserving native vegetation for culturally important uses. Spotted knapweed is removed to eliminate harm to cattle and grazing lands.
San Carlos Agency	Salt cedar, red brome, puncture vine, other annual, native woody species	5000 acres plus salt cedar	Mechanical and fire			
White Mountain Apache Tribe	Salt cedar, Russian knapweed, yellow star thistle, Johnson grass, Chinese elm, jointed goatgrass, bull thistle and others	Unknown	On a small percentage of areas infested, an integrated approach is used.	Informal restrictions on spraying		Invasive plants have the potential to adversely affect the environment. If left uncontrolled, these plants could have huge economic impacts.
Hualapai	Scotch thistle and milkweed	100	Chemical	None	None	
Yavapai Prescott Indian Tribe	Scotch thistle, Russian knapweed	Not answered	Integrated	None		
Pyramid Lake Paiute Tribe	Tamarisk, tall whitetop, purple loosestrife, musk thistle, yellow star thistle	50, 000	Chemical, biological, mechanical (Integrated)	None that I am aware of.		The tribe has a fishery with T & E species. This requires an improved riparian corridor, protection of corridor from livestock and sustainability for our cultural resources.
Paiute Indian Tribe of Utah	Scotch thistle, Bullhead, Canada thistle, Tamarisk	500	Chemical	None	Utah Prairie Dogs	**Improve Crop or Range Production.** Our reservation is very short of water. Some species infest wetter areas where animals drink. Thistle causes damages to animal's eyes. Salt cedar invades waterways and crowds out plants used by livestock for feed.
Cocopah Indian Tribe	Salt cedar, phragmites	2000	Mechanical, chemical,	Not answered.	14 miles of riparian corridor with the border of Mexico.	All of the invasive species occur in the riparian corridor and the tribe wants to restore the entire corridor

Navajo Region	Thistle, knapweed, R.olive, tamarisk	No answer	Chemical	None, Navajo has own pesticide program.	Protection of water resources would be a fundamental concern.	
BIA Western Region Forestry	Salt cedar, cheatgrass	Over 1 million	Mechanical and chemical treatments of salt cedar.	Some by Havasupai Tribe, possibly rescinded along Havasu Creek.	Cultural properties, riparian areas, salt cedar and "willow fly catcher" habitat.	Reduce the threat of wildand fire to residences and businesses impacted by the threat and growth of explosive stands of salt cedar and other exotic plant species.

8.2 *Appendix B-Public Comments and Responses*

Appendix B- PUBLIC COMMENTS and RESPONSES

Submitted at Public Meetings July-August 2010

Comments 1-13 are from the July 7th meeting in Phoenix; 14-20 are from August 10 meeting at Pyramid Lake for Western Nevada tribes. Comments 21-25 are from the meeting at Eastern Nevada Agency on August 12 and #'s 26-33 are from the August 17th meeting at Fort Yuma Agency. Comments 34-40 are from the July 16th meeting held in St. George Utah.

Table 8.2 Public Meeting Comments and Response to Comments

Comment	Summary of Comment	Response to Comment
1.	**Coordinate with agencies outside of BIA. Obtain input from USFS, EPA, NRCS, USFWS, ADOT, SRP, BOR, SCIP and others.**	**Draft copies of the EA will be sent to these agencies. Coordination meetings will be set up as time permits.**
2.	**Is the EA for Noxious Weeds or Invasive Species? Should it include native plants targeted for removal on some reservations for range improvement?**	**Invasive species is a broad term covering all types of invasive organisms, not just plants. Noxious weeds are regionally/politically defined by BIA, states, tribes, etc. We will use the term noxious weed for this EA. Concerns about invasive native plants can be included in the planning process but are not part of the evaluation of this EA.**
3.	**Consult with local weed groups on noxious weed list.**	**The BIA noxious weed list was updated as a result of the scoping meetings. Additional input will be obtained from local weed groups on weeds of local importance.**
4.	**Be aware that some medicinal or culturally-significant plant may be listed as noxious weeds.**	**This has been noted and the plant species cited will be handled cautiously in the EA process. Tribes will time to provide additional comments on such species during the comment period on Draft EA.**
5.	**The tribes want to have a variety of control methods identified and analyzed in the EA.**	**This has been addressed.**
6.	**Include lists of Endangered Species as an appendix.**	**This is noted and will be incorporated into the document.**

7.	**Include Adaptive Management, climate change, and Indian trust assets. Address that weeds are climate/rainfall dependent.**	**This is noted and will be incorporated into the document.**
8.	**Describe management strategies that can be tied to a number of weed species.**	**This is noted and will be incorporated into the document.**
9.	**Include funding sources to tie into action items for management plan.**	**This is noted and will be incorporated into the document.**
10.	**The Public Law 638 grant process is misunderstood by some tribal personnel. Tribes want training and have been unable to get it.**	**This will be brought to the attention of key people and addressed in grant-writing workshops provided to tribes.**
11.	**What are the requirements for weed control on transportation projects? Tribes believe that road crews were causing weed problems.**	**To address this, the regional director and/or superintendents need to implement policies to encourage cooperation between departments on weed control efforts. Training videos on weed control along roadways have been obtained and training needs to be set up.**
12.	**Develop range and agricultural management plans that address weed control efforts. Provide funding for these plans like Forestry has.**	**Although outside of the scope of this EA, this is an important consideration. In some BIA regions where range inventories are complete, inventory dollars are being used for range management plans.**
13.	**Work together within the agency (Transportation, Forestry, Irrigation, Natural Resources) and outside of the agency to coordinate efforts and fill in the gaps to accomplish more with our weed control dollars.**	**The coordination occurring as a result of the EA is a start but much more needs to be done under regional, division and agency leadership.**
14.	**The BLM is an adjacent landowner to most Indian lands. There is a communication breakdown with BLM.**	**Discussions have been held with some local BLM weed coordinators. Contacts with other BLM coordinators can be made to further the communication process.**
15.	**Add aquatic noxious weeds to the high priority list. Eurasian water milfoil was suggested due to the impact on tribal fisheries and endangered species. Curly-leaf pondweed should be added to watch list.**	**A few aquatic species were added to the list but these two were missed. They will be reviewed and considered for inclusion.**

16.	**Tribes need funds by March to start their programs for early control. They would support an earlier grant deadline such as October, if it would get funds to them earlier.**	**An earlier deadline was made but it had no effect on an earlier distribution of funding. Part, but not all, of the issue was due to the Continuing Resolution and the two-part funding distributions.**
17.	**Tribes are interested in biological control workshops.**	**Money was set aside for these workshops for 2011. Three workshops were held.**
18.	**Tribes need local source of native plants and native plant seed.**	**It was noted that there is a USDA Plant Material Center near Fallon that provides native seed but no further follow-up had been done on this item.**
19.	**EPA NPDES permitting and National Certification and Training Plan for Restricted Use Pesticide Applicators issues were discussed.**	**BIA has become heavily involved in these issues and the outcome is currently being decided.**
20.	**The EA needs to be streamlined and not reinvent the wheel. Paperwork reduction clauses were cited.**	**BLM has produced a 3 volume EIS. BLM Districts have weed management plans. The USFS has weed EA's for each forest. These will be used and cited as much as possible. Items unique to tribes and reservations including Indian trust assets, etc. need to be addressed in the EA.**
21.	**Tribes disagree with acreage point deduction for large infestations for the BIA grant. They said there are no biological control agents for their weeds and this puts them at a disadvantage.**	**This comment not yet been reviewed by the weed program coordinators. Tribes making these comments were fully funded in 2011. Most of the points affecting funding are due to tribes not having enough cost-share. This could be more of an issue in future years of limited funding.**
22.	**Goats are being described as biological control in the literature and tribes should be able to get the offset points for using specific and managed grazing such as the goats.**	**This has been noted but guidance issued by national ag and range program leader has not been changed at this time.**
23.	**Focus on a particular weed and outline control methods for that weed.**	**This is one way the management plan will be structured.**
24.	**Tribes are interested in weed control training for road maintenance crews.**	**Training videos on weed control along roadways have been obtained and training needs to be set up.**

25.	**Halogeton and kochia are not on the noxious list.**	**These were added to the Western Region Noxious Weed list.**
26.	**Phragmites, common reed, giant reed should be added to Noxious weed list. Giant Salvinia status should be elevated to high. Nutgrass and quailbush are other problem plants.**	**Phragmites, common and giant reed were added to the Noxious Weed list. Quailbush is a native shrub and cannot be added to the BIA Western Region Noxious Weed list.**
27.	**The protocol and consultation process for removing tamarisk in willow flycatcher habitat needs to be specified in the EA.**	**This will be included in the EA.**
28.	**Herbicide resistance to Garlon * 4, Pathfinder 2 and Remedy, all triclopyr formulations, has become an issue. The trees are re-sprouting and have to be painted 3 or more times.**	**This has been researched and techniques to avoid this resistance will be specified in the management plan.**
29.	**White and yellow sweet clover, purslane and arrow weed are problems in this area. (Fort Yuma)**	
30.	**There are problems with restoration/revegetation projects in obtaining enough water to get the willows and cottonwoods and other native vegetation to grow.**	**Funding sources have been explored but not found to be adequate within the BIA.**
31.	**Analysis of control methods for mistletoe in mesquite is desired.**	**This was researched but it was determined that since it is a native plant, it will NOT be included in the management plan. There is some scientific thought that it is not a threat to native trees.**
32.	**Are we able to use weed control funds to clean up abandoned leases?**	**When weed control funding is plentiful, this may not be a problem. BIA agencies could apply for funds to do this but their funding should not compete with or impede tribes from completing their weed projects. Cleaning up the weedy abandoned allotments would benefit the allotment owner, the operator and the tribe.**
33.	**Various disciplines have the opportunity to work together on weed management objectives. The BIA weed program could help supplement the ongoing weed control.**	

34.	**Why is the environmental assessment needed now? Why are the requirements to have a pesticide applicators license and filling out the pesticide use proposal and records not enough to ensure adequate environmental documentation?**	**Although the pesticide license and records would help prevent environmental harm, they are not the complete NEPA process. Every federal agency which dispenses weed control funding is required to have evaluated the proposed action for environmental impacts under NEPA. Until now, tribes submitting proposals had to provide their own environmental documentation. This is a burden on the tribes since they often did not have funding for this.**
35.	**Some tribes have staff members who object to the use of pesticides. How should this preference be incorporated into the alternatives?**	**At the meeting, we discussed only going with two alternatives but since there are enough tribes who have legitimate concerns about the use of chemicals and given the potential controversial nature of chemical or biological application , the alternative not to use these procedures will be a third alternative and evaluated separately.**
36.	**Specific rivers need not be listed in the Affected Environment section and can be generalize into riparian zones.**	**This comment was noted and the EA will adopt this approach.**
37.	**All the herbicides labeled for a certain weed need not be listed in the EA. There can be up to 50 herbicides for 1 weed.**	**Trade names will not be used. Chemical names may be used but much of this information has already been evaluated in the BLM EIS and will be cited as briefly as possible.**
38.	**Instead of listing all the techniques for specific weeds, describe the techniques and then list the weeds the management practices would be successful on.**	**In order to accommodate this comment and comment #23, a matrix will be incorporated into the EA, which allows the tribe to view both the control method and the weeds these methods work best on.**
40.	**ACTION ITEMS-Participants want: 1) training and information on the various weed control methods; including what chemical to spray on specific weeds 2) an understanding of biological control methods and organic and non-chemical methods.**	**Two GPS/Weed workshops were held in Western Region in 2011 and 2012 One was in Elko Nevada and the other one in Sacaton, AZ. The workshops had experts from various weed control topics speak. Biological control workshops were held separately.**

8.3 *Appendix C-Catalog of Forest Acres*

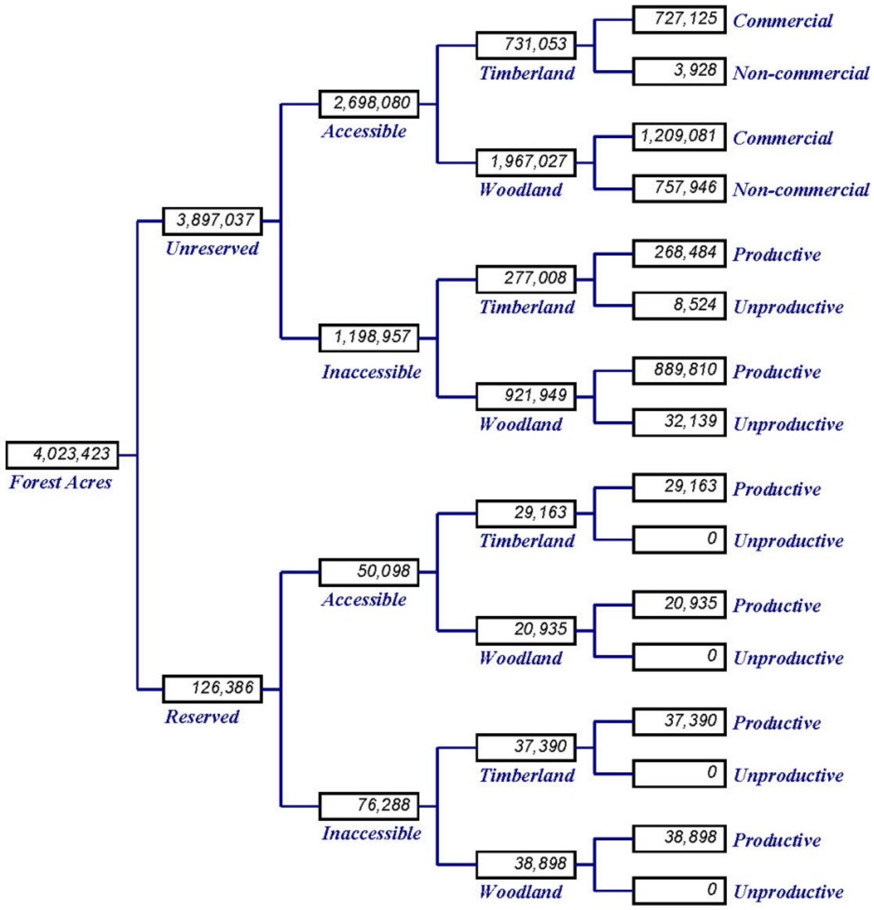
Table 8.3 Catalog of Forest Acres

Appendix C

Catalog of Forest Acres
Acres by Land Class
September 30, 2010

Summary for All Forested Reservations
WESTERN Region

Reservation Acres: 12,637,520
Nonforest Acres: 8,614,097
Forest Acres: 4,023,423



Note: This page contains BOTH Trust and Non-Trust Reservation Acreage

The above information has been derived from the current data contained in the National Indian Forestry Database. NOTE: all trust lands are to be stratified in this manner and in accordance with the definitions in the HANDBOOK ON FOREST MANAGEMENT INVENTORIES AND USE OF DATA IN MANAGEMENT PLANNING, 1983.

Appendix D-Total Acres of Rangeland and Farmland in Western Region

Table 8.4 Western Region Farmland and Rangeland Acres

RESERVATION	Total Acres Farmland	Total Acres Rangeland
Colorado River	99,375	135,191
Chemehuevi	1900	
Fort Mohave	17,109	
Duck Valley	12,000	289,819
Goshute	0	105,882
Duckwater	3814	2,871
Odgers Ranch	0	1,987
South Fork	13693	11,149
Fort Apache	5541	1631277
Cocopah	2450	
Quechan	9000	
Hopi- Trust Lands	2034	1135273
Hopi- Non-Trust Lands	0	305500
TON	10,500	2,805,126
Hia Ced O'odham Land	0	640
San Xavier	1,173	
Maricopa Ak-Chin	16000	
Gila River	74700	
Fort McDowell	1500	21000
Salt River	12000	20000
San Carlos Apache	1700	1,821,274

RESERVATION	Total Acres Farmland	Total Acres Rangeland
Kanosh		**500**
San Juan Paiute		4,989
Kaibab	200	91,000
Moapa	667	
Shivwits	200	27,509
Havasupai	125	123,010
Hualapai		824,692
Yavapai- Apache	300	
Yavapai-		871
Uintah and	80,000	282,982
Skull Valley	1632	
Fallon	4877	
Fort McDermitt	5574	34,245
Hog John Ranch	0	3,538
Pyramid Lake	1860	303,360
Summit Lake	500	10,098
Walker River	2943	313,690
Yomba	1216	
Washoe Ranches	447	2,600
W. Nev. Public Domain Allotments	0	60,222
Yerington Campbell Ranch	900	
TOTAL WR ACRES	384,438	10,370,295

8.4 *Appendix E Impaired Waters*

8.4.1 List of Arizona Impaired Waters for Pesticides

Arizona Impaired Waters, Cause of Impairment Group: Pesticides, Reporting Year 2008

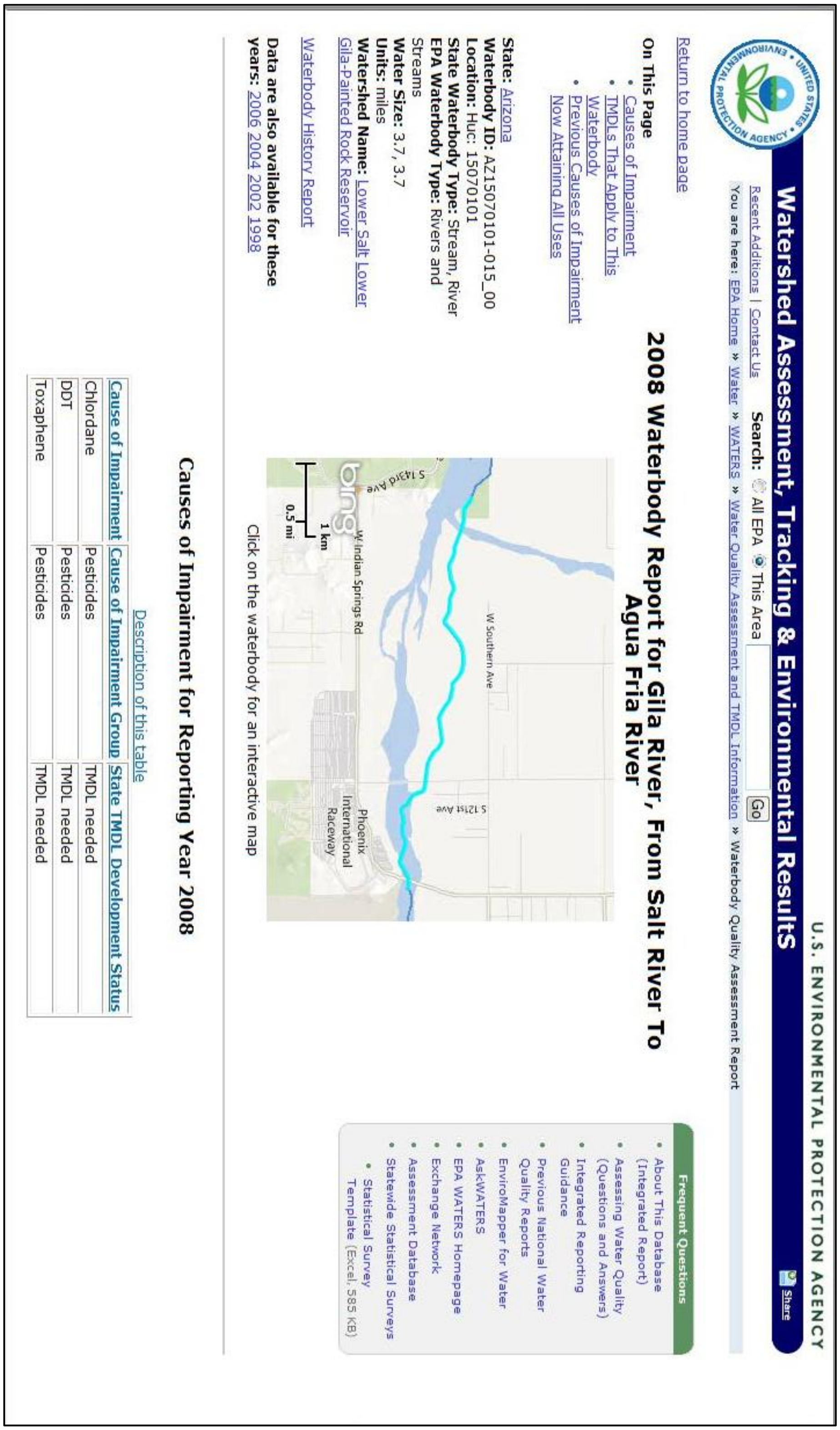
Description of this table

NOTE: Click on the underlined Waterbody Name for a detailed Listed Water Report. Click on the underlined "Waterbody Map" for a map of the Listed Water.

State	Waterbody Name	Map	State Basin Name	Location
AZ	GILA RIVER, FROM AGUA FRIA RIVER TO WATERMAN WASH	Waterbody Map		HUC: 15070101
AZ	GILA RIVER, FROM CENTENNIAL WASH TO GILLESPIE DAM	Waterbody Map		HUC: 15070101
AZ	GILA RIVER, FROM GILLESPIE DAM TO RAINBOW WASH	Waterbody Map		HUC: 15070101
AZ	GILA RIVER, FROM HASSAYAMPA RIVER TO CENTENNIAL WASH	Waterbody Map		HUC: 15070101
AZ	GILA RIVER, FROM RAINBOW WASH TO SAND TANK WASH	Waterbody Map		HUC: 15070101
AZ	GILA RIVER, FROM SALT RIVER TO AGUA FRIA RIVER	Waterbody Map		HUC: 15070101
AZ	GILA RIVER, FROM SAND TANK WASH TO PAINTED ROCK RESERVOIR	Waterbody Map		HUC: 15070101
AZ	GILA RIVER, FROM WATERMAN WASH TO HASSAYAMPA RIVER	Waterbody Map		HUC: 15070101
AZ	HASSAYAMPA RIVER, FROM BUCKEYE CANAL TO GILA RIVER	Waterbody Map		HUC: 15070103
AZ	PAINTED ROCK BORROW PIT LAKE	Waterbody Map		HUC: 15070201
AZ	PAINTED ROCK RESERVOIR, PERENNIAL WATER	Waterbody Map		HUC: 15070101
AZ	SALT RIVER, FROM 23RD AVENUE WWTP OUTFALL TO GILA RIVER	Waterbody Map		HUC: 15060106

8.4.2 Map of Arizona Impaired Waters for Pesticides

Table 8.5 Map of Arizona Impaired Waters for Pesticides


U.S. ENVIRONMENTAL PROTECTION AGENCY

Watershed Assessment, Tracking & Environmental ResultS

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Return to home page

On This Page

- Causes of Impairment
- TMDLs That Apply to This Waterbody
- Previous Causes of Impairment Now Attaining All Uses

State: Arizona
Waterbody ID: AZ15070101-015_00
Location: Huc: 15070101
State Waterbody Type: Stream, River
EPA Waterbody Type: Rivers and Streams
Water Size: 3.7, 3.7
Units: miles
Watershed Name: Lower Salt Lower Gila-Painted Rock Reservoir

Waterbody History Report

Data are also available for these years: 2006 2004 2002 1998

2008 Waterbody Report for Gila River, From Salt River To Agua Fria River

Click on the waterbody for an interactive map

Frequent Questions

- About This Database (Integrated Report)
- Assessing Water Quality (Questions and Answers)
- Integrated Reporting Guidance
- Previous National Water Quality Reports
- EnviroMapper for Water
- AskWATERS
- EPA WATERS Homepage
- Exchange Network
- Assessment Database
- Statewide Statistical Surveys
  - Statistical Survey Template (Excel, 585 KB)

Causes of Impairment for Reporting Year 2008

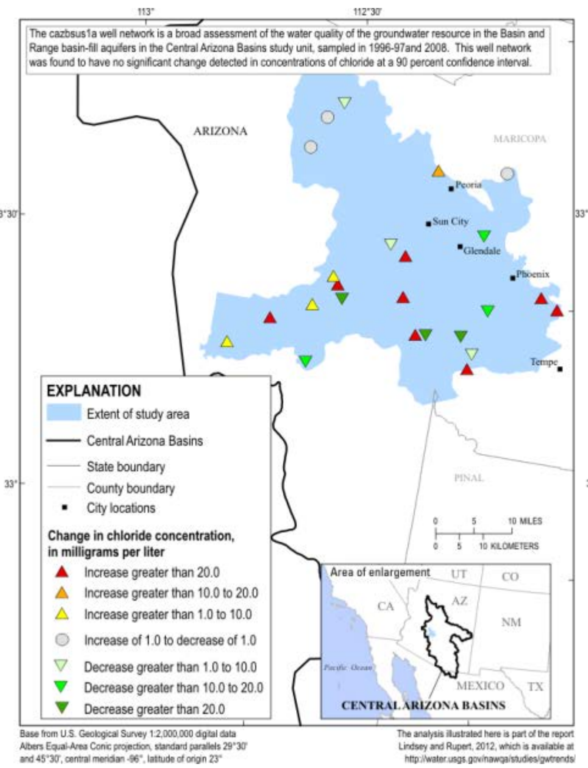
Description of this table

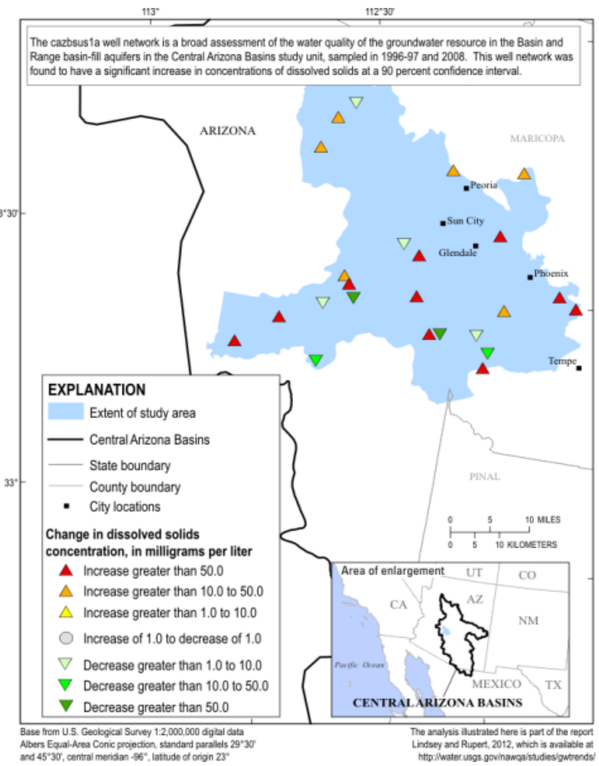
Cause of Impairment	Cause of Impairment Group	State TMDL Development Status
Chlordane	Pesticides	TMDL needed
DDT	Pesticides	TMDL needed
Toxaphene	Pesticides	TMDL needed

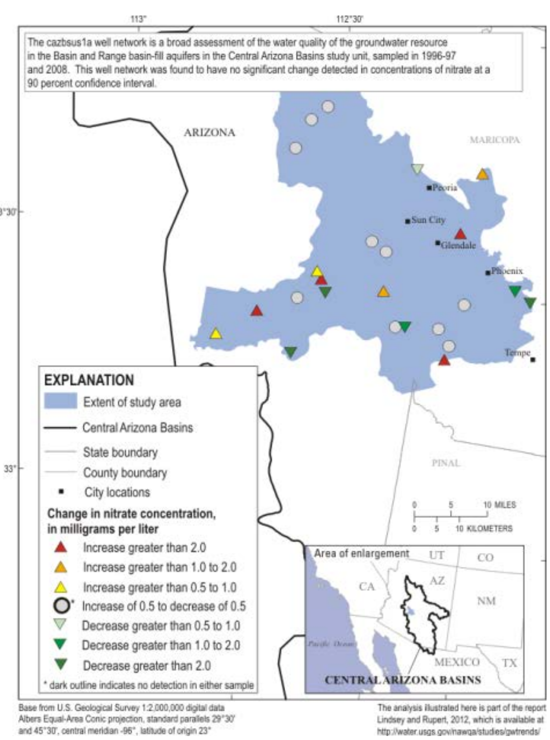
8.4.3 Groundwater-Quality Trends

Lindsey, B.D., and Rupert, M.G., 2012,

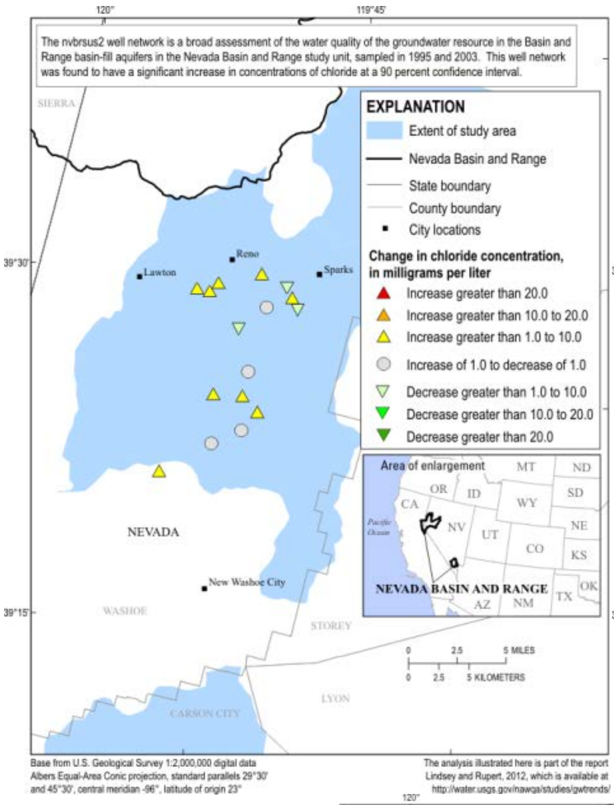
8.4.3.1 Central Arizona Basin

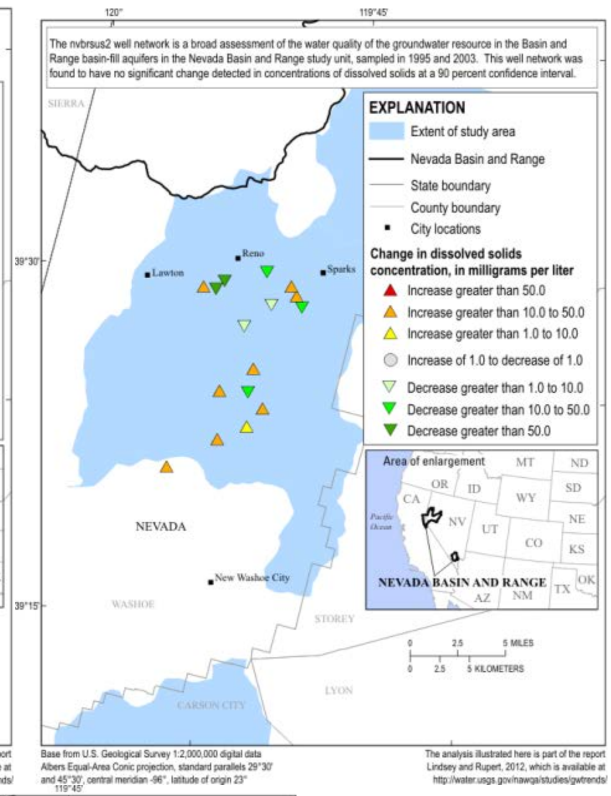


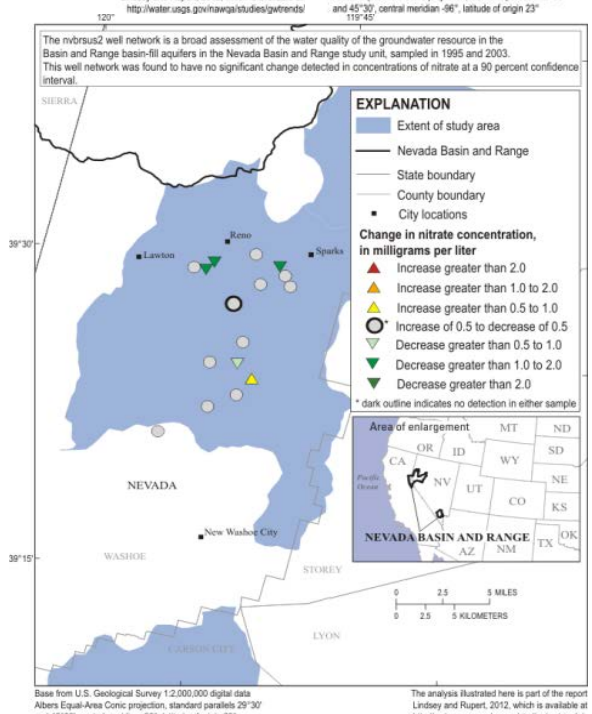




8.4.3.2 Nevada Basin and Range







http://water.usgs.gov/nawqa/studies/gwtrends/map.php?map=CL

8.4.4 Best Management Practices to Protect Groundwater from Pesticide Contamination

ADEQ
Arizona Department
of Environmental Quality

Some pesticides have been detected in Arizona groundwater at low concentrations (parts per billion range). To the best of our knowledge, these detections do not constitute a health hazard to the general public. The purpose of our Education and Outreach Plan is to encourage users of pesticides to adopt voluntary best management practices (BMPs) that will prevent pesticide migration into groundwater, particularly in areas with shallow groundwater and coarse-textured soils.

Goal: To actively manage pesticides of concern to protect groundwater through education
and outreach.

Managing Pesticides to Protect Groundwater Quality

Best Management Practices

a. Field Scouting.

- Regularly monitor the field for both pest and predator populations.
- Pests include insects, weeds, and diseases.

b. Cultural Practices.

- Evaluate whether an alternate form of biological control (such as predators, insect parasitoids and microbes) or other cultural practice may be used.
- Consider whether varieties or crops more resistant to known pests are available.
- Time your planting and harvest to minimize pest damage if applicable.
- Consider the opportunity to avoid pest build-up when you evaluate crop rotation.
- Grow crops on soil types that are most beneficial to that crop. This may help fight pest pressures.

c. Application.

- Apply the pesticide when it will be most effective. Pests have cycles as well, which are influenced by temperature and moisture.
- Match pesticide rates with pest conditions and pests.
- Delay pesticide applications for impending rain activities.

8.5 *Appendix F-Waters of the United States*

8.5.1 Nationwide Permit 27-Habitat Restoration Activities

U S Army Corps of Engineers
Sacramento District

Nationwide Permit Summary

33 CFR Part 330; Issuance of Nationwide Permits – March 19, 2012

27. Aquatic Habitat Restoration, Establishment, and Enhancement Activities. Activities in waters of the United States associated with the restoration, enhancement, and establishment of tidal and non-tidal wetlands and riparian areas, the restoration and enhancement of non-tidal streams and other non-tidal open waters, and the rehabilitation or enhancement of tidal streams, tidal wetlands, and tidal open waters, provided those activities result in net increases in aquatic resource functions and services.

To the extent that a Corps permit is required, activities authorized by this NWP include, but are not limited to: the removal of accumulated sediments; the installation, removal, and maintenance of small water control structures, dikes, and berms, as well as discharges of dredged or fill material to restore appropriate stream channel configurations after small water control structures, dikes, and berms, are removed; the installation of current deflectors; the enhancement, restoration, or establishment of riffle and pool stream structure; the placement of in-stream habitat structures; modifications of the stream bed and/or banks to restore or establish stream meanders; the backfilling of artificial channels; the removal of existing drainage structures, such as drain tiles, and the filling, blocking, or reshaping of drainage ditches to restore wetland hydrology; the installation of structures or fills necessary to establish or reestablish wetland or stream hydrology; the construction of small nesting islands; the construction of open water areas; the construction of oyster habitat over unvegetated bottom in tidal waters; shellfish seeding; activities needed to reestablish vegetation, including plowing or disking for seed bed preparation and the planting of appropriate wetland species; reestablishment of submerged aquatic vegetation in areas where those plant communities previously existed; re-establishment of tidal wetlands in tidal waters where those wetlands previously existed; mechanized land clearing to remove non-native invasive, exotic, or nuisance vegetation; and other related activities. Only native plant species should be planted at the site.

This NWP authorizes the relocation of non-tidal waters, including non-tidal wetlands and streams, on the project site provided there are net increases in aquatic resource functions and services.

Except for the relocation of non-tidal waters on the project site, this NWP does not authorize the conversion of a stream or natural wetlands to another aquatic habitat type (e.g., stream to wetland or vice versa) or uplands. Changes in wetland plant communities that occur when wetland hydrology is more fully restored during wetland rehabilitation activities are not considered a conversion to another aquatic habitat type. This NWP does not authorize stream channelization. This NWP does not authorize the relocation of tidal waters or the conversion of tidal waters, including tidal wetlands, to other aquatic uses, such as the conversion of tidal wetlands into open water impoundments.

Compensatory mitigation is not required for activities authorized by this NWP since these activities must result in net increases in aquatic resource functions and services.

Reversion. For enhancement, restoration, and establishment activities conducted:

(1) In accordance with the terms and conditions of a binding stream or wetland enhancement or restoration agreement, or a wetland establishment agreement, between the landowner and the U.S. Fish and Wildlife Service (FWS), the Natural Resources Conservation Service (NRCS), the Farm Service Agency (FSA), the National Marine Fisheries Service (NMFS), the National Ocean Service (NOS), U.S. Forest Service (USFS), or their designated state cooperating agencies;

(2) as voluntary wetland restoration, enhancement, and establishment actions documented by the NRCS or USDA Technical Service Provider pursuant to NRCS Field Office Technical Guide standards; or

(3) on reclaimed surface coal mine lands, in accordance with a Surface Mining Control and Reclamation Act permit issued by the Office of Surface Mining Reclamation and Enforcement (OSMRE) or the applicable state agency, this NWP also authorizes any future discharge of dredged or fill material associated with the reversion of the area to its documented prior condition and use (i.e., prior to the restoration, enhancement, or establishment activities).

The reversion must occur within five years after expiration of a limited term wetland restoration or establishment agreement or permit, and is authorized in these circumstances even if the discharge occurs after this NWP expires. The five-year reversion limit does not apply to agreements without time limits reached between the landowner and the FWS, NRCS, FSA, NMFS, NOS, USFS, or an appropriate state cooperating agency. This NWP also authorizes discharges of dredged or fill material in waters of the United States for the reversion of wetlands that were restored, enhanced, or established on prior-converted cropland or on uplands, in accordance with a binding agreement between the landowner and NRCS, FSA, FWS, or their designated state cooperating agencies (even though the restoration, enhancement, or establishment activity did not require a section 404 permit). The prior condition will be documented in the original agreement or permit, and the determination of return to prior conditions will be made by the Federal agency or appropriate state agency executing the agreement or permit. Before conducting any reversion activity the permittee or the appropriate Federal or state agency must notify the district engineer and include the documentation of the prior condition. Once an area has reverted to its prior physical condition, it will be subject to whatever the Corps Regulatory requirements are applicable to that type of land at the time. The requirement that the activity results in a net increase in aquatic resource functions and services does not apply to reversion activities meeting the above conditions. Except for the activities described above, this NWP does not authorize any future discharge of dredged or fill material associated with the reversion of the area to its prior condition. In such cases a separate permit would be required for any reversion.

Reporting. For those activities that do not require pre-construction notification, the permittee must submit to the district engineer a copy of:

(1) The binding stream enhancement or restoration agreement or wetland enhancement, restoration, or establishment agreement, or a project description, including project plans and location map;

(2) the NRCS or USDA Technical Service Provider documentation for the voluntary stream enhancement or restoration action or wetland restoration, enhancement, or establishment action; or

(3) the SMCRA permit issued by OSMRE or the applicable state agency. The report must also include information on baseline ecological conditions on the project site, such as a delineation of wetlands, streams, and/or other aquatic habitats.

These documents must be submitted to the district engineer at least 30 days prior to commencing activities in waters of the United States authorized by this NWP.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing any activity (see general condition 31), except for the following activities:

(1) Activities conducted on non-Federal public lands and private lands, in accordance with the terms and conditions of a binding stream enhancement or restoration agreement or wetland enhancement, restoration, or establishment agreement between the landowner and the U.S. FWS, NRCS, FSA, NMFS, NOS, USFS or their designated state cooperating agencies;

(2) Voluntary stream or wetland restoration or enhancement action, or wetland establishment action, documented by the NRCS or USDA Technical Service Provider pursuant to NRCS Field Office Technical Guide standards; or

(3) The reclamation of surface coal mine lands, in accordance with an SMCRA permit issued by the OSMRE or the applicable state agency. However, the permittee must submit a copy of the appropriate documentation to the district engineer to fulfill the reporting requirement. (Sections 10 and 404)

Note: This NWP can be used to authorize compensatory mitigation projects, including mitigation banks and in-lieu fee projects. However, this NWP does not authorize the reversion of an area used for a compensatory mitigation project to its prior condition, since compensatory mitigation is generally intended to be permanent.

A. **Regional Conditions**

1. **Regional Conditions for California, excluding the Tahoe Basin**

http://www.spk.usace.army.mil/Portals/12/documents/regula tory/nwp/2012_nwps/2012-NWP-RC-CA.pdf

2. **Regional Conditions for Nevada, including the Tahoe Basin**

http://www.spk.usace.army.mil/Portals/12/documents/regula tory/nwp/2012_nwps/2012-NWP-RC-NV.pdf

3. **Regional Conditions for Utah**

http://www.spk.usace.army.mil/Portals/12/documents/regula tory/nwp/2012_nwps/2012-NWP-RC-UT.pdf

4. **Regional Conditions for Colorado**.

http://www.spk.usace.army.mil/Portals/12/documents/regula tory/nwp/2012_nwps//2012-NWP-RC-CO.pdf

B. **Nationwide Permit General Conditions**

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/or Coastal Zone Management Act consistency for an NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR §§ 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR § 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

1. **Navigation**.

(a) No activity may cause more than a minimal adverse effect on navigation.

(b) Any safety lights and signals prescribed by the

U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.

I The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. **Aquatic Life Movements.** No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the

waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species.

3. **Spawning Areas**. Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. **Migratory Bird Breeding Areas.** Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. **Shellfish Beds**. No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. **Suitable Material**. No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).

7. **Water Supply Intakes**. No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

☐ 8.**Adverse Effects From Impoundments**. If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. **Management of Water Flows**. To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization and storm water management activities, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

10. **Fills Within 100-Year Floodplains**. The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. **Equipment**. Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. **Soil Erosion and Sediment Controls**. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow.

13. **Removal of Temporary Fills**. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. **Proper Maintenance**. Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. **Single and Complete Project**. The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. **Wild and Scenic Rivers**. No activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a “study river” for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service).

17. **Tribal Rights**. No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

18. **Endangered Species**. (a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which “may affect” a listed species or critical habitat, unless Section 7 consultation addressing the effects of the proposed activity has been completed.

(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. Federal permittees must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will review the documentation and determine whether it is sufficient to address ESA compliance for the NWP activity, or whether additional ESA consultation is necessary.

□□ Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that might be affected by the proposed work or that utilize the designated critical habitat that might be affected by the proposed work. The district engineer will determine whether the proposed activity “may affect” or will have “no effect” to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps’ determination within 45 days of receipt of a complete pre-construction notification. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the project, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification the proposed activities will have “no effect” on listed species or critical habitat, or until Section 7 consultation has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

□□ (d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species-specific regional endangered species conditions to the NWPs.

□□ Authorization of an activity by a NWP does not authorize the “take” of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the U.S. FWS or the NMFS, The Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word "harm" in the definition of "take'' means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

☐☐ (f) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the U.S. FWS and NMFS or their world wide web pages at http://www.fws.gov/ or http://www.fws.gov/ipac and http://www.noaa.gov/fisheries.html respectively.

☐ 19. **Migratory Birds and Bald and Golden Eagles**. The permittee is responsible for obtaining any "take" permits required under the U.S. Fish and Wildlife Service's regulations governing compliance with the Migratory Bird Treaty Act or the Bald and Golden Eagle Protection Act. The permittee should contact the appropriate local office of the U.S. Fish and Wildlife Service to determine if such "take" permits are required for a particular activity.

☐ 20. **Historic Properties**.

(a) In cases where the district engineer determines that the activity may affect properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

(b) Federal permittees should follow their own procedures for complying with the requirements of Section 106 of the National Historic Preservation Act. Federal permittees must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will review the documentation and determine whether it is sufficient to address section 106 compliance for the NWP activity, or whether additional section 106 consultation is necessary.

☐☐ Non-federal permittees must submit a pre-construction notification to the district engineer if the authorized activity may have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties may be affected by the proposed work or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of or potential for the presence of historic resources can be sought from the State Historic Preservation Officer or Tribal Historic Preservation Officer, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of Section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted and these efforts, the district engineer shall determine whether the proposed activity has the potential to cause an effect on the historic properties. Where the non-Federal applicant has identified historic properties on which the activity may have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects or that consultation under Section 106 of the NHPA has been completed.

(d) The district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA Section 106 consultation is required. Section 106 consultation is not required when the Corps determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR §800.3(a)). If NHPA section 106 consultation is required and will occur, the district engineer will notify the non- Federal applicant that he or she cannot begin work until Section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

I Prospective permittees should be aware that section 110k of the NHPA (16 U.S.C. 470h-2(k)) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of Section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

☐ 21.**Discovery of Previously Unknown Remains and Artifacts**. If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. Designated Critical Resource Waters. Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.

(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, and 52 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, and 38, notification is required in accordance with general condition 31, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

23. Mitigation. The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that adverse effects on the aquatic environment are minimal:

(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the adverse effects to the aquatic environment are minimal.

□□I Compensatory mitigation at a minimum one-to-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse effects of the proposed activity are minimal, and provides a project-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in minimal adverse effects on the aquatic environment. Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.

(1)The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in minimal adverse effects on the aquatic environment.

(2) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, wetland restoration should be the first compensatory mitigation option considered.

(3)If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4I(2) – (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)).

(4) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan only needs to address the baseline conditions at the impact site and the number of credits to be provided.

(5) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, and ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan.

□(d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation, such as stream rehabilitation, enhancement, or preservation, to ensure that the activity results in minimal adverse effects on the aquatic environment.

□I Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any project resulting in the loss of greater than 1/2-acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that a project already meeting the established acreage limits also satisfies the minimal impact requirement associated with the NWPs.

□(f) Compensatory mitigation plans for projects in or near streams or other open waters will normally include a requirement for the restoration or establishment, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, riparian areas may be the only compensatory mitigation required. Riparian areas should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to establish a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or establishing a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

(g) Permittees may propose the use of mitigation banks, in-lieu fee programs, or separate permittee-responsible mitigation. For activities resulting in the loss of marine or estuarine resources, permittee-responsible compensatory mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee-responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.

(h) Where certain functions and services of waters of the United States are permanently adversely affected, such as the conversion of a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse effects of the project to the minimal level.

24. Safety of Impoundment Structures. To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. Water Quality. Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA Section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4I). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. Coastal Zone Management. In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. Regional and Case-By-Case Conditions. The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4I) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. Use of Multiple Nationwide Permits. The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

29. Transfer of Nationwide Permit Verifications. If the permittee sells the property associated with nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

"When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below."

(Transferee)________________________________

(Date) _____________________________________

☐**30. Compliance Certification**. Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and any required compensatory mitigation. The success of any required permittee responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:

(a) A statement that the authorized work was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;

(b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and

I The signature of the permittee certifying the completion of the work and mitigation.

31. Pre-Construction Notification.

(a) **Timing**. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

☐ (1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

☐ (2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or in the vicinity of the project, or to notify the Corps pursuant to general condition 20 that the activity may have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or Section 106 of the National Historic Preservation (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2)(b) :

<u>Contents of Pre-Construction Notification</u>: The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed project;

(3) A description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause, including the anticipated amount of loss of water of the United States expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity. The description should be sufficiently detailed to allow the district engineer to determine that the adverse effects of the project will be minimal and to determine the need for compensatory mitigation. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the project and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans);

(4) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many waters of the United States. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;

(5) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse effects are minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.

(6) If any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, for non-Federal applicants the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed work or utilize the designated critical habitat that may be affected by the proposed work. Federal applicants must provide documentation demonstrating compliance with the Endangered Species Act; and

(7) For an activity that may affect a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, for non-Federal applicants the PCN must state which historic property may be affected by the proposed work or include a vicinity map indicating the location of the historic property. Federal applicants must provide documentation demonstrating compliance with Section 106 of the National Historic Preservation Act.

I Form of Pre-Construction Notification: he standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is a PCN and must include all of the information required in paragraphs (b)(1) through

(7) of this general condition. A letter containing the required information may also be used.

(d) Agency Coordination:

(1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the project's adverse environmental effects to a minimal level.

(2) For all NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States, for NWP 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52 activities that require pre-construction notification and will result in the loss of greater than 300 linear feet of intermittent and ephemeral stream bed, and for all NWP 48 activities that require pre-construction notification, the district engineer will immediately provide (e.g., via email, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (U.S. FWS, state natural resource or water quality agency, EPA, State Historic Preservation Officer (SHPO) or Tribal Historic Preservation Office (THPO), and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to telephone or fax the district engineer notice that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure the net adverse environmental effects to the aquatic environment of the proposed activity are minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(3) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of

any Essential Fish Habitat conservation recommendations, as required by Section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

(4) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre-construction notifications to expedite agency coordination.

C. District Engineer's Decision

1. In reviewing the PCN for the proposed activity, the district engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. For a linear project, this determination will include an evaluation of the individual crossings to determine whether they individually satisfy the terms and conditions of the NWP(s), as well as the cumulative effects caused by all of the crossings authorized by NWP. If an applicant requests a waiver of the 300 linear foot limit on impacts to intermittent or ephemeral streams or of an otherwise applicable limit, as provided for in NWPs 13, 21, 29, 36, 39, 40, 42, 43, 44, 50, 51 or 52, the district engineer will only grant the waiver upon a written determination that the NWP activity will result in minimal adverse effects. When making minimal effects determinations the district engineer will consider the direct and indirect effects caused by the NWP activity. The district engineer will also consider site specific factors, such as the environmental setting in the vicinity of the NWP activity, the type of resource that will be affected by the NWP activity, the functions provided by the aquatic resources that will be affected by the NWP activity, the degree or magnitude to which the aquatic resources perform those functions, the extent that aquatic resource functions will be lost as a result of the NWP activity (e.g., partial or complete loss), the duration of the adverse effects (temporary or permanent), the importance of the aquatic resource functions to the region (e.g., watershed or ecoregion), and mitigation required by the district engineer. If an appropriate functional assessment method is available and practicable to use, that assessment method may be used by the district engineer to assist in the minimal adverse effects determination. The district engineer may add case-specific special conditions to the NWP authorization to address site-specific environmental concerns.

2. If the proposed activity requires a PCN and will result in a loss of greater than 1/10- acre of wetlands, the prospective permittee should submit a mitigation proposal with the PCN. Applicants may also propose compensatory mitigation for projects with smaller impacts. The district engineer will consider any proposed compensatory mitigation the applicant has included in the proposal in determining whether the net adverse environmental effects to the aquatic environment of the proposed activity are minimal. The compensatory mitigation proposal may be either conceptual or detailed. If the district engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse effects on the aquatic environment are minimal, after considering mitigation, the district engineer will notify the permittee and include any activity-specific conditions in the NWP verification the district engineer deems necessary. Conditions for compensatory mitigation requirements must comply with the appropriate provisions at 33 CFR 332.3(k). The district engineer must approve the final mitigation plan before the permittee commences work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the district engineer will expeditiously review the proposed compensatory mitigation plan. The district engineer must review the proposed compensatory mitigation plan within 45 calendar days of receiving a complete PCN and determine whether the proposed mitigation would ensure no more than minimal adverse effects on the aquatic environment. If the net adverse effects of the

project on the aquatic environment (after consideration of the compensatory mitigation proposal) are determined by the district engineer to be minimal, the district engineer will provide a timely written response to the applicant. The response will state that the project can proceed under the terms and conditions of the NWP, including any activity-specific conditions added to the NWP authorization by the district engineer.

3. If the district engineer determines that the adverse effects of the proposed work are more than minimal, then the district engineer will notify the applicant either: (a) That the project does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; (b) that the project is authorized under the NWP subject to the applicant's submission of a mitigation plan that would reduce the adverse effects on the aquatic environment to the minimal level; or (c) that the project is authorized under the NWP with specific modifications or conditions. Where the district engineer determines that mitigation is required to ensure no more than minimal adverse effects occur to the aquatic environment, the activity will be authorized within the 45-day PCN period, with activity-specific conditions that state the mitigation requirements. The authorization will include the necessary conceptual or detailed mitigation or a requirement that the applicant submit a mitigation plan that would reduce the adverse effects on the aquatic environment to the minimal level. When mitigation is required, no work in waters of the United States may occur until the district engineer has approved a specific mitigation plan or has determined that prior approval of a final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation.

D. **Further Information**

1. District Engineers have authority to determine if an activity complies with the terms and conditions of an NWP.
2. NWPs do not obviate the need to obtain other federal, state, or local permits, approvals, or authorizations required by law.
3. NWPs do not grant any property rights or exclusive privileges.
4. NWPs do not authorize any injury to the property or rights of others.
5. NWPs do not authorize interference with any existing or proposed Federal project.

E. **Definitions**

Best management practices (BMPs): Policies, practices, procedures, or structures implemented to mitigate the adverse environmental effects on surface water quality resulting from development. BMPs are categorized as structural or non-structural.

Compensatory mitigation: The restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

Currently serviceable: Useable as is or with some maintenance, but not so degraded as to essentially require reconstruction.

Direct effects: Effects that are caused by the activity and occur at the same time and place.

Discharge: The term "discharge" means any discharge of dredged or fill material.

Enhancement: The manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s), but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area.

Ephemeral stream: An ephemeral stream has flowing water only during, and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.

Establishment (creation): The manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area.

High Tide Line: The line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in
Which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm?

Historic Property: Any prehistoric or historic district, site (including archaeological site), building, structure, or other object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria (36 CFR part 60).

Independent utility: A test to determine what constitutes a single and complete non-linear project in the Corps regulatory program. A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed even if the other phases were not built can be considered as separate single and complete projects with independent utility.

Indirect effects: Effects that are caused by the activity and are later in time or farther removed in distance, but are still reasonably foreseeable.

I**ntermittent stream**: An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

Loss of waters of the United States: Waters of the United States that are permanently adversely affected by filling, flooding, excavation, or drainage because of the regulated activity. Permanent adverse effects include permanent discharges of dredged or fill material that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody. The acreage of loss of waters of the United States is a threshold measurement of the impact to jurisdictional waters for determining whether a project may qualify for an NWP; it is not a net threshold that is calculated after considering compensatory mitigation that may be used to offset losses of aquatic functions and services. The loss of stream bed includes the linear feet of stream bed that is filled or excavated. Waters of the United States temporarily filled, flooded, excavated, or drained, but restored to pre-construction contours and elevations after construction, are not included in the measurement of loss of waters of the United States. Impacts resulting from activities eligible for exemptions under Section 404(f) of the Clean Water Act are not considered when calculating the loss of waters of the United States.

Non-tidal wetland: A non-tidal wetland is a wetland that is not subject to the ebb and flow of tidal waters. The definition of a wetland can be found at 33 CFR 328.3(b). Non-tidal wetlands contiguous to tidal waters are located landward of the high tide line (i.e., spring high tide line).

Open water: For purposes of the NWPs, an open water is any area that in a year with normal patterns of precipitation has water flowing or standing above ground to the extent that an ordinary high water mark can be determined. Aquatic vegetation within the area of standing or flowing water is either non-emergent, sparse, or absent. Vegetated shallows are considered to be open waters. Examples of "open waters" include rivers, streams, lakes, and ponds.

Ordinary High Water Mark: An ordinary high water mark is a line on the shore established by the fluctuations of water and indicated by physical characteristics, or by other appropriate means that consider the characteristics of the surrounding areas (see 33 CFR 328.3I).

Perennial stream: A perennial stream has flowing water year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for stream flow.

Practicable: Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

Pre-construction notification: A request submitted by the project proponent to the Corps for confirmation that a particular activity is authorized by nationwide permit. The request may be a permit application, letter, or similar document that includes information about the proposed work and its anticipated environmental effects. Pre-construction notification may be required by the terms and conditions of a nationwide permit, or by regional conditions. A pre-construction notification may be voluntarily submitted in cases where pre-construction notification is not required and the project proponent wants confirmation that the activity is authorized by nationwide permit.

Preservation: The removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in a gain of aquatic resource area or functions.

Re-establishment: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions.

Rehabilitation: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area.

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: reestablishment and rehabilitation.

Riffle and pool complex: Riffle and pool complexes are special aquatic sites under the 404(b)(1) Guidelines. Riffle and pool complexes sometimes characterize steep gradient sections of streams. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a course substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. A slower stream velocity, a streaming flow, a smooth surface, and a finer substrate characterize pools.

Riparian areas: Riparian areas are lands adjacent to streams, lakes, and estuarine-marine shorelines. Riparian areas are transitional between terrestrial and aquatic ecosystems, through which surface and subsurface hydrology connects riverine, lacustrine, estuarine, and marine waters with their adjacent wetlands, non-wetland waters, or uplands. Riparian areas provide a variety of ecological functions and services and help improve or maintain local water quality. (See general condition 23.)

Shellfish seeding: The placement of shellfish seed and/or suitable substrate to increase shellfish production. Shellfish seed consists of immature individual shellfish or individual shellfish attached to shells or shell fragments (i.e., spat on shell). Suitable substrate may consist of shellfish shells, shell fragments, or other appropriate materials placed into waters for shellfish habitat.

Single and complete linear project: A linear project is a project constructed for the purpose of getting people, goods, or services from a point of origin to a terminal point, which often involves multiple crossings of one or more waterbodies at separate and distant locations. The term "single and complete project" is defined as that portion of the total linear project proposed or accomplished by one owner/developer or partnership or other association of owners/developers that includes all crossings of a single water of the United States (i.e., a single waterbody) at a specific location. For linear projects crossing a single or multiple waterbodies several times at separate and distant locations, each crossing is considered a single and complete project for purposes of NWP authorization. However, individual channels in a braided stream or river, or individual arms of a large, irregularly shaped wetland or lake, etc., are not separate waterbodies, and crossings of such features cannot be considered separately.

Single and complete non-linear project: For non-linear projects, the term "single and complete project" is defined at 33 CFR 330.2(i) as the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers. A single and complete non-linear project must have independent utility (see definition of "independent utility"). Single and complete non-linear projects may not be "piecemealed" to avoid the limits in an NWP authorization.

Stormwater management: Stormwater management is the mechanism for controlling stormwater runoff for the purposes of reducing downstream erosion, water quality degradation, and flooding and mitigating the adverse effects of changes in land use on the aquatic environment.

Stormwater management facilities: Stormwater management facilities are those facilities, including but not limited to, stormwater retention and detention ponds and best management practices, which retain water for a period of time to control runoff and/or improve the quality (i.e., by reducing the concentration of nutrients, sediments, hazardous substances and other pollutants) of stormwater runoff.

Stream bed: The substrate of the stream channel between the ordinary high water marks. The substrate may be bedrock or inorganic particles that range in size from clay to boulders. Wetlands contiguous to the stream bed, but outside of the ordinary high water marks, are not considered part of the stream bed.

Stream channelization: The manipulation of a stream's course, condition, capacity, or location that causes more than minimal interruption of normal stream processes. A channelized stream remains a water of the United States.

Structure: An object that is arranged in a definite pattern of organization. Examples of structures include, without limitation, any pier, boat dock, boat ramp, wharf, dolphin, weir, boom, breakwater, bulkhead, revetment, riprap, jetty, artificial island, artificial reef, permanent mooring structure, power transmission line, permanently moored floating vessel, piling, aid to navigation, or any other manmade obstacle or obstruction.

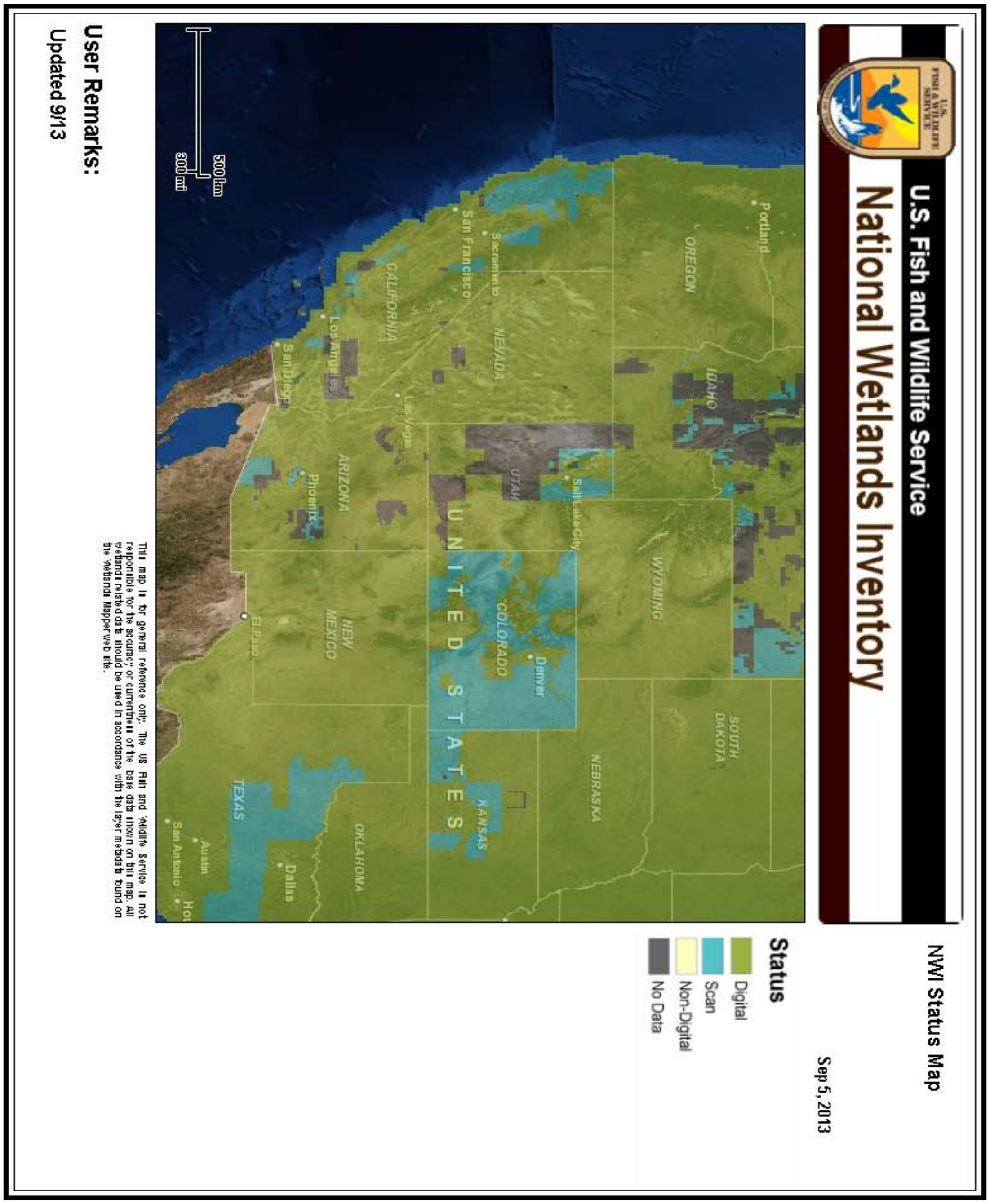
Tidal wetland: A tidal wetland is a wetland (i.e., water of the United States) that is inundated by tidal waters. The definitions of a wetland and tidal waters can be found at 33 CFR 328.3(b) and 33 CFR 328.3(f), respectively. Tidal waters rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by other waters, wind, or other effects. Tidal wetlands are located channelward of the high tide line, which is defined at 33 CFR 328.3(d).

Vegetated shallows: Vegetated shallows are special aquatic sites under the 404(b)(1) Guidelines. They are areas that are permanently inundated and under normal circumstances have rooted aquatic vegetation, such as seagrasses in marine and estuarine systems and a variety of vascular rooted plants in freshwater systems.

Waterbody: For purposes of the NWPs, a waterbody is a jurisdictional water of the United States. If a jurisdictional wetland is adjacent – meaning bordering, contiguous, or neighboring – to a waterbody determined to be a water of the United States under 33 CFR 328.3(a)(1)-(6), that waterbody and its adjacent wetlands are considered together as a single aquatic unit (see 33 CFR 328.4(c)(2)). Examples of “waterbodies” include streams, rivers, lakes, ponds, and wetlands.

8.5.2 NWI Status-Western Region-Updated Sept 2013

Map 3-5a UPDATE TO NWI STATUS



8.5.3 NWI Wetlands on Western Region Reservations by State and BIA Agency.

8.5.3.1 Arizona

Digital wetland data is incomplete for Arizona and database for linear wetlands is not available.

Table 8.6.1 NWI Colorado River Agency Reservations

RESERVATION	WETLAND TYPE	WETLAND TYPE	ACRES	LINEAR WETLANDS	LINEAR MILES
Chemehuevi					
Reservation	Colorado River				
		Forested/Shrub	0.38		
		Lake	0.54		
Sum ACRES		0.92			
Colorado River					
	Colorado River	Freshwater Emergent	631.77		
		Forested/Shrub	9695.18		
		Freshwater Pond	320.64		
		Lake	333.61		
		Riverine	3937.53		
Sum ACRES		14918.73			
Fort Mojave					
	Colorado River	Freshwater Emergent	199.54	Fort Mojave	
		Freshwater		Reservation	
		Forested/Shrub	1142.74	PSS1/2A	0.32
		Freshwater Pond	50		
		Lake	21.06	PSS1A	1.14
		Riverine	701.73		
Sum ACRES		2115.05		Sum Linear Miles	1.46
			17034.7		

Table 8.6.2 NWI Fort Yuma Agency Reservations

Polygon Wetlands		***Linear Wetlands***		***Description for codes***				
Reservation	**Acres**		**Acres**	**System**	**Sub system**	**Class**	**WATER REGIME**	**Special Modifier**
Cocopah								
Forested/Shrub	1079.17	R2UBHx	0.05	**R**	**2**	**UB**	**H**	**x**
Freshwater Pond	0.44	R4SBCx	1.41	Riverine	Lower Perennial	Unconsolidated Bottom	Permanently Flooded:	Excavated:
Riverine	288.28			Riverine	Intermittent	Streambed	Seasonally Flooded	Excavated
Sum ACRES Cocopah	**1367.9**	**Sum Lin Miles**	**1.46**					
Quechan								
Freshwater Emergent	34.58	PEM1Fx	8.02	Palustrine	Emergent	Persistent	Semi permanently Flooded	Excavated
Forested/Shrub	1815.4	PSS1/2J	4.94	Palustrine	Scrub-Shrub:	Broad/Needle-Leaved Deciduous	Intermittently Flooded	
Freshwater Pond	23.5	PSS2/1J	0.83	Palustrine	Scrub-Shrub:	Broad/Needle-Leaved Deciduous	Intermittently Flooded	
Lake	44.79	R2UBH	0.14	Riverine	Lower Perennial	Unconsolidated Bottom	Permanently Flooded:	
Other	9.54	R2UBHx	9.67	Riverine	Lower Perennial	Unconsolidated Bottom	Permanently Flooded:	Excavated
Riverine	494.8							
Sum ACRES Quechan	**2422.6**	**Sum Linear Wetland**	**23.6**					
Total Ft. Yuma Polygon Wetland	**5158.4**	**Total Ft. Yuma Linear Wetland**	**25.06**					

Table 8.6.3 NWI Hopi, Fort Apache, San Carlos, Papago Agency Reservations

RESERVATION	WETLAND TYPE	ACRES	RESERVATION	WETLAND TYPE	ACRES
Hopi Reservation	**Hopi Agency**		**San Carlos**	**San Carlos**	
	Freshwater Emergent	22.95	**Reservation**	**Freshwater Emergent**	385.48
	Forested/Shrub	79.6		**Forested/Shrub**	15058.34
	Freshwater Pond	10.46		**Freshwater Pond**	12.55
Sum ACRES		113.01		**Other**	24.55
				Riverine	711.52
White Mountain Apache	**Fort Apache**		**Sum ACRES**		16192.44
	Freshwater Emergent	653.9			
	Forested/Shrub	722.4	**San Xavier**	**Papago**	
	Freshwater Pond	174.19		**Other**	1.6
	Lake	851.53		**Riverine**	244.9
	Other	5.36	Sum ACRES		246.5
	Riverine	1138.53			
Sum ACRES		3545.91			

Table 8.6.4 NWI Truxton Canon Reservations

Reservation	***Wetland Type***	***Acres***
Yavapai Apache	*Freshwater Pond*	*10.96*
	Riverine	*15.5*
Sum ACRES		*26.46*
Havasupai	*Freshwater Emergent*	*1.59*
	Forested/Shrub	*69.41*
Sum ACRES		*71*
Hualapai	*Freshwater Emergent*	*11.62*
	Forested/Shrub	*188.37*
	Freshwater Pond	*29.63*
	Riverine	*1199.95*
Sum ACRES		*1429.58*
Yavapai-Prescott	*Forested/Shrub*	*1.3*
	Freshwater Pond	*0.02*
	Riverine	*11.38*
Sum ACRES		*12.7*
Sum NWI Wetland Acres- Truxton Canon Reservations		*1539.73*

8.5.3.2 Nevada

Table 8.6.5 NWI Eastern Nevada Agency Reservation

Reservation	WETLAND TYPE	ACRES	Linear Wetlands	Linear Miles
Duck Valley NV Wetlands			Duck **Valley**	
	Freshwater Emergent	3743.3	EM	72.1
	Forested/Shrub	670.3	FO/SS	60.7
	Lake	444.1	US/OW/UB/SB	90.2
Sum ACRES	4857.7		Sum Linear Miles	223.0
Duck Valley ID			Duckwater	
	Freshwater Emergent	556.0	PEM	0.6
	Forested/Shrub	132.5	R4SB	3.5
	Freshwater Pond	6.3	Sum Linear Miles	4.1
	Riverine	57.3	Elko Band	
	Sum ACRES	752.1	US/OW/UB/SB	4.4
Duckwater			Odgers Ranch	
	Freshwater Emergent	777.8	EM	2.9
Sum ACRES	777.8		US/OW/UB/SB	0.4
Elko Band			Sum Linear Miles	3.4
	Freshwater	24.8	Ruby Valley	
Goshute			FO/SS	0.1
	Freshwater	194.2	Sum Linear Miles	0.1
Odgers Ranch			South Fork Band	
	Freshwater Emergent	311.7	EM	4.2
South Fork Band			FO/SS	5.9
	Freshwater Emergent	1363.1	US/OW/UB/SB	4.5
			Sum Linear Miles	14.7

Table 8.6.6 NWI Western Nevada Agency Reservations

RESERVATION	WETLAND TYPE	ACRES	Linear Miles
Fallon	Freshwater Emergent	613.8	14.63
Fort McDermitt			
	Freshwater Emergent	2084.5	
	Freshwater Forested/Shrub	458.4	
	Lake	625.2	
	Riverine	19	
Sum ACRES	3187		34.75
Lovelock Colony	Freshwater Emergent	85.5	18.41
Pyramid Lake	Freshwater Emergent	211.1	
	Forested/Shrub	117.3	
	Lake	131545.3	
	Riverine	201.2	
Sum ACRES	132074.9		**132.36**
Reno-Sparks Colony	Freshwater Pond	2.7	
	Other	3.9	
	Riverine	0.6	11.62
Sum ACRES	**7.2**		
Stewart Colony			2.16
Summit Lake	Freshwater Emergent	230.9	
	Lake	823.9	
Sum ACRES	1054.8		9.42
Walker River	Freshwater Emergent	4791.8	
	Forested/Shrub	2816.8	
	Lake	1837	
Sum ACRES	**9445.6**		**87.25**
Washoe Ranches	Freshwater Emergent	280.1	
Sum ACRES	280.1		6.99
Winnemucca Colony			0.14
Woodfords Community	Freshwater Emergent	**0.8**	0.37
Yerington Colony			2.18
Yomba Reservation	Freshwater Emergent	314.5	6.25
Sum WNA ACRES	**146049.7**		**326.53**

8.5.3.3 Utah

Table 8.6.7 NWI Uintah and Ouray and Goshute Reservations

Utah Reservations Wetlands		
Reservation Name	**Wetland Type**	**Acres**
Goshute Reservation	Freshwater Emergent	291.2
Sum Acres-Goshute		**291.2**
Uintah and Ouray Reservation	Freshwater Emergent	**10,407.1**
	Freshwater Forested/Shrub Wetland	6414.9
	Freshwater Pond	451.9
	Lake	1624.7
	Riverine	3698.4
	Other	151.6
Sum Acres-Uintah and Ouray		22,748

NWI data was not available for Utah reservations under Southern Paiute Agency Jurisdiction at the time this table was prepared. .

8.5.3.4 Wetlands and Deepwater Habitats Mapping Codes-Table 8.6.8

Wetlands and Deepwater Habitats Mapping Codes

Class/Subclass	Code	Marine: Subtidal M1	Marine: Intertidal M2	Estuarine: Subtidal E1	Estuarine: Intertidal E2	Riverine†: Tidal R1	Riverine†: Lower Perennial R2	Riverine†: Upper Perennial R3	Riverine†: Intermittent R4	Lacustrine: Limnetic L1	Lacustrine: Littoral L2	Palustrine: N/A P	Water Regimes
Rock Bottom	RB	■		■		■		■		■	■	■	Nontidal F, G, H, K Tidal L, T*, V*
Bedrock	RB1	■		■		■		■		■	■	■	
Rubble	RB2	■		■		■		■		■	■	■	
Unconsolidated Bottom	UB	■		■		■	■	■		■	■	■	Nontidal F, G, H, K Tidal L, T*, V*
Cobble-Gravel	UB1	■		■		■	■	■		■	■	■	
Sand	UB2	■		■		■	■	■		■	■	■	
Mud	UB3	■		■		■	■	■		■	■	■	
Organic	UB4			■		■	■			■	■	■	
Aquatic Bed	AB	■	■	■	■	■	■	■		■	■	■	Nontidal C, F, G, H, K Tidal L, M, N, R*, T*, V*
Algal	AB1	■	■	■	■	■	■	■		■	■	■	
Aquatic Moss	AB2					■	■	■		■	■	■	
Rooted Vascular	AB3	■	■	■	■	■	■	■		■	■	■	
Floating Vascular	AB4			■	■	■	■	■		■	■	■	
Reef	RF	■	■	■	■								Tidal L, M, N, P
Coral	RF1	■	■										
Mollusk	RF2			■	■								
Worm	RF3	■	■	■	■								
Streambed	SB				■	■			■				Nontidal A, C, J, K Tidal M, N, P, R*, S*
Bedrock	SB1				■	■			■				
Rubble	SB2				■	■			■				
Cobble-Gravel	SB3				■	■			■				
Sand	SB4				■	■			■				
Mud	SB5				■	■			■				
Organic	SB6				■	■			■				
Vegetated (pioneer plants)	SB7					■			■				
Rocky Shore	RS		■		■	■	■	■			■		Nontidal A, C, J, K Tidal M, N, P, R*, S*
Bedrock	RS1		■		■	■	■	■			■		
Rubble	RS2		■		■	■	■	■			■		
Unconsolidated Shore	US		■		■	■	■	■			■	■	Nontidal A, C, J, K Tidal M, N, P, R*, S*
Cobble-Gravel	US1		■		■	■	■	■			■	■	
Sand	US2		■		■	■	■	■			■	■	
Mud	US3		■		■	■	■	■			■	■	
Organic	US4		■		■	■	■	■			■	■	
Vegetated (pioneer plants)	US5					■	■	■			■	■	

† **Unknown Perennial R5** - This Subsystem designation was created specifically for use when the distinction between Lower Perennial, Upper land Tidal subsystems cannot be made through remote sensing and no supplementary data are available. Use is limited to the Unconsolidated Bottom class. The only valid code is R5UB.

* Tidally influenced freshwater systems.

■ Valid | Invalid

Table Revised June 23, 2010

Wetlands and Deepwater Habitats Mapping Codes *continued*

Class/Subclass	Code	Marine: Subtidal M1	Marine: Intertidal M2	Estuarine: Subtidal E1	Estuarine: Intertidal E2	Riverine: Tidal R1	Riverine: Lower Perennial R2	Riverine: Upper Perennial R3	Riverine: Intermittent R4	Lacustrine: Limmetic L1	Lacustrine: Littoral L2	Palustrine: N/A P	Water Regimes
Moss-Lichen	ML											Valid	Nontidal B
Moss	ML1											Valid	
Lichen	ML2											Valid	
Emergent	EM				Valid							Valid	Nontidal A, B, C, E, F, G, H, J, K Tidal N, P, R*, S*, T*
Persistent	EM1				Valid							Valid	
Phragmites	EM5				Valid							Valid	
Nonpersistent	EM2				Valid	Valid	Valid	Valid			Valid	Valid	Nontidal F, G, H, K Tidal N and T*
Scrub-Shrub	SS				Valid							Valid	Nontidal A, B, C, E, F, G, H, J, K Tidal M, N, P, R*, S*, T*
Broad-leaved Deciduous	SS1				Valid							Valid	
Needle-leaved Deciduous	SS2				Valid							Valid	
Broad-leaved Evergreen	SS3				Valid							Valid	
Needle-leaved Evergreen	SS4				Valid							Valid	
Dead	SS5				Valid							Valid	
Deciduous	SS6				Valid							Valid	
Evergreen	SS7				Valid							Valid	
Forested	FO				Valid							Valid	Nontidal A, B, C, E, F, G, H, J, K Tidal M, N, P, R*, S*, T*
Broad-leaved Deciduous	FO1				Valid							Valid	
Needle-leaved Deciduous	FO2				Valid							Valid	
Broad-leaved Evergreen	FO3				Valid							Valid	
Needle-leaved Evergreen	FO4				Valid							Valid	
Dead	FO5				Valid							Valid	
Deciduous	FO6				Valid							Valid	
Evergreen	FO7				Valid							Valid	

* Tidally influenced freshwater systems.

Valid — Invalid

MODIFIERS

In order to more adequately describe wetlands and deepwater habitats, one or more of the special, water chemistry, or soil modifiers may be applied to classes or subclasses. The farmed modifier may also be applied to the Palustrine System level.

Water Regime Modifiers

Nontidal		Saltwater tidal	
A	Temporarily Flooded	L	Subtidal
B	Saturated	M	Irregularly Exposed
C	Seasonally Flooded	N	Regularly Flooded
E	Seasonally Flooded / Saturated	P	Irregularly Flooded
F	Semipermanently Flooded		**Freshwater Tidal**
G	Intermittently Exposed	S	Temporarily Flooded -Tidal
H	Permanently Flooded	R	Seasonally Flooded-Tidal
J	Intermittently Flooded	T	Semipermanently Flooded-Tidal
K	Artificially Flooded	V	Permanently Flooded-Tidal

Special Modifiers

These Codes are used to indicate habitats modified or created by man or beaver. The use of only one special modifier is permitted, (e.g. PUBHx).

b	Beaver
d	Partly Drained/Ditched
f**	Farmed
h***	Diked/Impounded
r	Artificial
s	Spoil
x	Excavated

Other Modifiers

Other modifiers are not widely used during image analyses but can be applied where additional information or field work provides sufficient information.

Water Chemistry: Coastal Halinity		Water Chemistry: Inland Salinity		Water Chemistry: pH Modifiers for all Freshwater		Soil	
1	Hyperhaline	7	Hypersaline	a	Acid	g	Organic
2	Euhaline	8	Eusaline	t	Circumneutral	n	Mineral
3	Mixohaline (Brackish)	9	Mixosaline	I	Alkaline		
4	Polyhaline	0	Fresh				
5	Mesohaline						
6	Oligohaline						
0	Fresh						

** Farmed wetlands are normally Pf (Palustrine farmed) but cultivated cranberry bogs may be classified as PSSf.

*** Because the diked/impounded modifier is crucial for sea-level models, it is given priority over any other modifiers. Example, diked/impounded - spoil areas will be coded h for diked/impounded.

8.6 *Appendix G Addendum to Programmatic Environmental Assessment for Noxious Weed Control Projects in BIA Western Region*

Addendum to Programmatic Environmental Assessment for Noxious Weed Control Projects in BIA Western Region

FOR

Name of project

Project Description and Purpose

[Describe the project to be carried out. Include the location of the project with map references, UTM or some other local reference such as roads, range unit number and other landmarks. Describe the approximate square footage or acreage of the project area. Attach a location map of the project area showing adequate detail.]

Topography

[Briefly describe general topography including elevation, aspect and slope. Include any significant topographical feature in the project area or adjacent.]

Fish and Wildlife and Endangered Species*.*

Describe the result of the field investigation of project areas and/or correspondence to and from the Tribal biologist regarding the presence or absence of significant plant and animal species. Include coordination efforts for Endangered Species Act compliance and effect determinations.

Cultural Resources

Describe and attach correspondences with State Historic Preservation Officer (SHPO) Tribal Historic Preservation Officer (THPO) for cultural clearance of project.

Protocol for Project

1. The project proponent and/or contractor shall immediately halt all activities in the immediate area of the discovery and take steps to stabilize and protect the discovered resource until it can be evaluated by a qualified archeologist.

2. The project proponent and/or contractor shall immediately notify the Cultural Preservation Director, Kaibab Band of Paiute Indians, and the BIA/WRO Regional Archeologist to document and preliminarily assess the find and formulate a recommendation regarding whether the discovery is National Register-eligible and merits further consideration. The assessment shall address the following factors:

a. The nature of the resource, such as the number and kinds of artifacts, and presence or absence of archeological features.

b. The spatial extent of the resource.

c. The nature of the deposits in which the discovery was made.

d. The contextual integrity of the resource, damage related to the initial discovery, and potential impacts of the continued activity that resulted in the discovery.

3. If the preliminary evaluation concludes that the find is not a National Register-eligible property, nor a contributing element of an historic property, or its documentation has exhausted the information potential, this conclusion and accompanying documentation shall be transmitted by BIA/WRO to the SHPO. If SHPO agrees within five calendar days of receipt, BIA/WRO may authorize resumption of the activity that resulted in the discovery.

4. If the preliminary evaluation concludes that the find is a National Register-eligible property or a contributing element of an historic property, or that its documentation has not exhausted the information potential, this conclusion and accompanying documentation shall be transmitted by BIA/WRO to the SHPO with a Treatment Plan. If the Consulting Parties determine that the Treatment Plan is acceptable, BIA/WRO shall ensure that the plan is implemented to resolve the adverse effects. The project proponents shall not resume the activity that resulted in the discovery until BIA/WRO, in consultation with the Consulting Parties, has determined that the adverse effect has been resolved and authorizes resumption of the activity.

Addendum to Programmatic Environmental Assessment for Noxious Weed Control Projects in BIA Western Region

Signatory Page

Prepared By: ____

Date: ____

Preparer's Title and Department ____

Approved By: ____

Date: ____

Title and Department: ____

Tribal Wildlife Biologist, ___________________Wildlife Department

Approved By: ____

Date: ____

State, Tribal Historic Preservation Officer or Cultural Resource Department

Approved By: ____

Date: ____

(Other approvals if needed)

8.7 *Appendix H Air Quality Non-Attainment Areas*

8.7.1 Classifications of Particulate Matter (PM-10) Nonattainment Areas *as of July 20, 2012*

Table 8.8.1 PM-10 Nonattainment Areas

SERIOUS
Clark Co, NV
Coachella Valley,
East Kern Co, CA
Imperial Valley, CA
Los Angeles South
Owens Valley, CA
Phoenix, AZ
Washoe Co, NV
MODERATE
Ajo (Pima County),
Anthony, NM
Bonner Co
Butte, MT
Columbia Falls, MT
Eagle River, AK
El Paso Co, TX
Eugene-
Flathead County;
Fort Hall Indian
Hayden AZ
Juneau, AK
Kalispell, MT
Lame Deer, MT
Lane Co, OR
Libby, MT
Mammoth Lake, CA
Miami, AZ
Missoula, MT
Mono Basin, CA
New York Co, NY
Nogales, AZ
Ogden, UT
Paul Spur/Douglas
Pinehurst, ID
Polson, MT
Rillito, AZ
Ronan, MT
Sacramento Co, CA
Salt Lake Co, UT
San Bernardino Co,
Sanders County
Sheridan, WY
Shoshone Co, ID
Trona, CA
Utah Co, UT
West Pinal, AZ
Yuma, AZ

8.7.2 Sulfur Dioxide Nonattainment Report

As of July 20, 2012

Table 8.8.2 Sulfur Dioxide Nonattainment Areas
ARIZONA (Region IX)
Hayden (Pinal County), AZ
Pinal Co (P)
UTAH (Region VIII)
Salt Lake Co, UT
Tooele Co (P)
(P) : A portion of the county is located within the area and is designated nonattainment

8.7.3 Classifications of Carbon Monoxide Maintenance Areas

As of July 20, 2012 (Edited to include Western Region States Only)

Table 8.9.3 Carbon Monoxide Maintenance Areas

-SERIOUS
Las Vegas, NV
Phoenix, AZ
MODERATE > **12.7PPM**
Provo, UT
MODERATE <**= 12.7PPM**
Ogden, UT
Reno, NV

8.8 *Appendix I-Herbicide Use and Effects*

8.8.1 Herbicides Used on Indian Lands in Western Region

Table 8.9.1 Herbicides used on Indian Lands in Western Region 2007-2011

Year	Herbicide	Acres	Target Weed(s)
2007	Telar, Milestone, Curtail	200	Canada & bull thistle
2007	Telar, 2-4-D-Amine, Curtail	105	Hoary cress
2007	Telar, Escort, Weed Master and Tordon	505	Multi-invasive species
2007	Rodeo	50	Purple Loosestrife
2007	Tordon, Transline	283	Russian knapweed Scotch & Musk Thistle
	Total	1143	

Year	Herbicide	Acres	Target Weed(s)
2008	Escort & Escort XP	5	Perennial pepperweed & camelthorn
2008	Escort and Rodeo	76	Hoary cress & thistles
2008	Escort and Weedar	140	Hoary cress; perennial pepperweed
2008	Garlon	67	Tamarisk
2008	Milestone and Telar	63	R. Knapweed, Canada & bull thistle
2008	Unknown	1538	cheatgrass
2008	Telar	64	hoary cress, p.pepperweed, thistles
2008	Telar, Escort, Weed Master and Tordon	750	musk thistle, knapweed, p.pepperweed, R. Olive
2008	Tordon, Transline	316	Russian Knapweed
2008	Weedar 64	110	Purple Loosestrife & P. Pepperweed
2008	Weedar 64/Tordon	10	Musk and Canada Thistle
2008	Weedar 64/Tordon	5	Russian Knapweed
2008	Total	3144	

8.10.1. Herbicides Used on Indian lands in Western Region 2007-2011			
Year	Herbicide	Acres	Target Weed(s)
2009	Aquamaster	75	Perennial Pepperweed & P. loosestrife
2009	Escort	100	Hoary Cress, p.pepperweed, thistles
2009	Garlon A & B	130	Tamarisk
2009	Milestone	116	Canada & Musk Thistle, Whitetop, R. Olive
2009	Plateau, Habitat, MSO, Dye	0.03	Tamarisk
2009	Rodeo	6	hoary cress, thistles
2009	Telar	120	Knapweed, thistles
2009	Telar XP and Milestone	50	P. pepperweed, hoary cress, thistle
2009	Tordon	40	Russian olive
2009	Tordon, R-11, Weedar, Arsenal, Transline, Milestone, Rodeo, Roundup, Telar	255	Russian knapweed
2009	Weedar 64	40	P. Pepperweed & P. Loosestrife
2009	Weedar, Telar, R-11, Dye, Plateau, MSO, Milestone	87	Hoary cress, p.pepperweed, thistles
2009	Total	1019.03	
Year	Herbicide	Acres	Target Weed(s)
2010	2,4,D-Amine, Round-up	378	P.pepperweed, hoary cress, thistle, knapweed, Y.Star Thistle (YST)
2010	Aquamaster/Telar	3	Perennial Pepperweed
2010	Escort	156	P.Pepperweed, hoary cress, thistle
2010	Escort & Rodeo (Retreat)	45	P.Pepperweed, hoary cress, thistle
2010	Escort-Telar	25	Hoary cress
2010	Garlon & Garlon 4	41	Tamarisk
2010	Milestone	193.5	R. knapweed, thistles, hoary cress, YST
2010	Plateau, Telar	80	p.pepperweed & hoary cress
2010	Rodeo	18	Russian knapweed
2010	Telar	120	R. Knapweed, thistles
2010	Tordon	311	Russian knapweed
2010	Transline	21	Russian knapweed
2010	Weedar	91	p.pepperweed
2010	Total	1482.5	

Year	Herbicide	Acres	Target Weed(s)	Notes
2011	2, 4-D Amine	937	knapweed, curly dock, cocklebur, tansy mustard, P.pepperweed, tansy, thistle, spurge	467 acres were treated, then re-treated.
2011	Aquamaster	14 river miles	Purple loosestrife	7 miles treated and retreated.
2011	Chaparral/Climb	40	Poison hemlock	
2011	Escort	30	Perennial Pepperweed	
2011	Escort, Weedar 64, Nufarm Polaris	86	Hoary cress and thistles	
2011	Garlon 4/3	34	Tamarisk	
2011	Milestone, Escort-Telar	56	Hoary cress, thistles, knapweed	
2011	Plateau/Telar	360	Hoary cress	
2011	Rodeo/Transline	284	Russian knapweed	
2011	Telar	229	P.Pepperweed, R. knapweed, H. Cress, thistles	
2011	Telar/Chaparral	40	Bull thistle/cockle bur	
2011	Weedar 64	291	Perennial pepperweed	179 acres initially treated and 112 were retreated
2011	Total	2387		

8.8.2 Herbicide Characteristics

Table 8.9.2 Herbicide Chemical Characteristics and Mode of Action

Pesticide name	Active Ingredient(s)	Chemical Family	Mode of Action
Weedar 64	2, 4-D Amine	phenoxy	Disturbs plant growth regulation by mimic of auxin hormone.
2,4-D	2, 4-D Ester	phenoxy	
Weedmaster	2,4-D + dicamba	Phenoxy-carboxylic acid + benzoic acid	
Milestone	aminopyralid	pyridinecarboxylic acid	Disturbs plant growth regulation.
Chaparral	aminopyralid + metsulfuron	pyridinecarboxylic acid and sulfonyureas	Disturbs plant growth regulation and inhibits amino acid synthesis.
Telar or Telar XP	Chlorsulfuron	sulfonylureas	Amino Acid Synthesis Inhibitors.
Transline	clopyralid	pyridine carboxylic acid	Disturbs plant growth regulation.
Curtail	clopyralid, 2,4-D	pyridine and phenoxy	Disturbs plant growth regulation.
Roundup	glyphosate	Phosphonate organic phosphorus compound	Amino acid synthesis inhibitor
AquaMaster™	glyphosate (isopropylamine salt)		
Rodeo	Glyphosate, isopropylamine salt* 53.8%		
Plateau	Imazapic (Ammonium salt)	Imidazolinone	Blocks amino acid synthesis
Habitat	Imazapyr	Imidazolinone	Amino acid synthesis inhibitor
Arsenal	imazapyr	Imidazolinone	Amino acid synthesis inhibitor
Nufarm Polaris	Imazapyr (Isopropylamine salt)	Imidazolinone	Amino acid synthesis inhibitor
Escort and Escort XP	Metsulfuron methyl	sulfonylureas	Mitosis inhibitor
Tordon	picloram	pyridine	Disturbs plant growth regulation.
Climb	Potassium carbonate	inorganic salt	buffering agent
Garlon-All	triclopyr	pyridine carboxylic acid	Disturbs plant growth regulation.

8.8.3 The Relative Toxicity of Commonly Used Herbicides

Trade Name	Active Ingredient	LD50 of the Active Ingredient mg/kg	Rating Oral	Rating Dermal
Arsenal	imazapyr	5,000	IV	IV
Garlon	triclopyr	630	III	II
Oust	sulfometuron methyl	5,000	IV	IV
Roundup	glyphosate	4,320	IV	IV
Tordon	picloram	8200/Possible carcinogen	*	*
Velpar	hexazinone	1,690	III	II
Weedone	2,4-D	375	II	II
Comparison:	Table Salt	3,750	IV	III
	Aspirin	1,700		
	Malathion (insecticide)	370		
	Caffeine	200	II	II

Table 8.9.3 Relative Toxicity of Commonly Used Herbicides

This is from "Environmental Safety of Forestry Herbicides," ANR-846 by Ken McNabb, Extension Forester, Associate Professor, Auburn University, 1997. Regardless of rating, follow all safety precautions for the applicator and always use protective equipment. The herbicide label is a legal document that provides information on proper use and handling of herbicides. ALWAYS READ AND FOLLOW LABEL DIRECTIONS. The label also provides information on sprayer calibration, dosage, and other guidelines to reduce risk to non-target plants. Avoiding off-site spray drift may be the best way to reduce harm to desirable plants. *See explanation in next section (8.1.4) on Tordon.

Although this table is often used to illustrate that herbicides are less toxic than caffeine or aspirin, it cannot be looked at this way. Everything can be toxic in certain amounts and the dose of a substance and method of entry are crucial. LD 50 measures oral ingestion only. Chronic toxicological information is based on tests on animals, over a short period of time (lifetime of a rat). Inert ingredients are not mandated by EPA to be tested for chronic toxicity. An Agricultural Health Study assessed over 90,000 certified pesticide applicators and their spouses, found a relationship between the use of certain pesticides and adverse health conditions that were not always indicated from previous EPA mandated toxicological tests.

8.8.4 Toxicity Rating Scale for Pesticides

Table 8.9.4 Toxicity Rating of Pesticides

Category	**Signal word required on label**	**LD50 oral mg/kg(ppm)**	**LD50 dermal mg/kg(ppm)**	**Probable oral lethal dose**
I-highly toxic	DANGER-POISON (skull and crossbones)	less than 50	less than 200	a few drops to a teaspoon
II-moderately toxic	WARNING	51 to 500	200 to 2,000	over 1 teaspoon to 1 ounce
III- slightly toxic	CAUTION	over 500	over 2,000	over 1 ounce
IV- practically non-toxic	none required			

A special warning about using this table to determine the toxicity of some herbicides such as Tordon: Although Tordon (picloram) has LD50 rating of over 8000, and is considered to be non-toxic according to this table, EPA has chosen to restrict the use of this herbicide because picloram is persistent in the environment with the potential to contaminate surface and groundwater supplies. It contains the contaminants; hexachlorobenzene (possible human carcinogen-Group B2) and nitrosamines. Health effects include liver and kidney damage. It is moderately toxic to fish and slightly toxic to aquatic invertebrates. It is extremely persistent in soil with high potential to leach to groundwater. It is highly water soluble with high mobility through soil.

The above table and the table in **Section 8.10.3, The Relative Toxicity of Commonly Used Herbicides** are often used in environmental documents to show that chemical methods have limited effects on the environment. They are included in this document to illustrate the fallacy of this thinking. Persistence in the environment, mobility, solubility and long term carcinogenic effects are often not included in this rating.

Source: Chemical Watch Factsheet, Picloram, A Beyond Pesticides/ NCAMP Factsheet, August 1988, Updated Nov 2007.

8.8.5 Human Poisoning Symptoms of Herbicides

Table 8.9.5 Human Poisoning Symptoms of Herbicides

Trade Name	Active Chemical Ingredient	Human Poisoning Symptoms
Various	2, 4-D Ester or Amine	Irritation of skin, eyes and respiratory tract. - Inhalation may cause burning sensation in nasopharynx and chest, coughing, and/or dizziness. - Headache, vomiting, diarrhea. - Confusion, bizarre or aggressive behavior. - Kidney failure, increased heart rate. - Metabolic acidosis resulting in peculiar odor on breath.
AquaMaster™ and Roundup	glyphosate (isopropylamine salt)	Formulations may show moderate toxicity. The trimethylsulfonium salt causes eye irritation in rabbits; Some formulations may cause much more extreme irritation of the skin or eyes.
Export and Export XP	Metsulfuron-methyl	Systemic toxicity is unlikely unless large amounts have been ingested. Symptoms are similar to chlorosulfuron and other urea compounds.
Telar	Chlorosulfuron (Urea Compound)	- Many substituted ureas are irritating to eyes, skin and mucous membranes. - Coughing and shortness of breath. - Nausea, vomiting, diarrhea, headache, confusion and electrolyte depletion. - Protein metabolism disturbances, moderate emphysema, and weight loss with chronic exposure. Skin and eye irritation
Habitat Garlon-All	Imazapyr triclopyr	Irritant of skin and eyes
Milestone Transline	aminopyralid clopyralid	No symptoms listed
Tordon	picloram	Burning sensation and cough if inhaled.
		Redness on skin.
		Redness, pain in eyes.
		Burning sensation, cough, nausea, if ingested.
		Prevent Dispersion of Dust. Insufficient data are available on the effects of this substance on human health therefore utmost care must be taken. Carrier solvents used in commercial formulations may change physical and toxicological properties. Do NOT take working clothes home. Tordon Amdon ATCLP Borolin K-PIN Chloramp Grazon are trade names.

Information obtained from PAN (Pesticide Action Network) http://www.pesticideinfo.org/ Accessed in Nov 2012 and February and March of 2013.

8.8.6 Characteristics and Effects of Common Herbicide Adjuvants

Adjuvant Name	Active Ingredient	Hazardous Ingredient	Mode of Action	Toxicity to Fish and aquatics	Toxicity to Mammals	Toxicity to Non-target plants	Persistance	Mobility	Carcinogen	Endocrine disruption	Water quality contaminant
MSO	Methylated Seed Oil/Ethylene oxide	Glycol Ether	Adheres to herbicide and increase absorbtion and potency.	High	Moderately high	High	Persistance in water.	Mobile in aquatic environments.	Yes, contains detectable amounts of ethylene oxide, a known carcinogen	Suspected	Yes
R-11	nonylphenol ethoxylates	20% butyl alcohol and 80% nonionic surfactants.	Adheres to herbicide and increase absorbtion and potency.	High	Moderately high	High	Persistance in water.	Mobile in aquatic environments.	Unknown	Low level	Yes
Roundup Pro (inert ingredient)	polyethoxylated tallowamine, or POEA	POEA	Irritation of biological membranes	High	Moderately high	High	Persistance in water.	Mobile in aquatic environments.	Possible		Yes

8.8.7 Herbicide Effects to Wildlife

Table 8.9.7-Herbicide Effects to Wildlife.*, **, ***

Herbicide	Trade Name	Adverse Effects	Comments
2, 4-D	Weedone, Weed n Feed”	At typical application rates, damage to external organs is expected. At high rates, mortality to mammals.	Exceeded thresholds more than any other herbicide.
Chlorsulfuron	Telar or Telar XP		No thresholds exceeded.
Clopyralid	Transline, Curtail		No thresholds exceeded.
Dicamba	Banvel, Diablo, Oracle and Vanquish in Weedmaster,	Adverse effects to mammals likely at typical rates, expected at high rates. High toxicity to birds.	Thresholds exceeded at high rates.
Glyphosate	Round Up, Aquamaster	Mortality in young rabbits, toxic to birds at high rates; may be toxic to amphibians.	No risks to birds or mammals at typical rates;
Imazapic	Plateau, Habitat		No thresholds exceeded.
Imazapyr	Arsenal		No thresholds exceeded.
Metsulfuron methyl	MSP, Ally, NuFarm, METSULFURON 60EG IVM,		Not registered in all WR states.
Picloram	Tordon	May be toxic to amphibians.	
Sethoxydim	E-Pro, Vantage	May be toxic to amphibians.	No thresholds exceeded.
Sulfometuron methyl	Oust		No thresholds exceeded.
Triclopyr	(Garlon, Pathfinder)	High toxicity to birds; malformed fetuses at high rates.	Thresholds exceeded at high rates. Low risks to mammals at typical rates.
*No herbicide exceeded thresholds for fish or mammal eating birds.			
**No data for reptiles, current studies being done.			
***Insufficient data to quantify for other groups of wildlife.			

USFS Region 6 study by Shauna Bautista

8.9 *Appendix J-Effects of Fire on Cultural Resources*

U.S. DEPARTMENT OF THE INTERIOR **BUREAU OF LAND MANAGEMENT**
Heritage Resources

Bare Bones Guide to Fire Effects on Cultural Resources For Cultural Resource Specialists

by Kate Winthrop, BLM

8. Introduction

This document briefly synthesizes some of the technical information available on the effects of fire on cultural resources. This synthesis should assist cultural resource specialists with their contributions to fire management planning, compliance for prescribed fire projects, and participation in wildland fire use or wildfire events.

Research on fire effects is on-going. A publication on this topic will soon be released under the USFS Rocky Mountain Research Station "Rainbow" series, and much of the data here is from drafts of articles for that publication. While there is a lot we do not know, there is also a considerable amount of work accomplished on this topic. This brief guide summarizes the results of some of these technical studies.

Fire effects to cultural resources, and the appropriate ways to manage for these effects, are context dependent. Fire itself is dependent on a suite of variables which change across the landscape; fire in grassland is likely to produce different effects to cultural materials than fire through a forest with heavy duff. Different types of archaeological materials, such as varieties of tool stones or types of ceramics may react differently in similar fire-related circumstances. This guide offers technical information which cultural resource specialists can use to craft locally and regionally appropriate strategies for protecting cultural resources within the context of fire.

References: References are cited at the end of the document. Where possible, links are provided to resources that are already available on the web. The "Rainbow" publication on "Fire Effects to Cultural Resources" will soon be available on the web and those links will be added to this document. The Western Archaeological Conservation Center, National Park Service, is currently digitizing many reports concerning fire effects on cultural resources. Those reports will also be available on the web in the next few months, and will be linked to this document.

II. Fire Basics

Fire effects to cultural resources vary depending on **temperature** and **duration** of exposure to heat. Generally, higher temperatures and/or longer duration of exposure to heat increase the potential for damage to cultural resources. Variables that affect temperature and duration include (Wiltz n.d., Hanes 2001):

Type of fuel

Fuel load/ distribution

Moisture content of fuels

Soil type, soil moisture

Weather, terrain

As a general rule, fire does not affect buried cultural materials. Studies show that even a few centimeters of soil cover (10 cm) are sufficient to protect cultural materials (Oster, n.d.). However, there are times when conditions do carry heat below the surface, with the potential to affect buried materials. These conditions include:

Stumps that smolder and burn have the potential of affecting buried materials that are in the vicinity.

Heavy duff, surface logs, and roots that smolder and burn also have the potential to expose subsurface materials to heat over a period of time, and hence have the potential to affect cultural materials.

Fires that burn hot and fast through a site may have less of an effect on certain types of cultural materials than fires that smolder in the duff, or than logs that burn for a period of time.

III. Cultural Resource Basics

When assessing the potential effects of fire on cultural resources there are some fundamental considerations (Hanes 2001, Duke et al. 2003):

Even if fire affects certain cultural materials, that effect may not be important. That is, the effect may not actually diminish characteristics that make a site eligible to the National Register. For example, high heat may destroy obsidian hydration bands on surface artifacts, but the surface component of the site may not be of particular value in the site's overall assessment. Fire may burn the solder out of a hole-in-cap can, but this effect does not diminish the can's ability to provide chronological information for a site.

Wildland fire is generally more destructive to cultural resources than prescribed fire, since it includes both uncontrolled fire effects and the effects of fire suppression. Management decisions may need to balance the potential effects of a prescribed burn with the risk of damage from an uncontrolled wildfire.

Fire history may be important. When assessing the potential effects of fire to cultural resources, cultural resource specialists should consider the nature of past fires compared to the potential for fire at the current time. For example, have fires routinely burned through an area? Have conditions (e.g. fuels and fuel loads) changed significantly over time? Will the effects of fire today be significantly different and pose a greater threat to cultural materials than in the past?

Prescribed fire can be controlled. Cultural resource specialists can work with fire managers to determine the predicted temperature and duration of a fire through an area, and possibly to modify burn plans to minimize effects to cultural resources.

Protecting cultural resources during fire begins with fire management planning. This is the place to define vulnerable cultural resources, appropriate protection measures for them, and appropriate management responses with regard to cultural resources in the event of wildland fire or a wildland fire use event.

As always, consultation with SHPO, tribes, and other appropriate entities should be part of the project planning process, especially when designing fire-specific protocols for identification and protection of potentially affected cultural resources.

III. Fire Effects on Lithics (Deal n.d., Buenger 2003)

Fire can affect chipped and ground stone tools, primarily through changes in morphology rather than in chemistry. Residues on artifacts are not necessarily destroyed by fire. As a general rule-of-thumb, hotter temperatures and longer exposure to fire may affect lithic materials. When these materials are important, it may be necessary to take protective measures.

Obsidian

Fire can modify or destroy obsidian hydration rinds, but does not affect obsidian source analysis (Shackley and Dillon 2002). High temperatures, such as those experienced in a catastrophic wildfire, may be sufficient to cause obsidian to bubble and crack, loosing shape as well as hydration capacity.

The exact temperature at which obsidian is affected varies, probably due to components of the field environment and/or differences in source materials. Duration of exposure increases the effect of heat on obsidian. High temperatures and smoldering fires can both affect hydration bands.

Obsidian: Approximate Temperature Guide (Deal n.d., Buenger 2003, Loyd et al. 2002)

Temperature	Effect
300 C (572 F)	Hydration band begins to become diffuse
400 C (752 F)	Hydration band not visible
450 C – 800 C (842-1472 F)	Enhanced fracture lines
760 C (1292 F)	Obsidian may melt

Chert

Fire can also affect chert (including various silicates), through fracturing, pot-lidding, crazing, shattering, changes in color and internal luster, and other such effects which might reduce an artifact's ability to render information about the past. Temperatures which affect chert vary, possibly dependent upon source or other variables such as prior heat-treatment for tool manufacture. Generally, longer and/or hotter fires produce more intense effects upon chert artifacts (Deal n.d., Waechter n.d.).

Chert: Approximate Temperature Guide (Deal n.d., Buenger 2003)

Temperature	Effect
350 C (662 F)	May become distorted, brittle or explosive
350 — 550 C (662 – 1022 F)	Cracking, Fracture

Basalt
Fire can produce changes in basalt including spalling, potlidding, crazing, and fracturing; these effects possibly result from rapid cooling. There is little experimental data for fire effects on basalt. One study indicates that spalling or flaking may occur at temperatures around 350 – 400 C (662 — 752 F) (Deal n.d.).

Groundstone
Rock types vary in their response to fire. Sandstone reportedly cracks or fractures at a lower temperature than basalt. Granites and quartzite withstand higher temperatures. Severe wildfire may cause portable ground stone to crack or fracture. Thermal shock—such as rapid heating or cooling—can cause fracturing and exfoliating of ground stone artifacts, including bedrock mortars. Burning or smoldering fuels on ground stone artifacts or features (e.g. a fallen tree on a bedrock mortar) may contribute to increased damage during a fire. As is true for other tool types, longer exposures to heat and/or hotter fires increases the potential for artifact damage (Deal n.d., Buenger 2003).

IV. Fire Effects on Ceramics (Rude n.d., Buenger 2003, Haecker n.d.)
Different types of clays, inclusions, and manufacturing techniques lead to different effects among distinct pottery types. Since all pottery—historic and prehistoric—has been fired to some degree, heat damage is not as significant a consideration for this artifact type as it is for others. Generally, structural damage does not occur until temperatures exceed the original firing temperature. The main type of damage noted is to the surface decoration or glaze.

Prehistoric Ceramics
Temperatures do not exceed the original firing temperature for most prehistoric ceramics until about 600 C (1112 F) (Andrews 2004). Fire can, however, affect the appearance of pottery shards, possibly leading to mis-identification. Effects from fire include surface spalling, alteration of painted decoration, blackening and sooting, and loss of appliqué designs which may break off. In one experiment painted designs faded and turned color at temperatures greater than 800 C (1472 F). However, sooting or blackening may be removed by cleaning in a lab, and discoloration does not necessarily prevent identification of pottery type (Rude n.d.).
Fire may affect the potential for thermoluminescence (TL) dating. However, surface potsherds are generally not used for this technique, and buried potsherds are not likely to be affected by fire. Another study also showed that TL dating was not affected at temperatures below 400 C (752 F), indicating that moderate intensity wildland and prescribed fire may not have an impact on TL dating (Rude n.d.).

Historic Ceramics
Historic ceramics consist of earthenwares, stonewares, and porcelain. These types of pottery are differentiated in part by the heat of firing. All of these pottery types may be glazed, and the glaze or other decoration is likely to be the most vulnerable characteristic. Some early glazes (e.g. majolica glaze) and glazes on "whiteware" (refined earthenware common at nineteenth and twentieth century sites) may crackle or spall even in a low temperature fire.

Ceramics: Approximate Temperature Guide
(Rude, n.d., Haecker n.d., Duke et al. 2003))

Ceramic	Firing Temperature	Temperature Effects
Prehistoric	> 350 C (662 F)	Minor effects (sooting, fading, discoloration)
Prehistoric	> 600 C (1112 F)	Structural change

		possible
Prehistoric	> 400 C (752 F)	TL dating potential compromised
Historic: Unrefined Earthenware	500–900 C (932–1652 F)	Glazes may crackle and spall at low fire temperatures
Refined Earthenware ("whiteware")	1100–1500 C (2012-2732 F)	Glaze may crackle at low fire temperatures
Stoneware	900–1100 C (1652-2012 F)	Temperatures above firing point may oxidize glaze or crack shards
Porcelain	1250-1450 C (2282-2642 F)	Temperatures above firing may oxidize glaze or crack shards

V. Fire Effects on Organic Materials

Organic Materials

Organics will usually burn or alter at lower temperatures than inorganic items. Artifacts (e.g. basketry, digging sticks, clothing, textiles) and features (e.g. structures, bow-stave trees, wikiups, dendroglyphs) made of or containing organics such as wood, leather and hide, or cordage will need protection or treatment before any fire burns through a site containing such items.

Bone and Shell

Bone and shell can sustain some degree of burning without complete destruction (Buenger 2003):

Bone and Shell: Approximate Temperature Guide (Buenger 2003)

Material	**Temperature**	**Effect**
Bone	200 C – 400C (392-752 F)	Bone chars, becomes darkened
Bone	600 C – 800 C (1112-1472 F)	Bone becomes calcined
Shell	>300 C – 400 C (572-752 F)	May delaminate, burn

Organic Residues

Plant and animal residues may survive exposure to fire. Pollen may be destroyed at temperatures greater than 300 C (572 F), but animal proteins survive to 800 C (1472 F) (Jones n.d.)

VI. Fire Effects on Historic Materials

The following chart provides melting points for materials commonly found at historic sites. Fire may produce complex interactions which affect these baseline temperatures, however. Metal alloys may react differently, and metal artifacts/ materials which do not melt may warp. The chart is derived from Haecker (n.d.).

Cans

Cans from late nineteenth and twentieth century sites are made from rolled, tinned steel. Fire may damage labels, melt solder on the older "hole-in-cap" cans, and burn off the tinned surface. However, can morphology (size, shape) which is usually the key to identification is unlikely to be affected by fire (Haecker n.d.).

Melting Points of Materials Commonly Found on Historic Sites (Haecker n.d.) (Temperatures are Approximate)

MATERIAL	TEMP (F)	TEMP I
Plastics	167-509	75-265
Solder (tin-alloy)	275-350	135-177
Tin	449	232
Pot Metal (copper-lead alloy)	572-752	300-400
White pot metal	572-752	300-400
Lead	621	327
Zinc	707	375
Glass	1100-2600	593-1427
Unrefined Earthenware	1112 – 1832	600-1000
Aluminum	1220	660
Brass (yellow)	1710	932
Silver	1760	960
Stoneware	1832-2192	1000-1200
Gold	1945	1063
Copper	1981	1082
Refined Earthenware	2192-2912	1200-1600
Cast Iron	1920-2550	1350-1400
Steel (stainless)	2600	1427
Nickel	2651	1455
Steel (carbon)	2760	1516
Iron	2795	1535
Porcelain	2822	1550

VII. Fire Effects on Inorganic Architectural Materials (Buenger 2003, Haecker n.d.)

Sandstone (Architectural)

Fire will damage architectural stone. Above about 300 C (572 F) sandstone will begin to oxidize and at higher temperatures (pervasive at 700 C, 1292 F) it will spall and fracture. These effects can significantly alter features constructed of this material and may constitute a significant effect to sites with these features (Buenger 2003).

Adobe

Adobe bricks and mortar and rammed earth walls are created from non-flammable sand, silt, and clay. These materials may be mixed with straw, however, and construction of adobe structures will often include wooden poles and posts, which may burn. Walls may be smoothed with adobe plaster. When intact, an adobe structure will resist fire. Plaster that is made with gypsum will spall when exposed to sufficient heat, which may expose more flammable parts of a structure. If the straw used in the adobe burns, the structure may also be weakened (Haecker n.d.).

Cement-mortared Fieldstone, Firebrick, Cinder Block, Cement Aggregate

These materials are generally resistant to fire. Low-fired, non-commercial, locally made brick may weaken and crumble in a hot fire. Hot fires will also calcinate lime-based mortar, causing it to crumble and the wall to eventually collapse. Masonry and cinder block may spall, resulting in damage to the surface of the structure (Haecker n.d.)

VIII. Fire Effects on Rock Art

Fire has a high potential for damage to rock art. Though there are no specific temperature guidelines for rock art, fire effects include soot smudging and discoloration from smoke, which obscure the rock art images; degradation of the rock surface from spalling, exfoliation, and increased weathering; changes in organic paints due to heat; and damage to rock varnish which may destroy its potential to date the art (Tratebas, 2004, Kelly and McCarthy 2001).

Fire retardants, slurry, foam, and water should never be dumped/ sprayed on rock art during a fire.

IX. Effects of Fire Suppression on Cultural Resources

Ground Disturbance

Fire suppression activities have considerable potential to damage archaeological and historic sites and materials from many activities, including fireline construction (hand line and bulldozer line), establishment of helicopter bases, fire camps, and related activities.

Fire Retardant/ Chemical Products

Application of fire retardant and other chemical products has the potential to affect cultural resources, although use of fire retardants on historic structures may protect them from destruction during a fire. Cultural resource specialists may need to consider the effects of fire itself versus the effects of retardant use or the possibility of other protection options during a fire. See these references for further information: Saleen, 2004, Corbeil, 2002, and the USDA Wildland Fire Chemical Systems website. This website (see references at end of this document) has brief descriptions of the types of chemicals used and their potential effects on structures.

There are various types of products:

- Long-term retardants, which contain salts (fertilizers) with additives that may color covered items red or which may turn metals bluish;
- Foam fire suppressants, which are detergents and surfactants (wetting agents);
- Water enhancers which increase the effectiveness of water.

There are various potential effects from use of retardants, foams, and water:

- Rapid cooling: dumps of any of these materials on hot surfaces may cause effects to archaeological materials (e.g. artifact fracture) from rapid temperature change;
- Materials dumped onto fragile archaeological features may break/ displace them;
- Long-term retardants contain salts which can be desiccants, which damage old, fragile wood and may cause spalling in sandstone; chemicals may cause corrosion in metals; iron oxide additives may leave a permanent red stain and corrosion inhibitors in the retardant may turn surfaces, especially metals, blue or black;
- Foams may hasten rusting on metal surfaces by removing protective coatings and may cause wood to flake due to swelling and contracting;
- Water enhancers are desiccants and may damage wood surfaces, strip surfaces of finishes, and damage sandstone; they are also difficult to remove from wood surfaces, especially for old or fragile wood.
- Retardant should be washed off important structures as soon as possible. Pre-soaking, then

hand-brushing with water and a mild detergent may work for sandstone or painted wood. Metals and glass may be wiped with water and a mild detergent. Power washing, sand-blasting, and acid based washes may damage historic materials.

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- Rapid cooling: dumps of any of these materials on hot surfaces may cause effects to archaeological materials (e.g. artifact fracture) from rapid temperature change;
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- Foams may hasten rusting on metal surfaces by removing protective coatings and may cause wood to flake due to swelling and contracting;
- Water enhancers are desiccants and may damage wood surfaces, strip surfaces of finishes, and damage sandstone; they are also difficult to remove from wood surfaces, especially for old or fragile wood.
- Retardant should be washed off important structures as soon as possible. Pre-soaking, then hand-brushing with water and a mild detergent may work for sandstone or painted wood. Metals and glass may be wiped with water and a mild detergent. Power washing, sand-blasting, and acid based washes may damage historic materials.

X. Effects of Fire on Archaeological Sites

There are a number of potential fire effects to cultural resources which do not depend upon effects to specific materials, including :

Increased visibility from vegetation burn-off and consequently greater vulnerability to vandalism

- Physical damage to sites from snags/ trees falling
- Soil erosion and loss of archaeological data
- Increased damage from rain, new drainage patterns, flood
- Increased rodent and insect activity within site soil matrix

XI. Protection Protocols

Management Measures

There are a number of actions which cultural resource specialists can take or promote to help preserve cultural resources from the effects of fire, including fire suppression:

- Serve as a technical specialist during fire events; the best protection for cultural resources during a wildfire is to have knowledgeable professionals ready and able to participate in the suppression effort.
- Prepare plans for protecting high value cultural resources before a fire occurs, and make sure that appropriate authorities know about and have access to these plans. Define ahead of time those high value cultural resources which are really worth saving. "Fire proof" vulnerable sites ahead of time when possible.
- Work with prescribed fire project planners to accommodate cultural resource concerns in the burn prescriptions.
- Ensure that cultural resource concerns are included in fire management plans, especially with regard to appropriate management responses to fire whenever it might occur in specific areas. For example, where there are areas of high value cultural resources and these are also areas where fires will be suppressed, ensure that plans include the necessity for "ordering up" a

cultural resource specialist when a fire occurs.

- Track fire effects on cultural materials in local contexts, and share that information regionally. When possible, do "before/after" experiments of prescribed burns, to assess the effects of fire in specific, local contexts on those archaeological materials which are typical in your area.

Protection measures

There are many actions which will help protect cultural resources from the effects of fire. Cultural resource specialists should work with fire specialists to implement these measures.

In some cases there may be adverse effects associated with implementing the protection measures, such as using retardant on historic structures during a fire, or clearing vegetation which screens sites from vandals. In these cases, of course, the effects of the protection measures must be weighed against the potential for loss of the resource due to fire. In all cases, prescribed fire offers the chance of greater control over fire effects than does wildfire.
Some of these protection measures are pertinent to prescribed fire, some to wildfire, and some to both. This list is not exhaustive.

- Identify and avoid vulnerable cultural resources. Note that avoidance may contribute to greater likelihood of wildfire in the future when sites have high fuel loads, or that avoidance may create "vegetation islands" that identify sites to vandals. If necessary, work with fire planners to minimize these effects.
- Record and collect information that would be lost during a fire. For important rock art, thorough recordation and collection of samples of the surface varnish for dating may be the best protection possible.
- Manually reduce fuels on and/or around vulnerable sites; pile debris offsite.
- Create fire breaks near/ around sites. This may be an effective way to protect rock art panels, for example.
- Use retardant or foam to protect structures.
- Wrap structures in fire proof materials to protect from fire.
- Remove logs/ heavy fuels from vulnerable sites/ features (e.g. clear snags off bedrock mortars), or cover with foam or retardant prior to burn.
- Flush cut and cover stumps with dirt, foam, or retardant, where burnout could affect subsurface cultural resources.
- Modify burn plans to minimize effects to cultural resources, such as burning when duff has high moisture.
- Identify and reduce hazard trees next to structures.
- Use low intensity backing fire in areas near historic features.
- Saturate ground/grass adjacent to vulnerable structures with water, foam, or gel before burning.
- Pre-burn site at lower intensity than planned for surrounding areas.
- Limit fire intensity and duration over vulnerable sites.
- Use a fast-moving, higher intensity fire over lithic scatters, where rock materials are vulnerable to longer-duration heating.
- Wrap carved trees, dendroglyphs, and other such features in fire retardant fabric.
- Limb carved trees to reduce ladder fuels, if possible to do so.
- Cover rock art in fire retardant fabric.
- Minimize fuels and smoke near rock art.
- Cover fuels near rock art with foam, water, or retardant, avoiding the rock art.

For a good discussion of protection measures for historic structures, see Matz (2002)

XII. Summary

Fire effects are context-dependent. The effects of fire on cultural resources depend upon factors which vary from place to place, including physical factors such as fuels, terrain, site type, and cultural materials present. Managing for fire effects also depends upon the value of the cultural materials at risk. In areas where surface materials have little integrity, for example, due to collecting, erosion, past fires, or other factors, surface effects from fire may be of minimal consideration.

The brief synthesis of fire effects information in this guide should assist cultural resource specialists to address the conditions that apply to their local/ regional circumstances. There are few hard and fast answers; local circumstances and conditions require appropriate strategies based on good technical information.

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Some of these references will be available on-line in the next few months. They will be added to this document as they are posted on the Web.

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USDA Wildland Fire Chemical Systems

Links to information on wildland fire chemicals:

http://www.fs.fed.us/rm/fire/
Wildland Fire Chemical Products: (Brief descriptions of chemicals used): http://www.fs.fed.us/rm/fire/documents/defin.pdf
Wildland Fire Chemical Products Effects on Structures: http://www.fs.fed.us/rm/fire/retardants/current/gen/pdf/effstructure.pdf
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Wiltz, L. Kate n.d. Effects of Wildland Fire on Cultural Resources. National Interagency Fire Center, Communicator's Guide. http://www.nifc.gov/preved/comm_guide/wildfire/fire_10.html

8.10 *Appendix K-BIA Noxious Weed Program Materials*

8.10.1 Grant Application

BIA Noxious Weed Program

Western Region
Grant Request Form for 2013

Contents

Grant Request Summary

1. Date of Application

2. Name of Tribe/Organization	3. Contact Person	
4. Mailing Address	5. Contact Phones	
	6. E-mail (optional)	

Summary of All Estimated Costs and Contributions

12. Total Amount Requested from BIA		
13. Matching Contributions		

13a. Private		
13b. City, County, State, other Federal		
13c. Other		
13d. Tribal/In-kind		
14. Subtotals for Matching Contributions		
17. Total Project Costs		

Summary of Estimated Activity

18. Total Estimated Acres to be Treated	
19. Total Estimated Acres to be Monitored	
20. Total Estimated Acres to be Inventoried	
21. Total Estimated Acres to be Re-vegetated	
22. Total Estimated Acres for Bio-control Release	
23. Total Education/Outreach (newspaper articles, fairs, etc.)	

Project Worksheets

Project #1

1. Project Name/Weed to be treated		2. Treatment Method
3. Estimated Acres to Treat	4. Estimated Acres to seed	5. Estimated Acres to Monitor
6. Estimated Acres to Inventory	7a. Estimated Biocontrol Acres	7b. Biocontrol Type

Estimated Grant Expenditures		
8. Requested BIA Contribution		
9. Estimated Cost-share Contributions		
9a. Private		
9b. City, County, State, other Federal		
9c. Other		
9d. Tribal In-Kind		
10. Subtotal-Total Cost share		
11. Total Estimated Cost of Project		

12. Narrative of Weed Control Activities (do not exceed window)
13. Describe proposed Early Detection and Rapid Response methods.

Project Worksheets
Project #2

1. Project Name/Weed to be treated		2. Treatment Method
3. Estimated Acres to Treat	4. Estimated Acres to seed	5. Estimated Acres to Monitor
6. Estimated Acres to Inventory	7a. Estimated Biocontrol Acres	7b. Biocontrol Type

Estimated Grant Expenditures		
8. Requested BIA Contribution		
9. Estimated Cost-share Contributions		
9a. Private		
9b. City, County, State, other Federal		
9c. Other		
9d. Tribal In-Kind		
10. Subtotal-Total Cost share		
11. Total Estimated Cost of Project		

12. Narrative of Weed Control Activities (do not exceed window)
13. Describe proposed Early Detection and Rapid Response methods.

Project Worksheets
Project #3

1. Project Name/Weed to be treated		2. Treatment Method
3. Estimated Acres to Treat	4. Estimated Acres to seed	5. Estimated Acres to Monitor
6. Estimated Acres to Inventory	7a. Estimated Biocontrol Acres	7b. Biocontrol Type

Estimated Grant Expenditures		
8. Requested BIA Contribution		
9. Estimated Cost-share Contributions		
9a. Private		
9b. City, County, State, other Federal		
9c. Other		
9d. Tribal In-Kind		
10. Subtotal-Total Cost share		
11. Total Estimated Cost of Project		

12. Narrative of Weed Control Activities (do not exceed window)
13. Describe proposed Early Detection and Rapid Response methods.

Project Worksheets
Project #4

1. Project Name/Weed to be treated		2. Treatment Method
3. Estimated Acres to Treat	**4. Estimated Acres to seed**	**5. Estimated Acres to Monitor**
6. Estimated Acres to Inventory	**7a. Estimated Biocontrol Acres**	**7b. Biocontrol Type**

Estimated Grant Expenditures		
8. Requested BIA Contribution		
9. Estimated Cost-share Contributions		
9a. Private		
9b. City, County, State, other Federal		
9c. Other		
9d. Tribal In-Kind		
10. Subtotal-Total Cost share		
11. Total Estimated Cost of Project		

12. Narrative of Weed Control Activities (do not exceed window)
13. Describe proposed Early Detection and Rapid Response methods.

Project Worksheets
Project #5

1. Project Name/Weed to be treated		2. Treatment Method
3. Estimated Acres to Treat	4. Estimated Acres to seed	5. Estimated Acres to Monitor
6. Estimated Acres to Inventory	7a. Estimated Biocontrol Acres	7b. Biocontrol Type

Estimated Grant Expenditures		
8. Requested BIA Contribution		
9. Estimated Cost-share Contributions		
9a. Private		
9b. City, County, State, other Federal		
9c. Other		
9d. Tribal In-Kind		
10. Subtotal-Total Cost share		
11. Total Estimated Cost of Project		

12. Narrative of Weed Control Activities (do not exceed window)
13. Describe proposed Early Detection and Rapid Response methods.

Estimated Cost Share Breakdown

For All Projects	**Funding**		**%**
1. BIA Request			
2. Estimated Cost Share Contributions			
3a. City, County, State, Federal			
A. Labor			
B. Equipment			
C. Herbicide			
D. Funding			
E. Other			
3b. Private/Other			
A. Labor			
B. Equipment			
C. Herbicide			
D. Funding			
E. Other			
3c. Tribal In-Kind			
A. Labor			
B. Equipment			
C. Herbicide			
D. Funding			
E. Other			
4. Subtotal Estimated Cost-share			
5. Total Estimated Award and Matching Contributions= Total Project Costs			100 %

Authorization

6a. Print Authorized Name	6b. Authorized Signature

Be sure to make a copy for your records.

Allowed Cost-Share Fees
(If your cost-share fees differ from the chart please attach supporting documentation.)

Cost Share Item		**Hourly Fee**
Labor		$ 22.00
Equipment		
Sedan	$	12.00
Truck 2x4	$	15.00
Truck 4x4	$	18.00
Truck 4x4 w/spray rig$		25.00
ATV 4x4	$	15.00
ATV 4x4 w/spray rig	$	20.00
ATV 6x6 w/spray rig	$	22.00
Trailer single axle	$	12.00
Trailer double axel	$	15.00
Backpack sprayer 2-5 gal	$	5.00
Boat	$	10.00
Boat w/motor	$	20.00
Boat w/motor and trailer	$	25.00
GPS non-corrected	$	5.00
GPS differential correction	$	10.00
Sweep Net	$	2.50
Computer	$	8.00

You may also use In-Kind Rate Table in Grant Package.

8.10.2 Grant Proposal Scoresheet

BUREAU OF INDIAN AFFAIRS

Noxious Weed Management Project
Ranking Criteria Scoring Table

Project Name: ______________________________
Reservation: ______________________________
Proponent: ______________________________

Score: __________

The following table is to be used to score and rank weed control project proposals for FY 2014 funding. Consideration is limited to treatment of trust and restricted Indian lands managed for maintenance of native species; projects to treat lands set aside for economic and community development will not be funded. Proposed projects must be supported by an appropriate NEPA decision document and be fully compliant with applicable pesticide use regulations. Total possible points are 90.

	Criterion	Standard	Points	Score
1	**Cooperative Management.** Long-term weed control will be effective only if adjacent land owners/users and appropriate governmental agencies are actively committed to addressing the problem. *Include score for all items that apply. Note: For items that DO NOT apply, a zero (0) must be placed in the Score cell for the Total Score formula to work properly.*	Proponent is member of an active Weed Management Area. Claim these points if the proponent currently coordinates weed management activities with neighboring land owners/operators as part of an established Weed Management Area.	3	
		There is an up-to-date Coordinated Weed Management Plan covering the project area. Claim these points if there is a document, updated in the last three years, that outlines a coordinated approach to control of noxious weeds on the WMA, reservation, or county.	3	
		Control of target weed species is actively supported by tribal, state and/or county governments. Claim these points if control of the target weed species is specifically encouraged by local governing bodies.	2	

Criterion		Standard	Points	Score
		Target weed species is (are) object of current control efforts by majority of affected adjacent land owners/users. Claim these points if the more than half of adjacent landowners with known infestations of the target weed are taking control measures.	2	
2	**Cost Share.** The more that cooperators contribute to weed control projects the greater the reach of Bureau funds in terms of both projects initiated and acreage treated. This effect is further enhanced by requiring that both Bureau and matching funds be used for direct control costs. These include the cost of on-the-ground labor and procurement of equipment and control agents (i.e., biological agent, chemicals, seed). *Choose level that applies to project. A proposal that does not document at least 50% cost share will not be considered.* .	More than 70% of on-the-ground control costs contributed by project cooperators.	10	
		From 61% to 70% of on-the-ground control costs contributed by project cooperators. Because these funds are very limited, they cannot be used to establish or to maintain anyone's weed management program; rather, they are to be used for specific weed control projects. If it is not an on-the-ground, project-specific cost, do not include it in either the Bureau or the cooperators' share for this calculation	7	
3	**Integrated Weed Management (IWM).** An integrated approach to weed management results in more effective and long-term weed control. IWM combines weed awareness programs, weed prevention measures, consideration of all potential methods of control (i.e., mechanical, cultural and biological), management and policy changes (e.g., grazing adjustments, weed-free hay regulations, mandatory control requirements) in response to weed presence, and an ongoing assessment of management efforts. *Include score for all items that apply.*	An analysis of full range of control methods documented in project proposal. Claim these points if the project proposal shows that the pros and cons of several alternative methods of control were evaluated.	2	
		An on-going weed awareness program implemented by at least one project participant. Claim these points if one or more of the project principals regularly performs some sort of weed outreach such as weed ID classes, school visits, brochure distribution, a booth at the fair	2	
		Project includes a change in management factors that contributed to the weed infestation, including measures to establish desirable competitive species post treatment. Claim these points if project proposal details management changes that will reduce or prevent re-infestation or spread from identified sources, e.g., stocking rate reductions; establishment of competitive vegetation;	5	

Criterion		Standard	Points	Score
		closure of infested parking lots, barrow sources, ATV tracks; establishment of facilities to clean farm and construction equipment.		
		Project includes a multi-year monitoring plan to assess the success of control efforts. Include these points if the project proposal details a method and schedule for assessing project results in out years.	3	
4	**Priority Weed Species.** Weed species priority is based on Regionally approved lists; however, only projects targeting non-native terrestrial species will be considered for funding under this program. *Choose level that applies to project.*	Weed is high-priority species on Regionally approved list. The Region must identify the appropriate weed priority list – state if one exists, tribal, or one developed by the Regional Office. Score 10 points if the target weed is listed as high priority for control. If more than one weed species occupies the same piece of ground and both will be targeted with the same treatment, you can claim points for the highest priority weed. Otherwise, you have two proposals.	10	
		Weed is medium-priority species on Regionally approved list. Claim 5 points for medium-priority weed species. If your target weed is not rated as either high or medium priority, claim 0 (zero) points for this criterion.	5	
5	**Early Detection, Rapid Response (EDRR).** EDRR increases the likelihood that localized invasive populations will be found, contained, and eradicated before they become widely established. *Include score for all items that apply.*	Reservation is subject to regularly scheduled, comprehensive weed survey. Claim these points if a noxious weed survey is conducted on a pre-determined schedule by individuals trained in weed ID. Claim these points if weed survey is specifically included as part of other regularly scheduled activities such as grazing utilization surveys.	5	

Criterion		Standard	Points	Score
		Treatment target is a species recently discovered on the Management Area that presents a genuine (concurrence in determination by County or State weed authorities) opportunity for eradication. These points can only be claimed with written concurrence from a weed management peer (county, state, university specialist) that the weed is new and that eradication, not just control, ERADICATION, is possible.	5	
6	**Extent of Target Weed Infestation.** The extent to which a weed has infested a management area reflects how well established the plant is and how difficult it would be to achieve and maintain control of that species. The acreage figures here are for the area of infestation in the entire management area, NOT just the targeted infestation or treatment area. Thus, if you are treating 15 acres of weed A in a WMA where there are 20 acres of that species, you can score 15 points. If there are 100 acres of that weed in the WMA you can score 10 points, and 5 points if there are 800 acres. If there are more than 1000 acres of the targeted weed in the WMA, you score zero points for this criterion.	Total infestation of target weed in Management Area less than 25 acres.	15	
		Infestation within Management Area totals between 25 and 150 acres.	10	
		Infestation within Management Area totals between 150 and 1000 acres. *Choose level that applies to project. In absence of declared Weed Management Area, use county*.	5	
7	**Biological Control Off-set.** Biological control has the potential to return very large areas of Indian and neighboring lands to productive use. Assigning points will offset the reduction of points for areas greater than 1000 acres on the Extent of the Target Weed Infestation criterion above. *Include score if applicable. If points are claimed under Criterion 6, score zero points here.*	Project targets, with a proven biological control agent, an infestation within or adjacent to the Management Area of greater than 1000 acres. Score these points ONLY if the extent of infestation of the target weed species within the WMA is GREATER than 1000 acres, AND, the control tool is a proven biological control agent that might reasonably be expected to spread to the full infestation.	15	
8	**Geographic Information Systems.** GIS software and technical support is available at no cost to all Agency and Tribal programs. This technology is of extreme value in the development of a cooperative and integrated weed management program. *Choose level that applies to project.*	Full range of project and Management Area elements (e.g., land ownership, land use, lease/permit status for trust lands, noxious weed infestations, travel and utilities corridors) captured in GIS. Score at this level if elements important to a full examination of weed management needs, options and possibilities within the weed management area are available for analysis in GIS. Think in terms of the extent of the weed problem, likely contributors to the problem (such as uncontrolled rights-of-way, grazing levels), who your most appropriate partners are going to be, and what	10	

Criterion		Standard	Points	Score
		other resource values need to be considered in your weed management decisions.		
		Only immediate, project-specific elements captured in GIS. If you do not use GIS claim zero points here.	5	
9	**Weed Management Environment.** Tribal or landowner awareness, support, and regulation of activities and products concerning noxious weeds is critical for program success. *Include score for all items that apply.*	Weed-free forage and/or weed-free seed law enforceable at the reservation level. Claim these points if movement of weed-contaminated forage/seed onto the reservation is controlled by law and mechanisms for enforcement (inspection stations, designated officials, etc.) are in place.	4	
		Regional Director, Agency Superintendent, or Tribal governing body has issued specific written direction requiring management of noxious weeds in connection with actions taken by non-ag programs (e.g. Roads, Forestry, Wildlife). Count these points if a responsible official has gone on record requiring managers in all programs to address noxious weed concerns in the analysis and implementation of their activities.	4	
10	**Continued Success.** Because noxious weed control is seldom achieved with a single treatment, it is important to support "in-progress" projects. Annual reports must show previous year success and be submitted with the proposal. A reduction in targeted weed acreage or density should be documented. *Include score if applicable.*	Project represents continuation/extension of a successful previous-year project. Claim these points if the project represents continuing control measures applied to an infestation treated (with measurable results) in a previous year. Previous treatment does not need to have been Bureau funded.	5	
Total Score		[*Table/Formula/=SUM(ABOVE)*]		

8.10.3 Program Guidelines

BIA Noxious Weed Funding

Guidelines for Submitting Proposals

The proposal should consist of: **A**) narrative proposal and **B**) BIA Noxious Weed Grant Request form. Attaching some background or supporting information may be helpful. **C)** Pesticide Use Proposals and Pesticide applicator certification due before project starts **D)** Report-these are items to be submitted after the project is completed.

Essential elements to include in the Narrative:

1) **Follow the Noxious Weed Management Project Ranking Criteria Scoring Table**. **(FY 2013 Nox Weed Scoring Table-Annotated.pdf).** Go through each item and provide supporting documentation for each criterion. Guidance has been added to clarify how you should expect to be scored. It is very important to address all of the criteria. This is how you will be rated.

2) **A short introductory paragraph** to describe the noxious weed issues on your reservation. Acreages and species of infestations, past control efforts, land use and other issues related to invasive species. Background information about the geography, size or location of the reservation is not necessary, unless it relates to noxious weed control.

3) **List cooperators on the project.** Even if the Tribe owns all the land, you can cooperate with other tribal and BIA entities, county and state weed control groups, other governmental agencies, adjacent landowners, Cooperative Extension or weed management groups. List anyone you obtain technical or financial support from. Look up your local BLM or Forest Service Weed Coordinator. They are often eager to work with tribes on noxious weed issues.

4) **List each species and acres** of your proposed projects.

5) **Submit a budget.** This is where you show your actual costs. Include personnel wages, chemical, equipment. If you already own the equipment, include reasonable cost of upkeep, maintenance, fuel, etc. If equipment is borrowed, show it as a cost share element. A good budget will itemize your expenses and cost share items from other agencies. Show everything, but be reasonable. Our national guidelines allow up to 10% administrative costs for cost share but funding for indirect or contract support cannot come out of Noxious Weed Grants.

6) **Attach Supporting Documentation.** Some tribes submit their management plans or strategic plans (submit sections related to noxious weeds only), training and awareness bulletins or agendas, monitoring forms, etc. Do not get too carried away with submitting large plans or proposals, but some of these documents provide a good indication of the efforts going into invasive species awareness and control.

B) Fill out the grant request form and project sheets for each proposed project. Cost share amounts for each project must be included. Combine projects if the rating elements are similar, but if you have a different weed, different methods or different cooperators, you probably should separate.

Cost share guidelines

- Other weed control grants may be included in cost share.
- Time other agencies and organizations spend to assist you with the project may be included.
- Borrowed equipment may be included. Give it a dollar value as a rental.
- You cannot include overhead costs or salary amounts from an administrator who does not have much to do with the project.
- Our national guidelines allow up to 10% administrative costs for cost share but additional costs for indirect or contract support cannot be included and will have to be removed.

50 % cost share is 50% of Total Project Costs-not just your BIA request. Example: BIA request is $10,000; your cost share must be at the very least $10,000. If you can get it up to 61% or 71%, this will help your rating by 7 and 10 points, respectively. (See the table below.) *Depending on where the cutoff is, 7 points can prevent you from being funded, so try to get your cost share as high as possible. Call the Noxious Weed Coordinator for assistance or questions with this.*

BIA Project Costs	Cost Share Amount	Total Project Cost	Percent Cost Share
$10,000	24500	$34,500	71.0%
$10,000	15500	$25,500	61%
$10,000	10000	$20,000	50%

This spreadsheet in Excel format will be provided to all noxious weed applicants. The formulas are in the spreadsheet and you can easily figure cost share requirements.

C) Pesticide Use Proposals (PUPs) and pesticide applicator certification are due before project starts. *(Many of you forget to send in the PUPs and I plan to send additional reminders on this step for 2013).*

D) The final report is due after completion of project. The 201_ reports are due Dec 31, 201_.

a) Final Report
b) Daily pesticide application logs, Pesticide Use Records, or spreadsheets.

8.10.4 BIA Western Region Noxious Weed List

High Priority Weeds: These are priority noxious weeds. Potential for wide spread expansion is imminent. Emphasis will be placed on prevention, education, awareness, identification, monitoring, and treatment. These are noxious weeds that tribes consistently request funding for.

Medium Priority Weeds: These are non-native noxious weeds that have been problems within Western Region but have not been as serious as the high priority weeds. They may occur in isolated patches. Emphasis is placed on immediate control, prevention of seed spread and eradication. Education, awareness, identification, control and monitoring will be the priorities.

Established noxious weeds: These are weeds are normally wide-spread and well–established. Control efforts are not a high priority with the amount of funding available through the BIA Noxious Weed Program. Example: field bindweed. Emphasis is placed on management, education, awareness, and identification/monitoring. As other higher priority weeds are under control and more funding becomes available, more control of these weeds will be possible.

Watch List: Weeds to be on the lookout for. These are not currently causing large problems in Western Region but if discovered, they should be controlled. These will receive a medium point rating.

High Priority –A RATING

Common Name	Scientific Name	Code
Buffelgrass	Pennisetum ciliare (L.) Link)	PECI
Bull thistle	Cirsium vulgare	CIVU
Camelthorn	Alhagi pseudalhagi	ALPS
Canada thistle	Cirsium arvense	CIAR
Common reed	Phragmites australis	PHAS
Dalmatian toadflax	Linaria dalmatica	LIDA
Diffuse knapweed	Centaurea diffusa	CEDI
Eurasian watermilfoil	Myriophyllum spicatum L.	MYSP
Giant reed	Arundo donax	ARDO
Giant salvinia	Salvinia molesta	SAMO
Musk thistle	Carduus nutans	CANU
Perennial pepperweed	Lepidum latifolium	LELA
Purple loosestrife	Lythrum salicaria L.	LYSA
Russian knapweed	Acroptilon repens	ACRE
Russian Olive	Elaeagnus angustifolia	ELAN
Scotch thistle	Onopordum acanthium	ONAC
Spotted knapweed	Centaurea stoebe L. subspecies micranthos (C.biebersteinii & maculosa)	CEST (formerly CEBI & CEMA)

Tamarisk, Saltcedar	Tamarix L.	TAMAR2
Whitetop (Hoary Cress)	Lepidium draba	CADR
Yellow starthistle	Centaurea solstitialis	CESO
Yellow toad flax	Linaria vulgaris	LIVU
Black henbane	Hyoscyamus niger	HYNI

Medium Priority- B RATING		
Common Name	Scientific Name	Code
Annual sowthistle	Sonchus oleraceus	SOOL
Barbwire Russian thistle	Salsola paulsenii	SAPA
Dyers' woad	Isatis tinctoria L.	ISTI
Field sandbur	Cenchrus incertus	CEIN
Fountain grass	Pennisetum setaceum	PESE
Hairy whitetop	Cardariapubescens	CAPU
Halogeton	Halogeton glomeratus	HAGL
Houndstongue	Cynoglossum officinale	CYOF
Iberian starthistle	Centaurea iberica	CEIB
Johnsongrass	Sorghum halepense	SOHA
Klamath weed St. John's wort	Hypericum perforatum	HYPE
Lens-podded hoary cress	Cardaria chalapensis	CACH
Malta starthistle	Centaurea melitensis	CEME
Medusahead	Taeniatherum caput-medusae	TACA
Perennial sowthistle	Sonchus arvensis	SOAR
Prickly Russian thistle	Salsola tragus	SATR
Purple starthistle	Centaurea calcitrapa	CECA
Rush skeletonweed	Chondrilla juncea	CHJU
Sahara mustard	Brassica tournefortii	BRTO
Sicilian starthistle	Centaurea sulphurea	CESU
Slender Russian thistle	Salsola collina	SACO
Spiny sowthistle	Sonchus asper	SOAS
Squarrose knapweed	Centaurea squarrosa	CESQ

LOW Priority-C RATING		
Common Name	Scientific Name	Code
Bermudagrass	Cynodon dactylon	CYDA
Cheatgrass	Bromus tectorum	BRTE
Field bindweed, wild morning glory	Convolvulus arvensis	COAR
Jointed goatgrass	Aegilops cylindrica	AECY
Kochia	*Kochia scoparia*	KOSC
Pampas grass	Cortaderia selloana	COSE
Puncturevine	Tribulus terrestris	TRTE
Quackgrass	Elytrigia repens	ELRE3
Red brome	Bromus rubens	BRRU
Ripgut brome	Bromus diandrus	BRDI
Smooth brome	Bromus inermis	BRIN
Three-lobed morning glory	Ipomoea triloba L.	IPTR
Nutgrass	Cyperus rotundus	CYRO
Bur buttercup	Ceratocephala testiculata	CETE5

Watch List-D RATING

Common Name	Scientific Name	Code
Curly pondweed	Potamogeton crispus L.	POCR
Tree of Heaven	Ailanthus altissima	AIAL
Himalayan Blackberry	*Rubus armeniacus*	RUAR9

8.10.5 Pesticide Use Record

UNITED STATES DEPARTMENT OF INTERIOR
BUREAU OF INDIAN AFFAIRS

PESTICIDE APPLICATION RECORD (PAR)

- ***IMPORTANT NOTE:*** **This form is mandatory and must be completed within 24-hours after completing any pesticide application, and must be kept on record for a minimum of 10-years.**

1. Project Name:_______________ **2. Operator:**_______________

3. Reservation:_______________ **4. County:**_______________

5. Location(s):_______________ **6. PUP #:**_______________

7. Date:__________ **8. Start Time:**__________ **9. Stop Time:**__________

10. Applicator's Name(s):_______________

11. Equipment Type Used:_______________

12. Pesticide (s) Used:

- Company/Manufacturer's Name:_______________
- Trade Name:_______________
- Formulation (check box): ☐ Liquid ☐ Granular ☐ Pellets ☐ Wetable Powder ☐ Emulsifiable Concentrate ☐ Dry Flowable Powder ☐ Briquetts ☐ Other (Describe)

13. Application Rate Used:

Active Ingredient/Acre: __________ Formulation Volume/Acre: __________

14. Project Area Size/Acreage:

Area Treated:__________ Total Project Area:__________

15. Primary Pest(s) Involved:_______________

16. Stage of Pest Development:_______________

17. Site(s) Treated: ☐ Native Veg. ☐ Seeded Veg. ☐ Other (Describe)__________

18. Weather Conditions:

Wind Dir:______ Wind Speed:______ Temp:______ RH:______ DP:______ HI:______

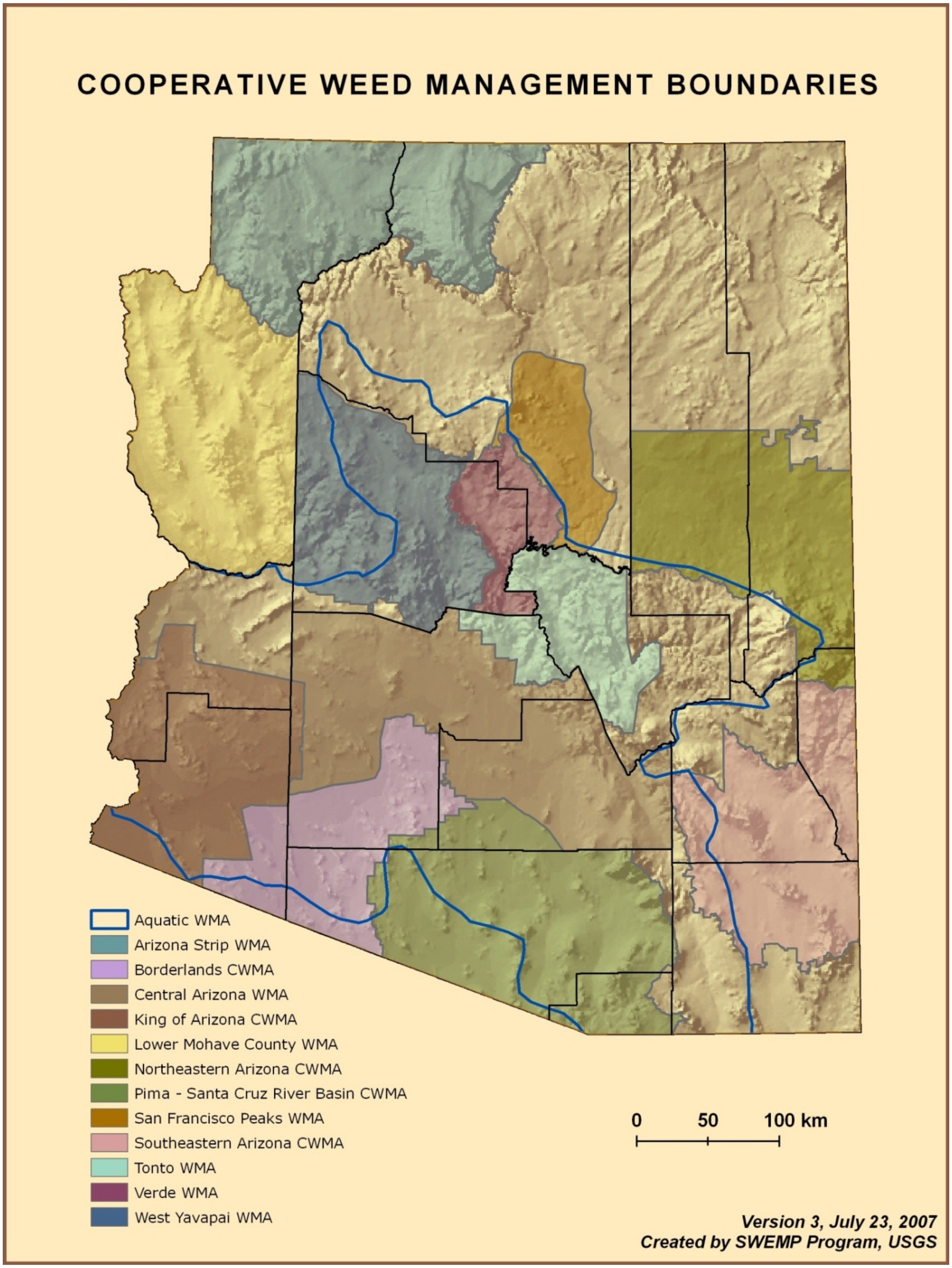
19. Monitoring Record (if necessary-continue on back):_______________

____

____

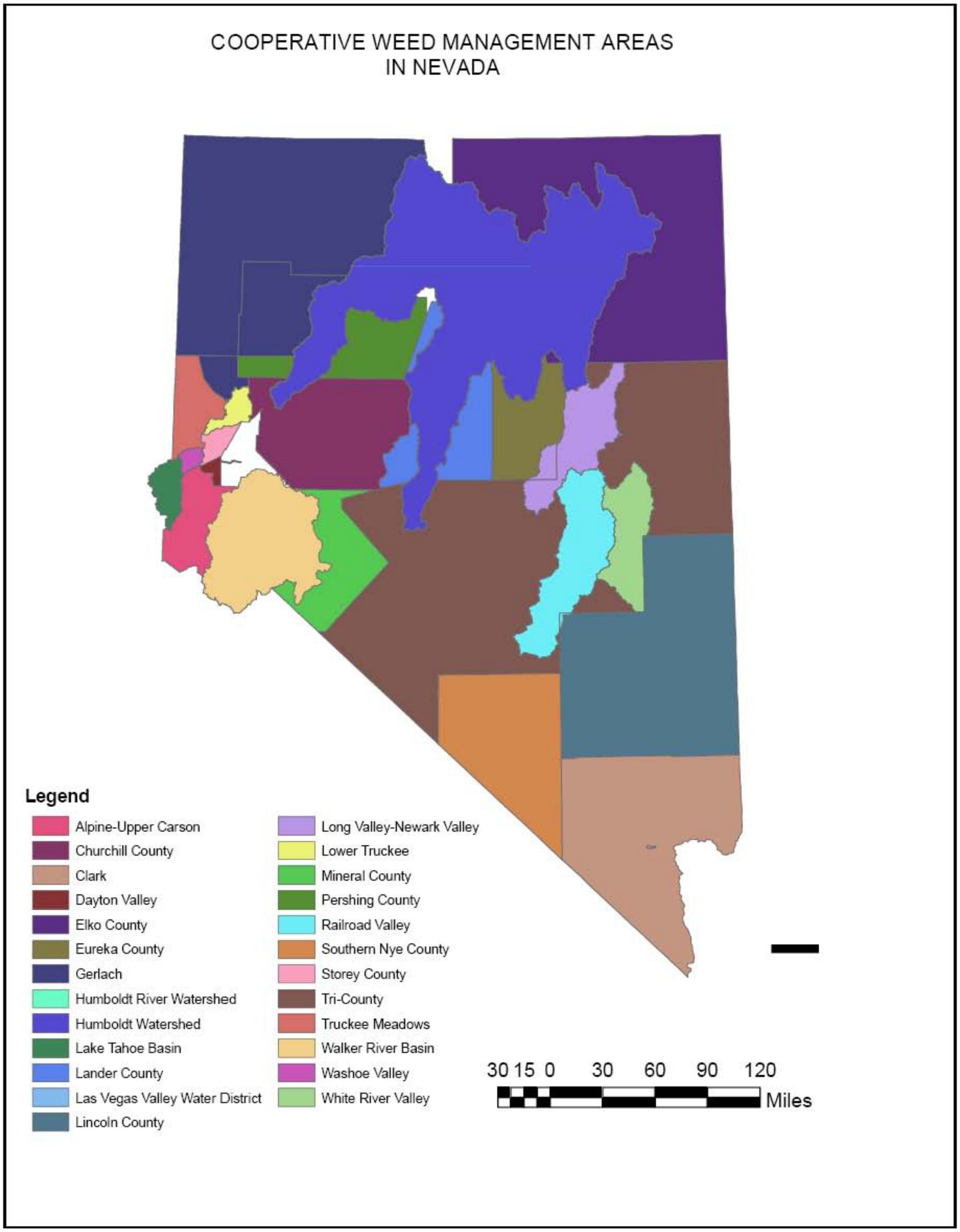
8.11 *Appendix L-Cooperative Weed Management Areas*

Map 8.11.1Arizona Cooperative Weed Management Areas

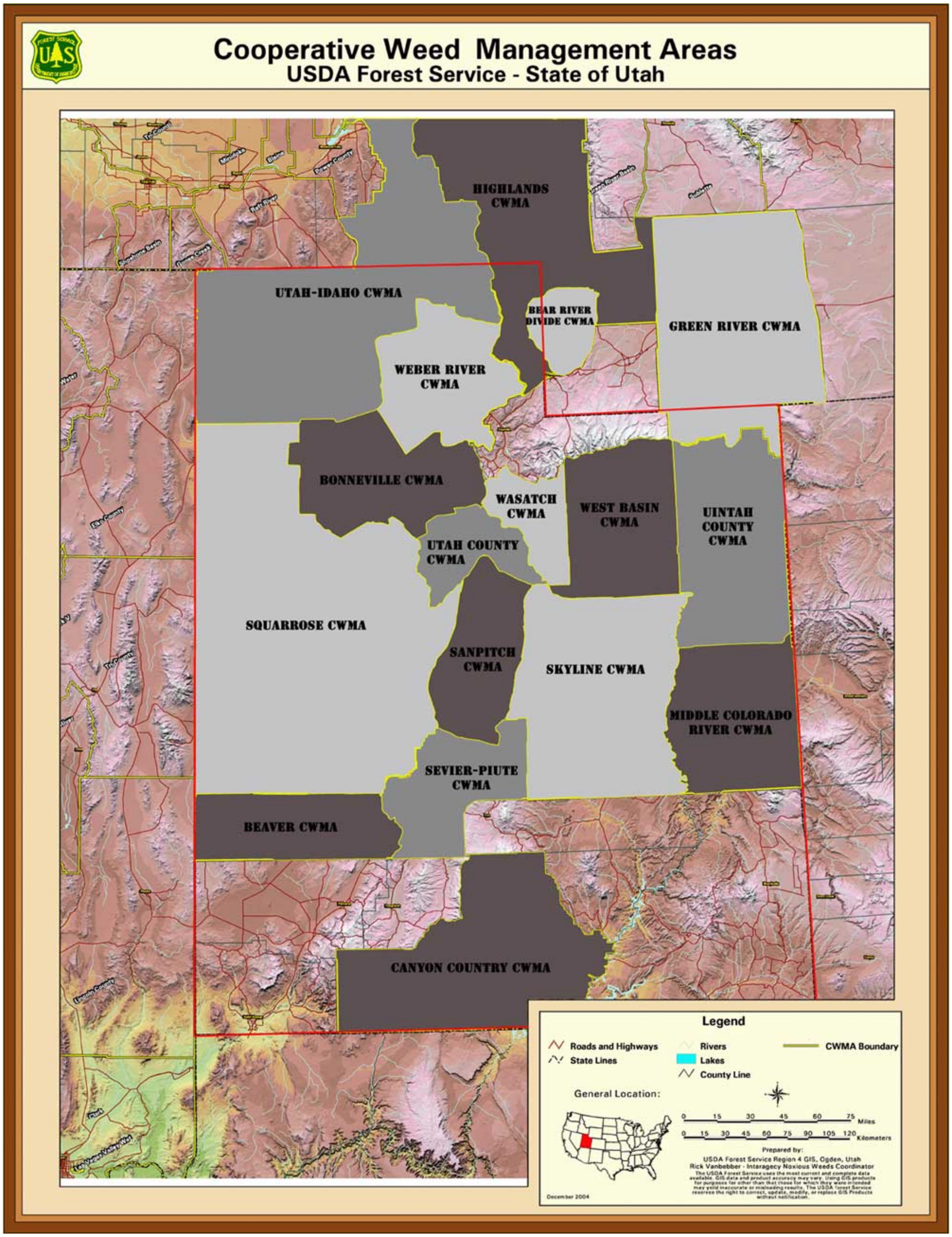


The Southwest Vegetation Management Association Arizona Weed Management Area Contact List	
Borderlands Cooperative Weed Management Area Curt McCasland 1611 N Second Ave Ajo, AZ 85321 520-387-5359 curtis_mccasland@fws.gov	**Lower Colorado River Giant Salvinia Task Force** Theresa Olson US Bureau of Reclamation PO Box 61470 Boulder City, NV 89006 702-293-8146 Tolson@lc.usbr.gov
Central Arizona Weed Management Area Ed Northam 216 E. Taylor Tempe, AZ 85281 480-947-3882 fnortham@msn.com	**Mohave Weed Management Area** Rob Grumbles University of Arizona Extension Service 101 E. Beale St. Suite A Kingman, AZ 86401-5827 928-753-3788 grumbles@ag.arizona.edu
Eastern Arizona Weed Management Area Herbert Hopper Herbert.Hopper@rcdnet.net Dennis Chandler Dennis.Chandler@az.usda.gov Little Colorado River Plateau RC&D 51 W. Vista Ste #4 Holbrook, AZ 86025 928- 524-6063 x5	**Phoenix Weedwackers** Claudia Bloom Website: www.phoenixweedwackers.com Claudia@phoenixweedwackers.com greytdogs@cox.net 480-641-7449
Grand Canyon Weed Management Area Lori Makarick Vegetation Program Manager Grand Canyon National Park 1824 S. Thompson Street Suite 200 Flagstaff, AZ 86001 phone (928)638-7455 fax (928)638-7492 lori_makarick@nps.gov	**San Francisco Peaks Weed Management Area** Steve Gatewood, Coordinator c/o GFFP 1300 South Milton Road Flagstaff, AZ 86001
King of Arizona Cooperative Weed Management Area Karen Reichhardt BLM Yuma Field Office 2555 Gila Ridge Road Yuma, AZ 85365 928-317-3245 Karen_Reichhardt@blm.gov	**Sonoran Desert Invasive Species Council** Cheryl McIntyre, Project Manager Sonoran Desert Program Sonoran Institute 7650 E Broadway Blvd, Ste 203 Tucson, AZ 85710 520-290-0828 x222 CMcIntyre@sonoran.org
Southern Utah-Northern Arizona Cooperative Weed Management Area L.D. Walker BLM – Arizona Strip Office 345 E Riverside Drive St. George, UT 84790 435-688-3242 ldwalker@blm.gov	**Sonoran Desert Weedwackers** Marilyn Hanson mfhanson@comcast.net

Map 8.11.2 Nevada Cooperative Weed management Areas



Map 8.11.3 Utah Cooperative Weed Management Areas



8.12 *Appendix M-Additional Noxious Weed or Invasive Species Funding Opportunities*

Invasive Species Grants and Funding Opportunities

Modified from USDA National Agricultural Library, National Invasive Species Information Center, MANAGER'S TOOLKIT http://www.invasivespeciesinfo.gov/toolkit/grants.shtml

Provides resources for general grants and funding information for invasive species. A listing of requests for proposals is available on the **Request for Proposals** page. Information for grants that have been awarded is available on the **Funds Awarded** page.

- **Federal Government**
- **State Government**
- **University/Academic**
- **Organizations**

General Grant Resources

Federal Government

U.S. Department of Agriculture (USDA) Grant and Partnership Programs that Can Address Invasive Species Research, Technical Assistance, Prevention and Control - Federal Fiscal Year 2013

Grants.gov / View Grants.gov RSS feeds (scroll to view)

Grants.gov is a central storehouse for information on over 1,000 grant programs and provides access to approximately $500 billion in annual awards. Site is searchable and contains summary information on all federal funding opportunities with links to the full announcements. Users can search announcements by topic, funding agency, and date, as well as subscribe to an email notification service based on these parameters.

NIFA Request for Applications / NIFA Grants - Recently Opened Grants / Grant Search
USDA. National Institute of Food and Agriculture.

Program of Research on the Economics of Invasive Species Management (PREISM) (webarchive)
USDA. Economic Research Service.

Conservation Innovation Grants (CIG)
USDA. Natural Resources Conservation Service.

Grassland Reserve Program
USDA. Natural Resources Conservation Service.

Wildlife Habitat Incentives Program (WHIP)
USDA. Natural Resources Conservation Service.

8.13 *Appendix N-BIA Fire Statistics and Maps*

8.13.1 Table 8.14.1- BIA Fire Summary for Arizona (1998-2008)

Size of Fire

	>5000 acre		1000 to 4999 acre		300 to 999 acres		1 to 299 acres		< 1 acre		All Fires	
YEAR	*Year Count*	*Acre Count By Year*	Year Count	Acre Count By Year	Year Count	Acre Count By Year	Year Count	Acre Count By Year	Year Count	Acre Count By Year	Total Count By Year	Total Acres By Year
1998	*1*	*20308*	13	24697.5	14	5918	532	3159.1	921	216	1481	54298.6
1999	*7*	*49834*	10	28965.6	7	5371	207	2781	622	119.7	853	87071.3
2000	*1*	*8690*	3	5990	3	1543	277	2860.4	943	178	1227	19261.4
2001	*1*	*5133*	10	29786	5	3429	308	2792.1	798	195.1	1122	41335.2
2002	*2*	*468863*	2	5058	1	740	236	1378	807	176.5	1048	476215.5
2003	*2*	*188109*	6	8474	4	2982	164	1962.1	644	115.4	820	201642.5
2004	*0*	*0*	3	7000	2	1410	250	1749.2	700	144.9	955	10304.1
2005	*0*	*0*	13	32275	12	6586.1	537	5931.9	927	213.5	1489	45006.5
2006	*0*	*0*	6	12272	6	3615	251	2818.2	613	132.9	876	18838.1
2007	*1*	*7267*	8	18416	9	6254	162	1501.5	592	124.1	772	33562.6
2008	*1*	*6660*	7	13806	1	724	140	801.3	458	110.1	607	22101.4
AVERAGES	***1.5***	***68624***	**7.4**	**16976.4**	**5.8**	**3506.6**	**278.5**	**2521.3**	**729.5**	**156.9**	**1022.7**	**91785.2**

Federal Fire Occurrence Website
http://wildfire.cr.usgs.gov/firehistory/data.html
Source Date: 2/25/13

8.13.2 Table 8.14.2 BIA Fire Summary for Nevada (1998-2008)

	>5000 acre		**1000 to 4999 acre**		**300 to 999 acres**		**1 to 299 acres**		**< 1 acre**		**All Fires**	
YEAR	Year Count	Acre Count By Year	Year Count	Acre Count By Year	Year Count	Acre Count By Year	Year Count	Acre Count By Year	Year Count	Acre Count By Year	**Total Count By Year**	**Total Acres By Year**
1998	1	11631	0	0	2	1160	16	133	11	2.5	30	12926.5
1999	0	0	1	1992	0	0	37	672.3	21	4.6	59	2668.9
2000	0	0	1	2370	2	1098	11	637	18	4	32	4109
2001	1	6525	0	0	1	445	21	281.5	15	3.3	38	7254.8
2002	0	0	0	0	1	350	10	86	18	3.5	29	439.5
2003	0	0	0	0	0	0	14	250.9	17	4.1	31	255
2004	0	0	0	0	0	0	8	371.4	15	2.7	23	374.1
2005	1	12855	0	0	0	0	18	108	8	2	27	12965
2006	0	0	0	0	0	0	20	308.3	13	1.6	33	309.9
2007	0	0	0	0	1	675	20	503.8	9	1	30	1179.8
2008	0	0	0	0	0	0	15	137.8	7	2.4	22	140.2
Averages	**0.3**	**2819.182**	**0.2**	**396.5**	**0.6**	**338.9**	**17.3**	**317.3**	**13.8**	**2.9**	**32.2**	**3874.8**

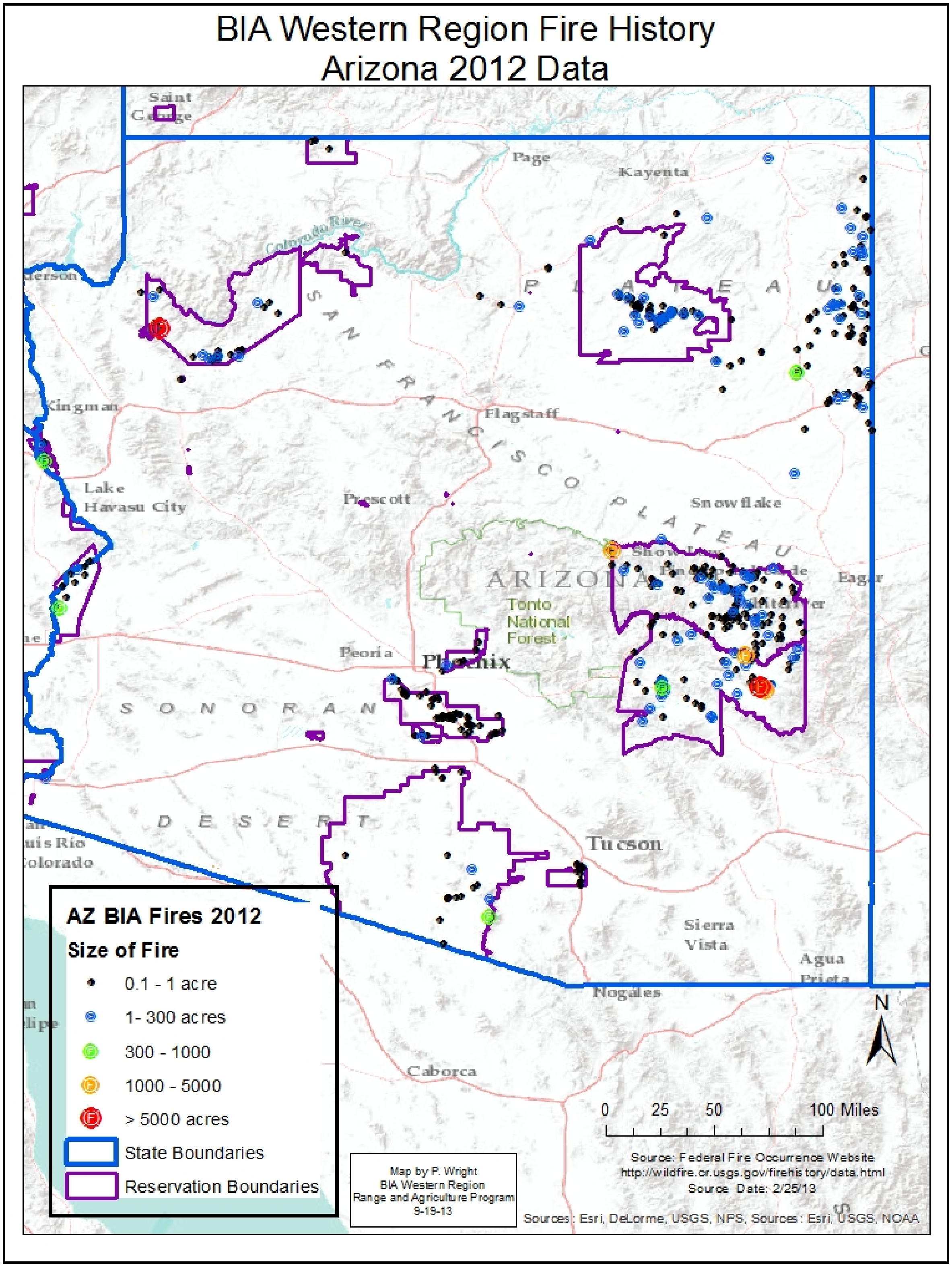
Federal Fire Occurrence Website
http://wildfire.cr.usgs.gov/firehistory/data.html
Source Date: 2/25/13

8.13.3 Table 8.14.3 BIA Fire Summary for Utah (1998-2008)

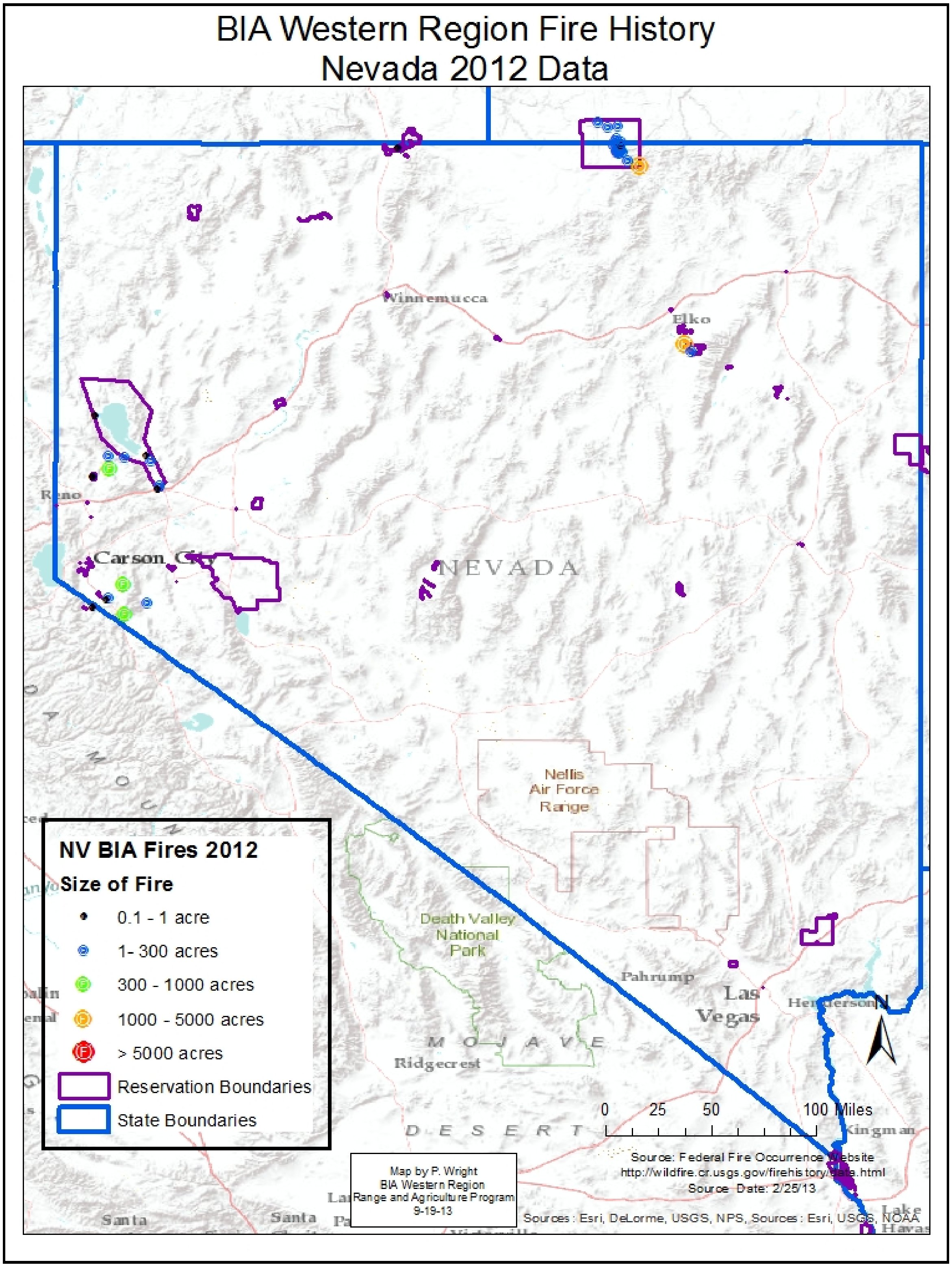
	Size of Fire											
	>5000 acre		**1000 to 4999 acres**		**300 to 999 acres**		**1 to 299 acres**		**< 1 acre**		**All Fires**	
YEAR	YEAR COUNT	ACRES BY YEAR	YEAR COUNT	ACRES BY YEAR	YEAR COUNT	ACRES BY YEAR	YEAR COUNT	ACRES BY YEAR	YEAR COUNT	ACRES BY YEAR	**TOTAL Count by YEAR**	**ACRES BY YEAR**
1998	0	0	0	0	0	0	1	30	18	3.9	19	33.9
1999	0	0	1	1010	1	908	7	262	24	4	33	2184
2000	0	0	1	3000	1	464	3	167.5	25	4.6	30	3636.1
2001	0	0	0	0	1	354	8	600.8	39	8.5	48	963.3
2002	0	0	2	6600	2	1743	7	236	31	10	42	8589
2003	0	0	0	0	1	300	2	26	27	6.5	30	332.5
2004	0	0	0	0	0	0	3	189	32	5.1	35	194.1
2005	0	0	2	5365	0	0	6	420.5	18	4.6	26	5790.1
2006	1	7266	1	4786	2	1180	7	425.9	37	5.9	48	13664
2007	1	43820	1	0	0	0	5	155	30	5.8	37	43981
2008	0	0	0	0	1	740	1	25	27	6.2	29	771.2
AVG	**0.2**	**4644.2**	**0.7**	**1887.4**	**0.8**	**517.2**	**4.5**	**230.7**	**28.0**	**5.9**	**34.3**	**7285.3**

8.13.4 2012 BIA Western Region Fire History Maps

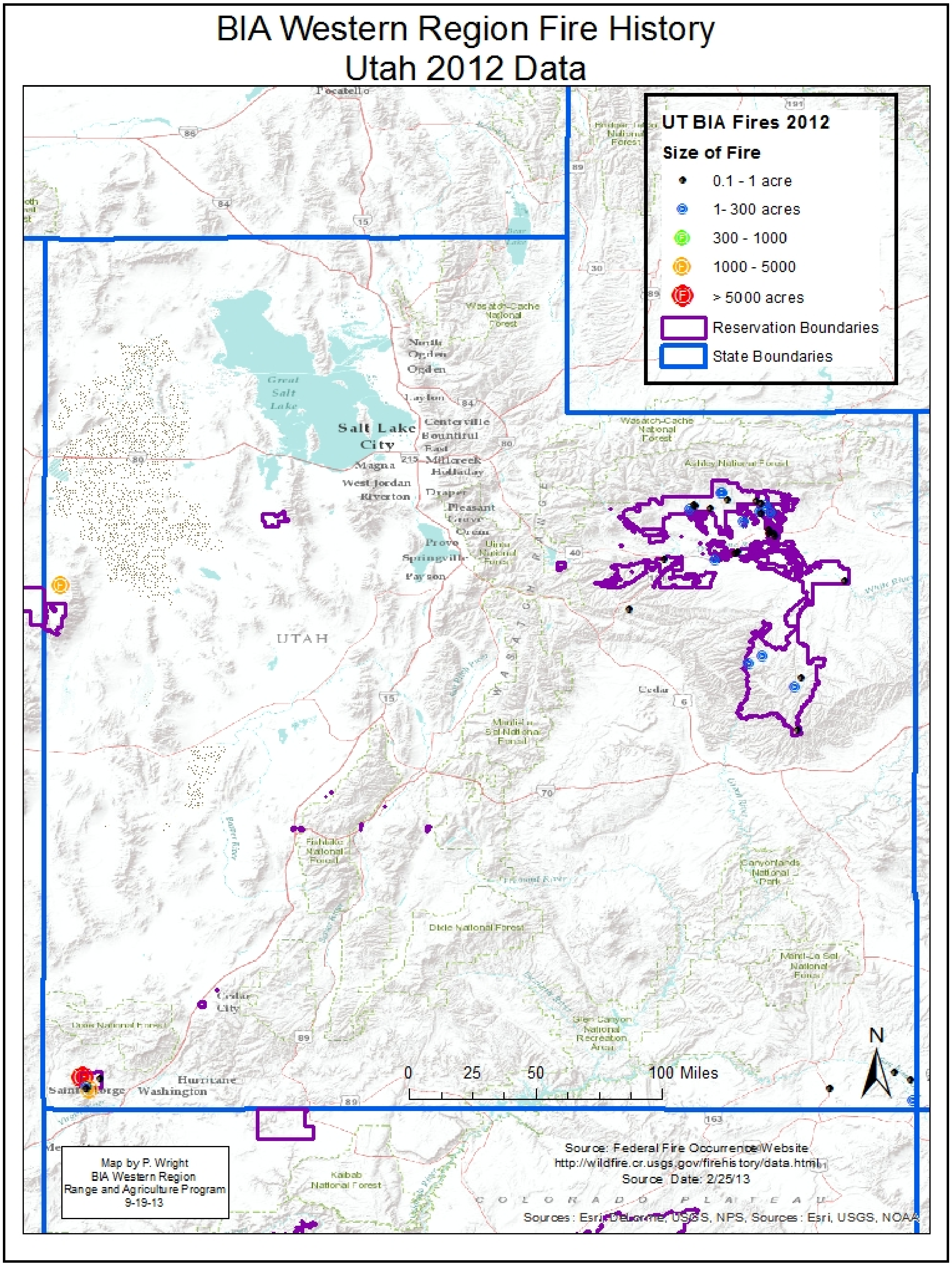
Map 8.14.1a BIA WR Fire History-AZ 2012



Map 8.14.1b-BIA WR Fire History NV 2012

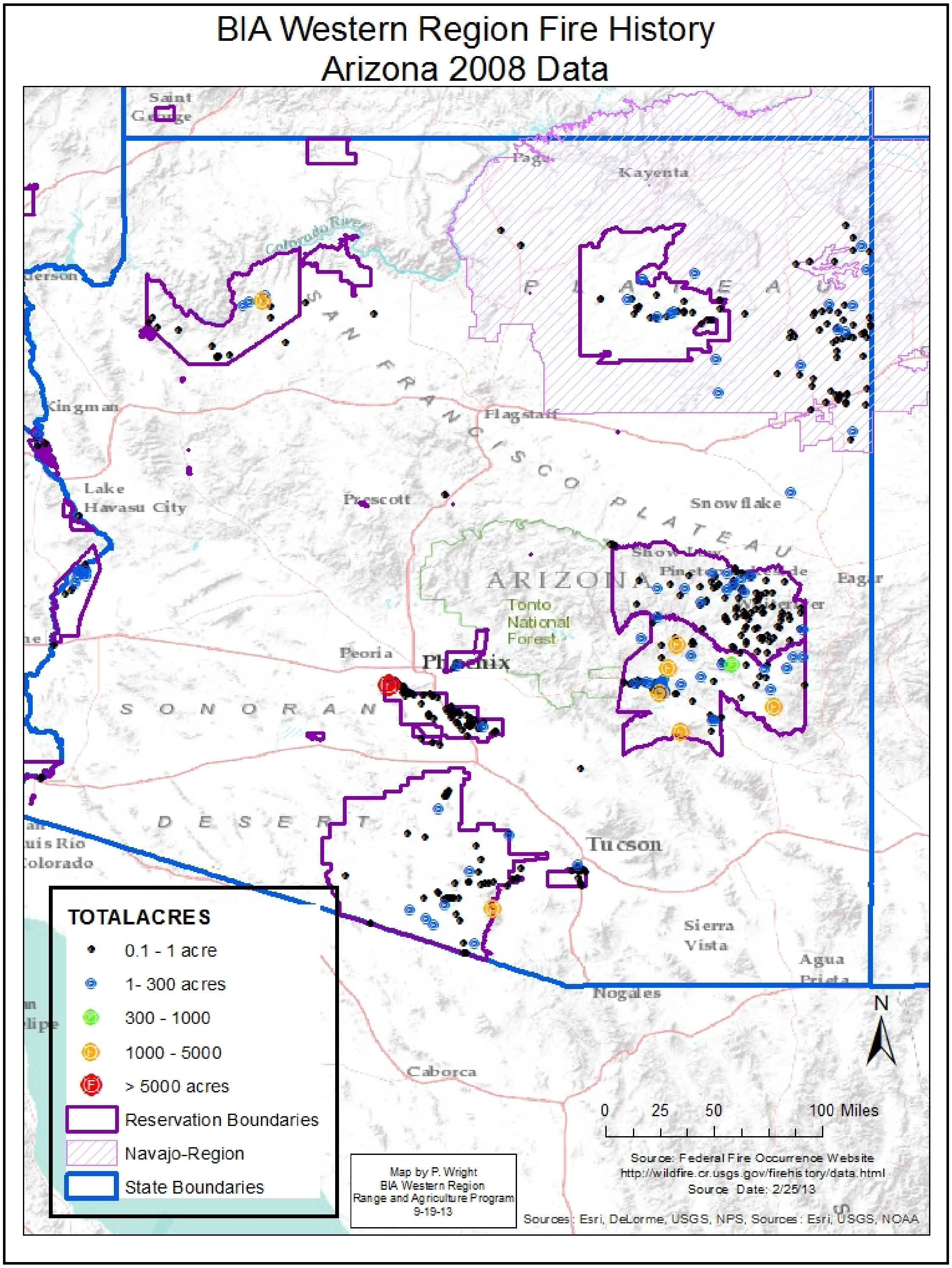


Map 8.14.1c BIA WR Fire History UT 2012

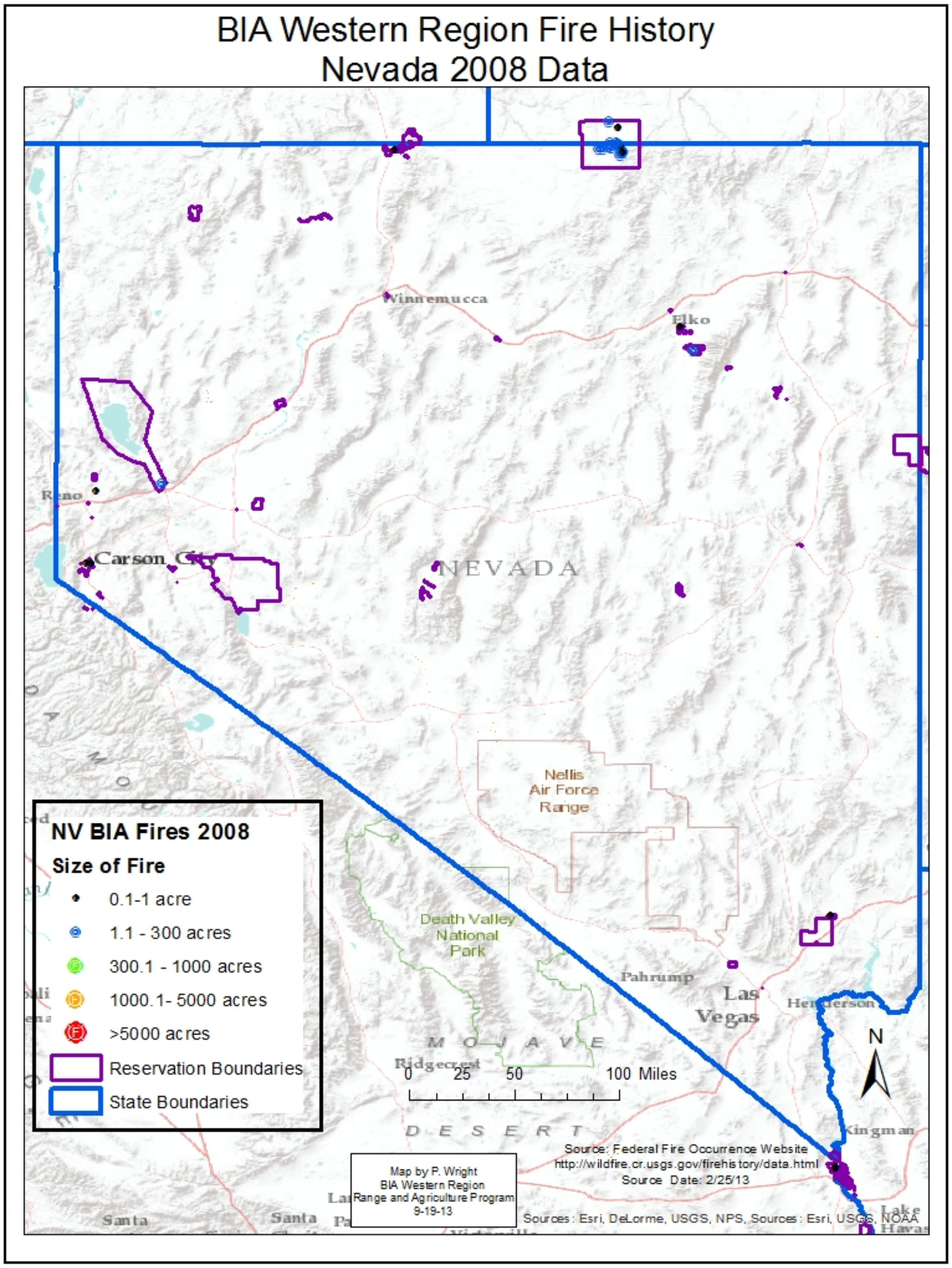


8.13.5 2008 BIA Western Region Fire History Maps

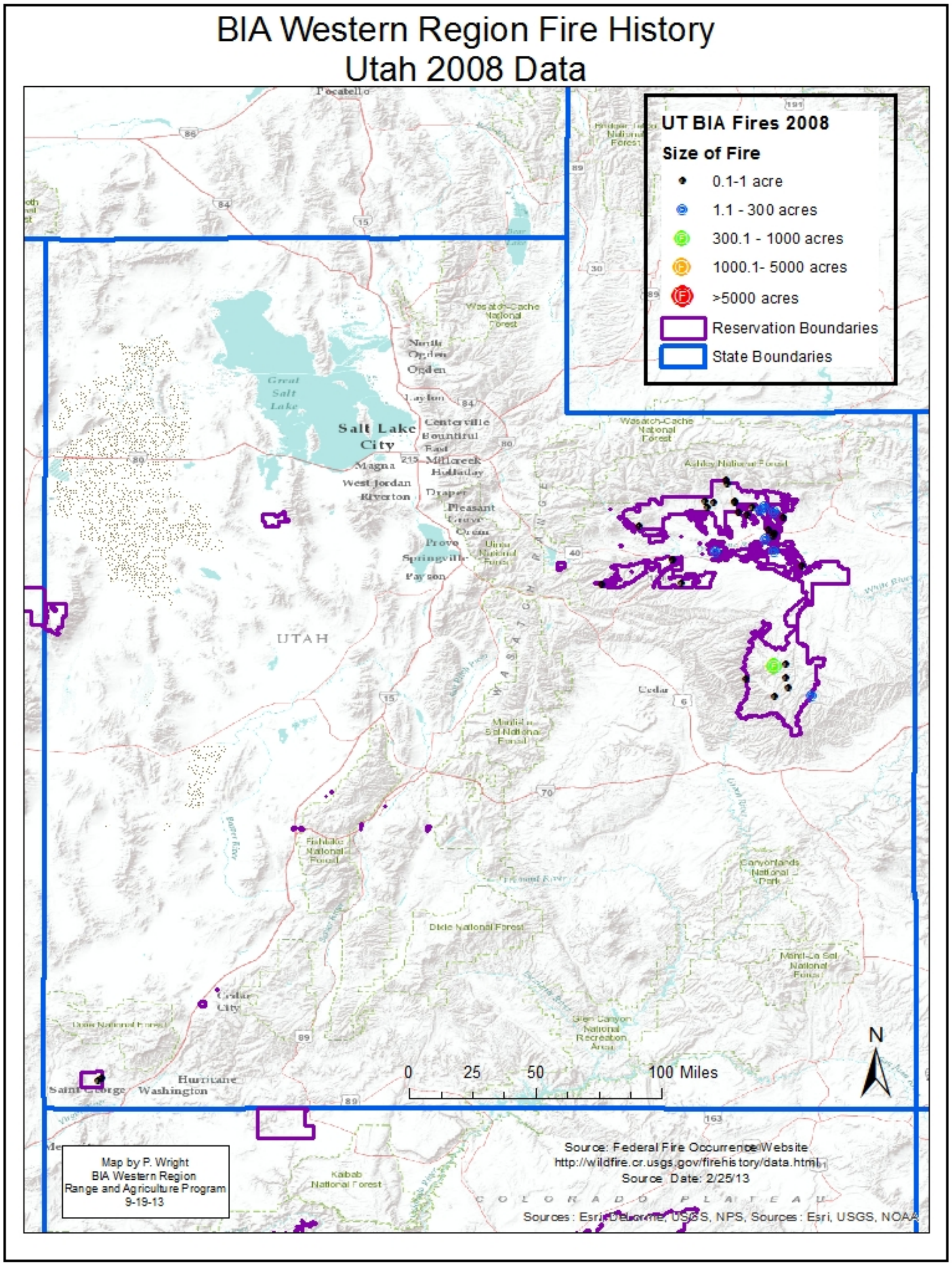
Map 8.14.2c BIA WR Fire History AZ 2008



Map 8.14.2c BIA WR Fire History NV2008

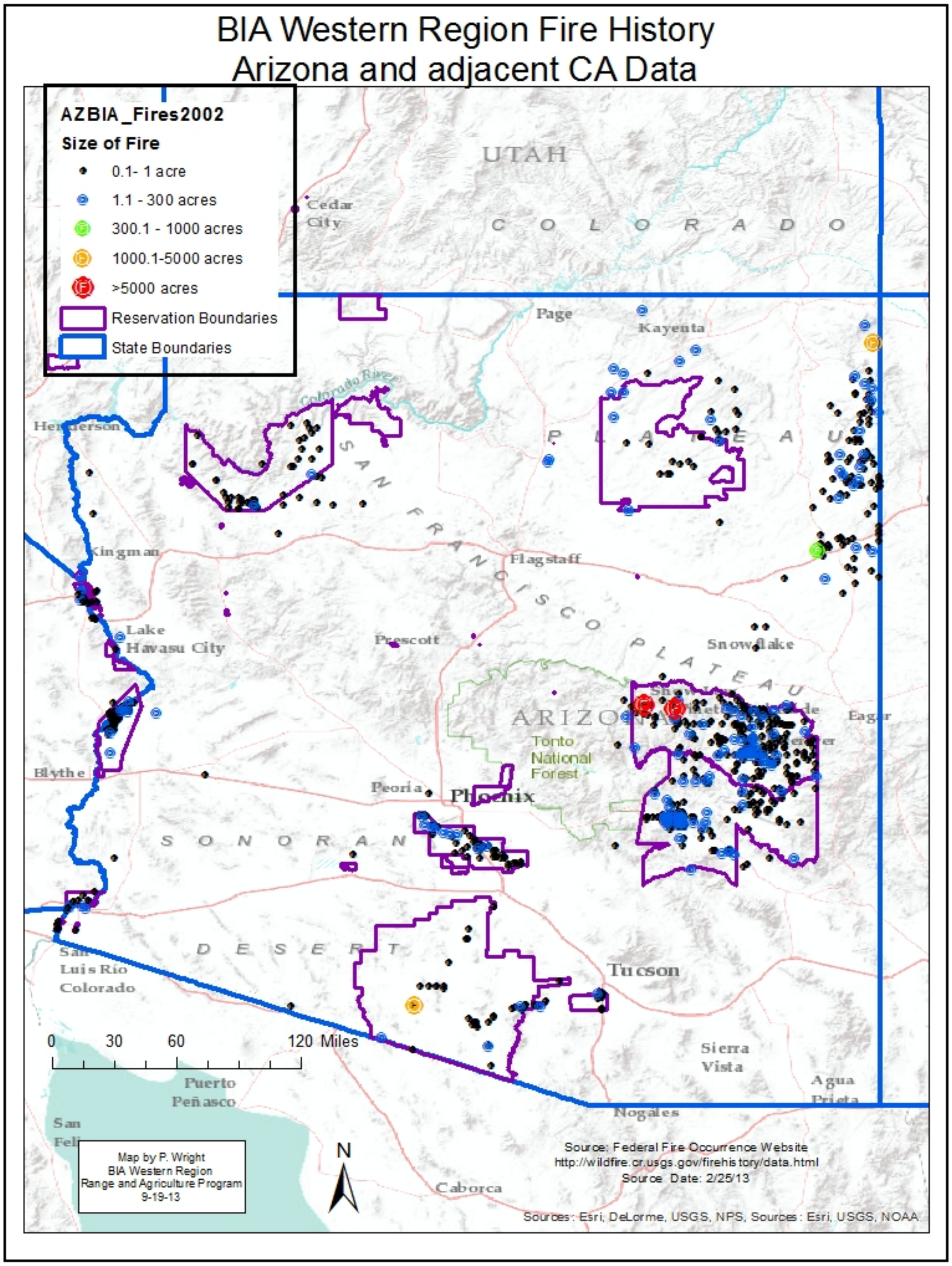


Map 8.14.2c BIA WR Fire History UT 2008

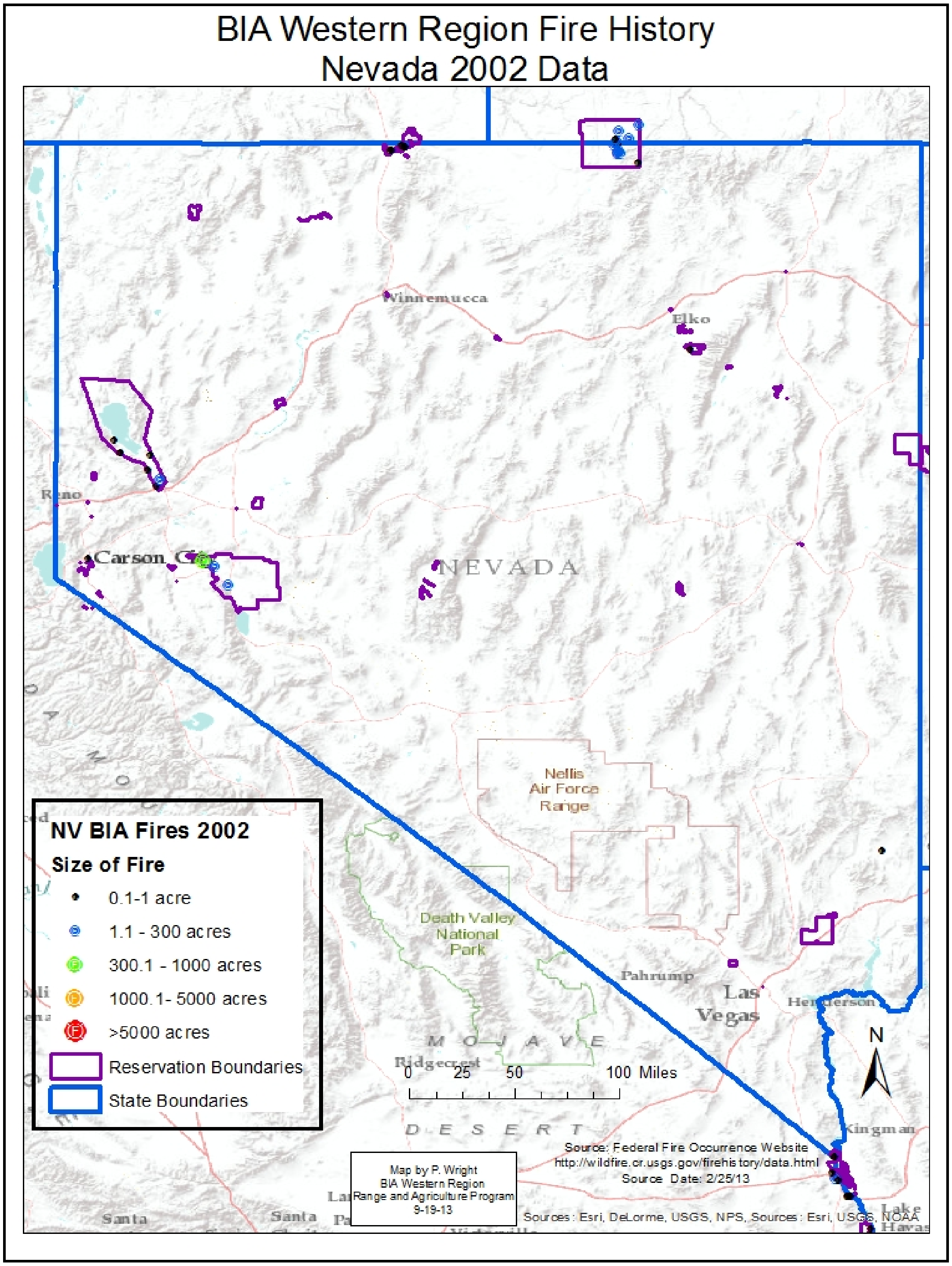


8.13.6 2002 BIA Western Region Fire History Maps

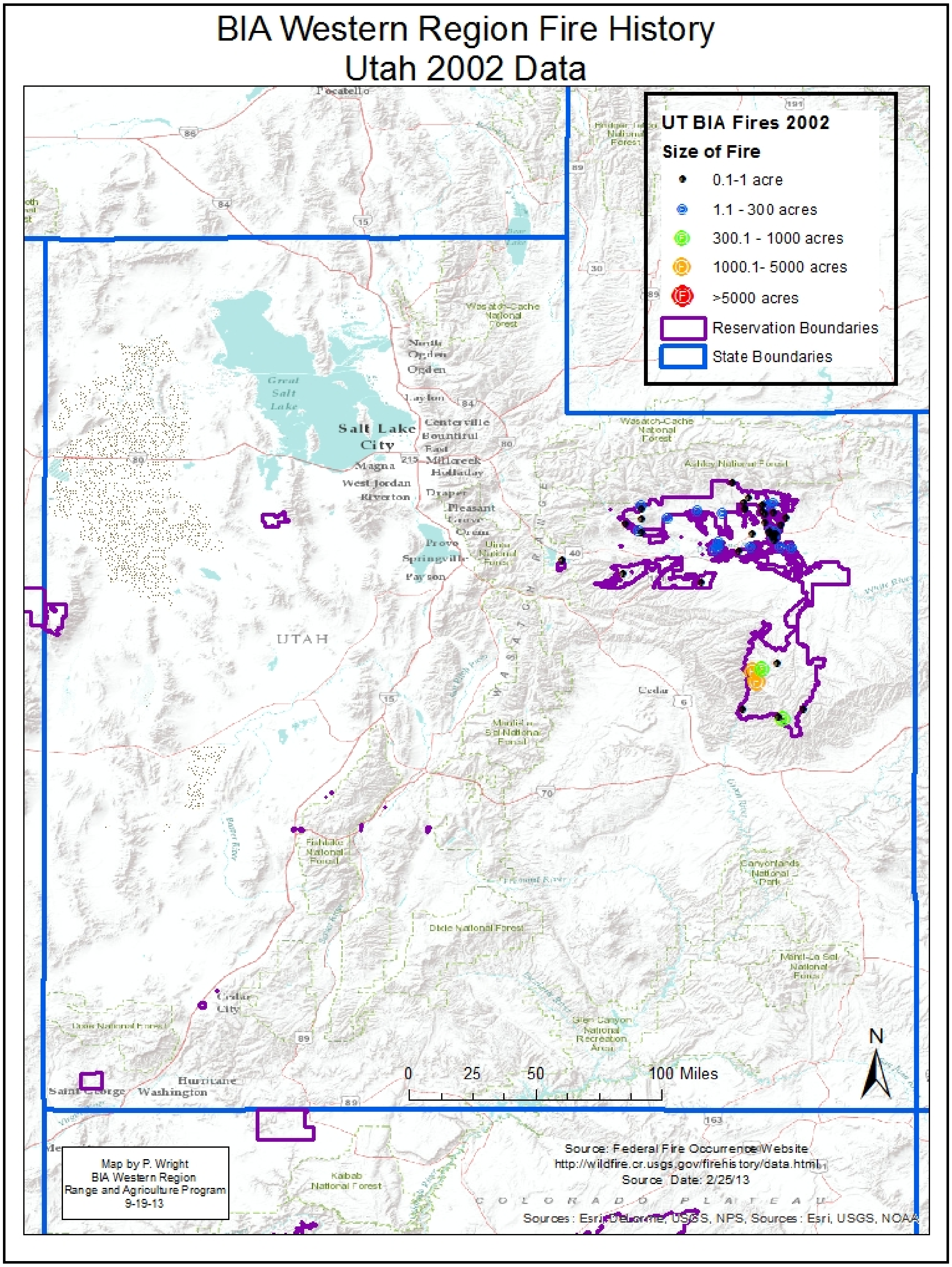
Map 8.14.3a BIA WR Fire History AZ 2002



Map 8.14.3b-BIA WR Fire History NV 2002



Map 8.14.3c BIA WR Fire History UT 2002



8.14 Appendix O-Noxious Weed Treatment Guidelines

This appendix contains all of the required and recommended practices to protect aspects of the affected environment. Section 8.15.1 contains all of the tables of noxious weed treatment guidelines to protect particular resources. Section 8.15.2 contains recommended conservation measures in areas known to be occupied by T&E species. Section 8.15.3 contains required and recommended practices that are part of the BIA Noxious Weed Program. Section 8.5.3.1 list the guidelines that are required as part of the BIA Noxious Weed Program. Section 8.15.3.2 lists the grant criteria that, although not required, most tribes do in order to obtain the best score on the grant. The checklist in 8.15.3.3 lists practices BIA would like to encourage. BIA Western Region will be using the checklists as part of program requirements with the next fiscal year (FY15) grant submissions. All other guidelines in this appendix, unless specifically mentioned in Section 8.15.3.1, are assumed to be recommended practices.

8.14.1 Noxious Weed Treatment Guidelines-Tables

Table 8.15.1 Noxious Weed Treatment Guidelines to Reduce Impacts to All Resources

Table 8.15.1 **Noxious Weed Treatment Guidelines to Reduce Impacts to Resources**			**Resource: All**
General/Mechanical	Fire Management	Biological and Cultural	Chemical
Wash vehicles and equipment before leaving weed infested areas to avoid infecting weed-free areas	Prepare fire management Plans.	Use only biological control agents that have been tested and approved to be host specific.	Prepare spill contingency plan in advance of treatment.
Keep equipment in good operating condition.	Minimize frequent burning in arid environments.	Select sites with weeds that are palatable and non-toxic to domestic animals.	Select herbicides least damaging to environment while providing desired results.
Minimize soil disturbance, to reduce weed development.	Do not burn herbicide-treated vegetation for at least 6 Months.	Manage intensity and duration of domestic animals to prevent over-utilization of desirable plant species.	Use proper amount of chemical to achieve results. Follow product label for use and storage.
Use trained personnel with adequate equipment	Ensure that crews have proper fire-suppression tools during the fire	Use domestic animals to contain the target species prior to weed seed set.	Licensed applicator must oversee or apply herbicides. Comply with herbicide-free buffer zones to reduce drift.
Collaborate on weed projects with nearby landowners and agencies.	Carefully plan fires in to avoid or minimize loss of structures and property.	If seed set had occurred, do not move the domestic animals to uninfested areas for a period of 7 days.	Keep records of herbicide application, (Pesticide Use Records-PUR) including the active ingredient, formulation, application rate, date, time, location.
Ensure that power cutting tools have approved spark arresters.	Notify nearby residents and landowners potentially affected by smoke intrusions or other fire effects.	Notify nearby residents and landowners who could be affected by biological control agents.	Dispose of unwanted herbicides promptly and correctly. Post treated areas and specify reentry times.

(Source: BLM, 2005)

Table 8.15.2 Noxious Weed Treatment Guidelines to Reduce Impacts to Soil Resources

Treatment Method	Table 8.15.2 Noxious Weed Treatment Guidelines to Reduce Impacts to Resources Resource: Soil					
General/Mechanical	Use equipment that minimizes soil disturbance and compaction.	Minimize use of heavy equipment on steep slopes.	Conduct treatments when the ground is sufficiently dry to support heavy equipment.	Implement erosion control measures in areas where heavy equipment use occurs.	Conduct mechanical treatments along contours to minimize runoff and erosion.	Facilitate revegetation by planting or seeding.
	Minimize damage to biological soil crusts by treating when crusts are moist, not dry.	Leave plant debris on site to serve as mulch.	Use heavy equipment when soils are frozen and plants are brittle to minimize soil disturbance.	Take measures to prevent oil and gas spills.	Avoid treatments before, after or during rain events.	
Chemical	Minimize use of herbicides in areas with fine textured and sandy soils near sensitive areas.	Clean up spills immediately, Use absorbent mats under vehicles when fueling or servicing in the field	Limit spraying with heavy equipment after rain events to prevent compaction.	Evaluate soil characteristics prior to application to assess likelihood for herbicide transport in soil.	Avoid herbicides with high soil mobility in areas where soil type would contribute to soil mobility	Avoid herbicides with high soil mobility in areas where soil type would contribute to soil mobility
Fire Management	Prescribe broadcast and other burns consistent with soil management activities.	Plan burns so as to minimize damage to soil	Use equipment that minimizes soil disturbance and compaction.	Reseed native species to convert a site to a less flammable site.		
Biological and Cultural	Minimize use of domestic animals if soil erosion or impact biological soil crusts.	Limit grazing after rain events to prevent compaction.				

(Source: BLM, 2005)

Table 8.15.3 Noxious Weed Treatment Guidelines to Reduce Impacts to Vegetation Resources

Table 8.14.3 Noxious Weed Treatment Guidelines to Reduce Impacts to Resources Resource: Vegetation				
Manual	Chaining is not recommended in areas where annual rainfall is less than 6-9 inches.	Chaining is not recommended where brome grass species are present.	Minimize disturbance of understory vegetation.	Prepare seedbed at advantageous time for seeding, often in fall or early winter.
Mechanical	Power wash equipment to remove weedy vegetation and seeds.	Leave appropriate amounts of woody material (snags, downed logs, litter) following treatment.	Manage riparian areas to provide adequate shade, sediment control, bank stability, and recruitment of wood into stream channel	Use plant stock or seed from sites of similar elevation to re-vegetate treated areas
Fire Management	Conduct low intensity burns to minimize impacts to large vegetation.	Limit area cleared for fire breaks and clearings to reduce potential for weed infestations.	Integrate mechanical treatments into burn plan to prepare forests for the reintroduction of fire.	Reseed following burning to reintroduce native species, or to convert a site to a less flammable plant association.
Biological and Cultural	Use domestic animals at the time the animals are most likely to damage invasive species.	Use approved biological pathogen for unwanted weeds. Plants remain in place with reduced runoff or sedimentation.	Only thoroughly tested and researched biological control agents would be released according to APHIS regulations..	
Chemical	Use drift reduction agents, to reduce the drift hazard to non-target species.	Minimize damage to non-target plants by using a selective herbicide and a wick or backpack sprayer.		

(Source: BLM, 2005)

Table 8.15.4 Noxious Weed Treatment Guidelines to Reduce Impacts to Impaired Waters

Table 8.15.4 Noxious Weed Treatment Guidelines to Reduce Impacts to Impaired Waters. **Method: Chemical** **Resource: Impaired Waters**
Proper use of pesticides involves following all EPA and state guidelines and regulations regarding the proper application, selection, and mixing of pesticides and other safety consideration.
Pesticide selection includes consideration of pesticide effectiveness, toxicity ratings, pesticide persistence and solubility of the pesticides.
Timing of pesticide applications should avoid windy conditions and heavy precipitation. Winds in excess of 5-10 mph can result in excessive drift and environmental damage.
Pesticide Application methods should be evaluated for each site, such as the advantages and disadvantages of using ground sprayers versus aerial application or chemigation as well as management of chemigation tail-waters.
IPM as a pest control system includes the use of parasites, predators, pest resistant plants, insect pheromones, and bacterial insecticides. IPM can reduce dependence on pesticides. It involves careful crop selection, pest scouting, cultural controls, biological controls and pest attractants.
Source: Environmental Protection Agency

Table 8.15.5 Noxious Weed Treatment Guidelines to Reduce Impacts to Cultural Resources

Table8.14.5 Noxious Weed Treatment Guidelines		Resource: Cultural Resources
Document the site.	Locate and record sites so project impacts can be identified.	Place buffers, signs, camouflage or coverings, depending on the strategy to protect the site. Easily viewed, frequently visited, and publicly-interpreted settings are among the least looted or vandalized.
Stabilize the site.	Prevent erosion near streams by vegetation, hay bales or sandbags.	Restrict or redirect ORV, bicycle, horse and pedestrian traffic around the site.
Remove unwanted vegetation.	To limit ground disturbance near cultural sites, remove top portion of trees and leave roots to rot in place.	Clearing vegetation around a cemetery should be done in conjunction with a professional archaeologist or cemetery preservationist.
Monitor the site.	Regular visits to your archaeological site will alert looters that you care about the site and will take steps to protect it. Use site monitoring to keep a log of activities that could be used in court.	Increased site visitation results in decreased looting and vandalism events. Authorized visitors, such as elders, archaeological groups or special classes could assist in monitoring the site.
Preserve the site.	Follow standard procedures for compliance with Section 106 of the National Historic Preservation Act as implemented through 36 CFR Part 800, including necessary consultations with the State or Tribal Historic Preservation Officers and interested tribes.	Use existing cultural resource information or collect information through inventory to determine cultural resource areas, and types at risk from the proposed treatment, and develop appropriate measures to minimize or mitigate adverse impacts. Identify cultural resource types at risk from treatments and design inventories that are sufficient to locate these resources. Provide measures to minimize impacts.
Source: Best Management Practices: An Owner's Guide To Protecting Archaeological Sites, Florida Department of State Division of Historical Resources, 2005 & BLM, 2005		

Table 8.15.6 Noxious Weed Treatment Guidelines for Managed Grazing

Table 8.15.6 Treatment Guidelines for Managed Grazing
Follow planned vegetation management program limited amount of time livestock remain on one site.
Use fencing and/or salt or nutrition blocks to restrict livestock to one area.
Keep livestock away from sensitive riparian areas.
BLM, 2005 p. 4-16

Table 8.15.7 Noxious Weed Treatment Guidelines to Protect Wilderness

Table 8.15.7 Treatment Guidelines to Protect Wilderness
Monitor for new invaders.
Promote public awareness on how weeds are spread.
Encourage weed-free hay for livestock and saddle horses.
Encourage tying of livestock to minimize disturbance
Reseed disturbed sites with native vegetation when possible
Use minimalist strategies, such as hand-and backpack tools and/or sprayers.
Work in off-season or weekends when area is less used.
Select herbicides that have the least effect on non-target species.

Table 8.15.8 Noxious Weed Treatment Guidelines to Ensure Worker and Resident Safety

Table 8.15.8 Noxious Weed Treatment Guidelines to Ensure Worker and Resident Safety
Applicators wear safety equipment and clothing.
Notify nearby residents of spraying.
Follow label instructions including conditions of Environmental Hazards on label.
Establish herbicide buffer zones.
Herbicides are carefully selected, considering effects from adjuvants and inert ingredients.
Minimize herbicide use when possible.

Table 8.15.9 Noxious Weed Treatment guidelines for Riparian Areas

Table 8.15.9 Noxious Weed Treatment Guidelines for Riparian Areas
Use buffers when using herbicides not registered for aquatic use or adjacent to all riparian corridors, when possible.
Reseeding or re-vegetating is important to stabilize the streambank and keep area weed free.
Plant only disease-free seeds or plants.
Plant at recommended depth.
Ensure proper water supply.
Match plant selections to soil and moisture conditions.

Table 8.15.10 Noxious Weed Treatment Guidelines to Minimize Impacts to Wildlife and Endangered Species

Develop an erosion control plan tailored to the site and inspect erosion controls routinely, especially after rain events. Take immediate corrective action if erosion or sedimentation is observed.
Maintain a vegetated buffer (50-100 feet) adjacent to ditches or drainages to reduce erosion and protect water quality.
Re-vegetate disturbed areas immediately with a native species or an annual grass.
Complete work that results in exposed earth during periods when significant rainfall is not predicted.
Conduct any work that involves clearing large tracts of land in phases, with rapid revegetation upon completion of each phase.
Locate work 50-100 feet from any nearby intermittent or permanent streams to reduce sediment runoff and turbidity.
Avoid the bird nesting season and critical reproductive periods (from April to June) or (December-March, in winter habitats).
Leave 70% of sagebrush or other native habitat in place, when possible.
Leave large blocks of Pinyon-Juniper habitat undisturbed for mule deer, small mammals and bird species diversity.
Minimize shrub removal in riparian areas and draws. Strive to protect creosote bush and cacti.
Create smaller dispersed clearings or strips, instead clearing an entire area.
Follow practices determined in agreement with USFWS during consultation.
Modified from http://www.fws.gov/daphne/section7/bmp.html and BLM, 2005.

Table 8.15.11 Noxious Weed Treatment Guidelines for Recreation

Concentrate recreation to limit impacts and weed introductions to sites that are convenient for weed monitoring and treatment.
Reduce access to areas that are weed-free.
Provide interpretive sites and signs describing the replacement of native systems by weeds, the increase in fires that kill native plants, and the importance of protecting biological soil crusts that aid in preventing weed establishment.
Provide localized field guides for highest priority weeds.
Limit trails to existing corridors.
Provide clearly marked camp sites.
Insure that trail users understand the importance of avoiding off-trail impacts.
Reduce roads, trails, and access to riparian areas to avoid compounding impacts.
Identify and avoid low-resiliency sites (Belnap et al. 2001).
Promote off-season use to reduce access during seasons when most sensitive.
Prevent off-road driving by fencing roads and providing frequent parking locations.
Where feasible, rotate use areas and provide recovery periods.

8.14.2 Conservation Measures to expect in Areas Known to be Occupied by Endangered and Threatened Species.

8.14.2.1 General Conservation Measures

- Off-road motorized travel for any purpose, including moving livestock, hunting or to retrieve game, or other activities will not be allowed in the area known to be occupied by federally-listed species. Exceptions may be authorized on a case-by-case basis and subject to stipulations deemed necessary.
- If off-road travel is deemed necessary, survey cross-country travel paths for species presence prior to use and close alternate pathways after restoration activities are completed.
- Increase education and interpretive efforts to promote a greater appreciation, respect and stewardship for historic, cultural, and natural resource values in the area, including TES and Critical Habitat.

8.14.2.2 Conservation Measures for Management Activities in Riparian and Aquatic Habitats

- Seed regionally native or sterile non-native species of grasses and herbaceous vegetation following ground disturbance to stabilize soils and prevent erosion by both wind and water.
- Use sediment traps or other erosion control methods to reduce or eliminate sedimentation into aquatic systems.
- Restrict the use of motorized vehicles during restoration activities in suitable or occupied habitat to existing roads, trails, or washes, and to temporary access roads.
- Rehabilitate temporary roads, vehicle tracks, skid trails, and off-road vehicle (ORV) trails resulting from fire suppression (water bars, etc.), and close them for future use.
- Provide public education to discourage or restrict fires and fire-prone recreation uses during high fire-risk periods. Develop brochures, signs, and other interpretive materials to educate recreationists about the ecological role of fires, and the potential dangers of accidental fires.
- Avoid crossings of perennial streams in suitable or occupied habitat, unless an established road already exists or where dry, intermittent sections occur.
- Avoid the use of chemicals in riparian habitats or within 300 feet of aquatic habitats occupied by federally protected species.
- Place camps, staging areas, and aircraft landing or refueling sites outside of riparian habitats or corridors occupied by federally protected species.
- When drawing on water sources supporting federally-protected species, consider replacing water when appropriate. However, do not dump water from fire abatement activities in sites occupied by federally protected aquatic species to avoid introducing non-native species, diseases, or parasites.
- Use containment systems for portable pumps to avoid fuel spills in riparian or aquatic systems.
- Develop and implement restoration plans for affected riparian or aquatic habitats, including long-term monitoring, to document changes in conditions in the riparian zone and watershed that maintain flood regimes and reduce fire susceptibility.
- Monitor stream water quality and riparian ecosystem health to determine effects of management activities. Coordinate efforts and results with the USFWS
  (BLM, 2010)

8.14.2.3 Species-Specific Conservation Measures

Southwestern Willow Flycatcher

- Implement the Conservation Measures for Management Activities in Riparian and Aquatic Habitats (Section 8.5.11.2).
- Avoid developing access roads that would result in fragmentation or a reduction in habitat quality
- Conduct vegetation treatment projects adjacent to occupied or unsurveyed suitable habitat only when willow flycatchers are not present (October 1 – March 31).

Bald Eagle

- No human activity is allowed within ½ mile of known bald eagle nest sites between December 1 and June 30.
- No tree cutting is allowed within ¼ mile of known nest trees or immediate area around winter roost sites, as determined by tribal or USFWS biologists.
- No human activity is allowed within ¼ mile of known bald eagle winter roost areas between October 15 and April 15.
- No helicopter or aircraft activity is allowed within ½ mile of bald eagle nest sites between December 1 and June 30 or winter roost sites between October 15 and April 15.

Yellow-billed Cuckoo

- Implement the Conservation Measures for Management Activities in Riparian and Aquatic Habitats.

Spikedace

- Implement the Conservation Measures for Management Activities in Riparian and Aquatic Habitats for occupied reaches and critical habitat.
- Minimize disturbance within wet or flowing tributary channels.
- No heavy equipment will be used off-road during projects within the wet or flowing areas of the river.
- No pollutants, or chemicals associated with projects or activities enter surface waters of reaches occupied by endangered fish species.

Flowering Plants

The following conservation measure for known locations and unsurveyed habitat of all federally protected plant species within the planning area will be implemented:

- Reduce threat from trampling or crushing from humans and vehicles by not allowing personnel or vehicles within 100 meters of identified individuals, populations or habitat.

Lesser Long-nosed Bat

- Protect long-nosed bat forage plants, saguaros and high concentrations of agaves from recreational and management activities. (“Agave concentrations” are contiguous stands or concentrations of more than 20 plants per acre.) Avoid driving over plants or piling slash on top of plants. Locate staging areas for crews or equipment in sites already disturbed.

- Educate workers and the public in the identification of agave and columnar cacti and the importance of their protection to the lesser long-nosed bat survival.
- Conduct pre-project surveys prior to implementing any activities for agaves and saguaros that may be directly affected by activities.
- Do not seed or plant nonnative plants in any treatment site with agaves or saguaros. Brief personnel on TES concerns and mitigation measures
  (BLM, 2010)

8.14.3 BIA Noxious Weed Program Checklists (Required and Recommended Practices)

8.14.3.1 Noxious Weed Program Checklist-Program Requirements

[ ] At least 50% cost share documented for each project (on a project by project basis, not just total cost share).

[ ] Narrative proposal addresses the BIA Noxious Weed Program criteria.

[ ] Annual report of previous field season activities submitted to BIA Regional Weed Coordinator.

[ ] Non-native species is targeted.

[ ] Tribal resolution or policy in support of Noxious Weed treatments is in place.

[ ] NEPA documentation (biological assessment, cultural resource clearance, etc.) completed.

[ ] Only thoroughly tested and researched biological control agents are released according to APHIS regulations.

Pesticide Safety

[ ] Pesticide Use Proposals (PUP) submitted before project commences and Pesticide Use Records (PUR) submitted with Final Report, for each chemical and applicator.

[ ] Pesticide Applicators license is submitted with grant proposal and report.

[ ] Secure and adequate pesticide storage areas are available.

[ ] Spray applications are not done when winds exceed 5-10 mph or before, after or during heavy rain events. (Documentation in PUPS and PUR submitted.)

[ ] Project follows all tribal, state and federal laws.

[ ] Notice of Intent filed for discharge under NPDES PGP (when applicable).

[ ] Proper protective clothing and equipment for the use and handling of pesticides are available and used.

[ ] No Restricted Use Pesticide are used until EPA certification process is in place and adhered to by tribe.

[ ] Only approved pesticides are used near riparian areas.

[ ] Unwanted herbicides are disposed of promptly and correctly.

8.14.3.2 Noxious Weed Program Criteria

(The following guidelines are not required but most applicants do them to obtain points in the grant rating system. The grant criteria and scoresheet are in Appendix K.)

[ ] Map showing land-use, ownership, and infestation (polygons, points) is submitted.

[ ] Active membership in Cooperative Weed Management Area (CWMA)

[ ] Coordinated Weed Management Plan and/or Conservations Plans for reservation or parcel are in place.

[ ] Adjacent landowners were consulted and are cooperative on project

[ ] Analysis of all weed control methods is documented in proposal

[ ] Weed Awareness bulletins or events documented in Final Report.

[ ] Changes in management practices are undertaken to reduce weed populations.

[ ] Revegetation is integral part of weed management program.

[ ] Weed inventory and monitoring is carried out each year and documented in Final Report.

[ ] Early Detection, Rapid Response (EDRR) techniques are used for new invaders.

[ ] Biological control methods are investigated and used, when possible.

[ ] GPS technology is used to document weeds.

[ ] GIS or Google Earth maps are made with accurate depiction of weeds and treatment areas.

[ ] Appropriate weed control methods selected or other management methods used that did not contribute to increased infestations.

[ ] Treatment has shown to successfully reduce weeds in project area.

[ ] Weed-free hay policy enforced at reservation level.

8.14.3.3 Checklist of Noxious Weed Treatment Guidelines-Recommended

General Protection Practices

[ ] Vehicles and equipment washed before leaving weed infested areas to avoid infecting weed-free areas.

[ ] Vegetated buffers (50-100 feet) are used in riparian areas.

[ ] Use of earth-moving equipment is minimized to reduce weed development.

[ ] Equipment is kept in good working order and operated by trained personnel.

[ ] BIA and tribal fire management policies adhered to when using prescribed burning as a treatment method.

[ ] Guidelines from Tribe or BIA are followed to protect cultural resources and plants.

[ ] Managed grazing is used on sites that contain palatable, non-toxic weeds and are grazed prior to seed set.

[ ] Only weed-free hay is used for livestock/horses on reservation.

Practices for Human Health and Safety *(In addition to BIA or tribal required practices)*

[ ] Treated areas are posted with specified reentry times.

[ ] Herbicide-free buffer zones are established when spraying near homes and businesses.

[ ] Nearby residents and landowners are notified when weed control projects are carried out.

[ ] Pesticide Discharge Plan and Pesticide Storage and Handling Plan are in place.

[ ] Tribal pesticide codes are in place.

[ ] Methods to reduce pesticide use have been employed successfully.

[ ] Tables from Noxious Weed Management EA on Human Poisoning Symptoms,

[ ] Effects of Herbicide Adjuvants and Herbicide Effects to Wildlife have been read.

Practices to Protect Soil and Groundwater

[ ] Presence of soil biological crusts are documented, and if present, applications are timed when surface is slightly moist.

[ ] Soil type and condition have been documented and herbicide application adjusted accordingly. (Sandy soils are subject to leaching leading to groundwater contamination. Heavy clays have slow infiltration and subject to runoff.)

[ ] Heavy equipment removal of vegetation (except tamarisk) is not carried out in areas where annual rainfall is less than 6-9 inches.

[ ] Mechanical control methods are used sparingly and judiciously when brome grass species, certain thistles, Russian knapweed and other easily spread weeds are present.

[ ] Disturbance of understory vegetation is minimized and 70% sagebrush cover or other native brush cover is maintained.

Wildlife Protection Practices

[ ] Erosion control plan tailored to the site is developed and erosion controls are inspected routinely, especially after rain events.

[ ] Immediate corrective action is taken if erosion or sedimentation is observed.

[ ] Rapid revegetation is undertaken after upon completion of each phase of land disturbance or clearing.

[ ] Bird nesting season and critical reproductive periods (from April to June) or (December-March, in winter habitats) are avoided when carrying out a project in sensitive areas. (Likely required by tribal or USFWS conservation measures)

[ ] Practices determined in agreement with USFWS during consultation are followed. (This would be required)

[ ] Large blocks of pinyon-juniper habitat are left undisturbed for mule deer, small mammals and bird species diversity.

[ ] Smaller dispersed clearings or strips are used, instead of clearing an entire area.

[ ] Shrub removal is limited in riparian areas and draws. Creosote bush, cacti are and other native plants are protected.

8.16 *Appendix P-Endangered Species Act*

8.16.1 Natural Resources of Concern-Federally Listed Species Lists for Specific Areas and Reservations

This following list is to be used for planning purposes only and an official list should be requested for ESA compliance during the consultation process. Those carrying out weed control projects may also want to further define their project area or reservation using the USFWS online system described in Sec 5.2.7, Areas Known to be Occupied by Threatened and Endangered Species.

Table 8.16.1 Sensitive Species with Potential to Occur In BIA Western Region

SENSITIVE SPECIES WITH POTENTIAL TO OCCUR IN BIA WESTERN REGION			
Scientific name	**Common Name**	**Region(s)**	**Status**
Amphibians			
Rana draytonii	California red-legged frog	Lower Colorado Reservations	Threatened
Lithobates chiricahuensis	Chiricahua leopard frog	Eastern AZ Reservations	Threatened
Rana luteiventris	Columbia Spotted frog	Duck Valley, Ft. McDermitt, South Fork	Candidate
Lithobates onca	Relict leopard frog	Lower Colorado Reservations	Candidate
Birds			
Sterna antillarum browni	CA Least Tern	AZ-Maricopa, Mohave, Pima counties.	Endangered
Gymnogyps californianus	California condor	Kaibab Reservation, PITU	Experimental-nonessential
Centrocercus urophasianus	Greater sage-grouse	Kaibab, Duck Valley, Eastern NV Reservations, Southern Paiutes, Ft. McD, Goshute, Skull V., Uintah & Ouray, South Fork, Summit Lake, Walker River, Washoe	Candidate
Vireo bellii pusillus	Least Bell's vireo	Lower Colorado Reservations	Endangered
Sterna antillarium	Least stern	Eastern AZ Reservations	Endangered
Strix oxxidentalis lucida	Mexican spotted owl	Eastern AZ Reservations, Havasupai/Hualapai, Southern Paiutes, Uintah & Ouray	Threatened
Empidonax traillii extimus	Southwestern Willow flycatcher	Kaibab, Lower Colorado Reservations, Moapa, Southern Paiutes, Uintah and Ouray, Yavapai Apache	Endangered
Anthus spragueii	Sprague's Pipit	Lower Colorado and SE AZ, Santa Cruz County	Candidate
Coccyzus americanus	Yellow-Billed Cuckoo	Kaibab Reservation, Lower Colorado Reservations, Moapa, Southern Paiutes, Fort McD, Goshute, Skull V. Uintah & Ouray	Proposed Threatened
Rallus longirostris yumanensis	Yuma Clapper rail	Lower Colorado Reservations, Moapa	Endangered
Conifers and Cycads			
Pinus albicaulis	Whitebark pine	Duck Valley, Ft. McDermitt, South Fork, Elko, Summit Lake	Candidate
Fish			
Gila elegans	Bonytail chub	Lower Colorado Reservations, Uintah & Ouray	Endangered
Salvelinus confluentus	Bull Trout	Duck Valley, Ft. McDermitt	Threatened
Gila nigrescens	Chihuahua chub	Eastern AZ Reservations (SE)	Endangered
Ptychocheilus lucius	Colorado pikeminnow	Lower Colorado Reservations except Salt and Verde R., Uintah & Ouray	Endangered
Chasmistes cujus	cui-ui	Pyramid Lake	Endangered
Eremichthys acros	Desert dace	Summit Lake	Threatened, Critical Habitat
Poeciliopsis occidentalis	Gila topminnow	Eastern AZ Reservations (SE & Central)	Endangered
Oncorhynchus gilae	Gila trout	Central AZ in Gila, Graham, Greenlee and Yavapai counties	Threatened

Scientific name	Common Name	Region(s)	Status
Gila nigra	Headwater chub	Central AZ, in Gila, Graham and Yavapai counties	Candidate
Gila cypha	Humpback chub	Uintah & Ouray, Hualapai & Havasupai	Endangered
Chasmistes liorus	June sucker	Uintah& Ouray	Endangered
Oncorhynchus clarkii henshawi	Lahontan cutthroat trout	Ft. McDermitt, Pyramid Lake, South Fork, Summit Lake, Walker River, Washoe	Threatened
Lotichthys phlegethontis	Least chub	Goshute, Skull Valley	Candidate
Moapa coriacea	Moapa dace	Moapa Reservation	Endangered
Crenichthys nevadae	Railroad Valley springfish	Duckwater Shoshone	Threatened, Critical Habitat
Xyrauchen texanus	Razorback sucker	Lower Colorado Reservations, Uintah&Ouray, Yavapai Apache Hualapai/Havasupai	Endangered
Gila robusta	Roundtail chub	Most of AZ except Yuma, Pima, Santa Cruz & Cochise counties	Candidate
Meda fulgida	Spikedace	Central AZ in Gila, Graham, Greenlee, Pinal and Yavapai counties (Yavapai Apache and Prescott Apache)	Endangered
Gila seminuda (=robusta))	Virgin River Chub	Shivwits	Endangered, Critical Habitat
Plagopterus argentissimus	Woundfin	Lower Colorado Reservations, Shivwits,	Endangered (Not Gila Rivr)
Catostomus discobolus yarrowi	Zuni Bluehead Sucker	Apache County in AZ	Proposed Endangered
Flowering Plants			
Schoenocrambe barnebyi	Barneby reed-mustard	Uintah & Ouray	Endangered
Lepidium barnebyanum	Barneby ridge-cress	Uintah & Ouray	Endangered
Phacelia argillacea	Clay phacelia	Uintah & Ouray	Endangered
Schoenocrambe argillacea	Clay reed-mustard	Uintah & Ouray	Threatened
Arctomecon humilis	Dwarf Bear-poppy	Shivwits	Endangered
Trifolium friscanum	Frisco clover	PITU-Kanosh	Candidate
Penstemon grahamii	Graham beardtongue	Uintah & Ouray	Proposed Threatened
Cycladenia humilis var. jonesii	Jones Cycladenia	Kaibab Reservation, Uintah & Ouray	Threatened
Eriogonum corymbosum var. nilesii	Las Vegas buckwheat	Kaibab Reservation, Shivwits, Las Vegas Colony	Candidate
Sclerocactus brevispinus	Pariette cactus	Uintah & Ouray	Threatened
Astragalus ampullarioides	Shivwits milk-vetch	Shivwits	Endangered
Schoenocrambe suffrutescens	Shrubby reed-mustard	Uintah & Ouray	Endangered

Scientific name	Common Name	Region(s)	Status
Pediocactus echinocactus,utahia) sileri	Siler Pincushion cactus	Kaibab, Shivwits	Threatened
Rorippa subumbellata	Tahoe Yellow cress	Washoe (near Tahoe)	Candidate
Sclerocactus wetlandicus	Uinta Basin hookless cactus	Uintah & Ouray	Threatened
Spiranthes diluvialis	Ute ladies'-tresses	Goshute, Skull V., Uintah & Ouray	Threatened
Ivesia webberi	Webber Ivesia	Washoe	Proposed Threatened & Critical Habitat
Asclepias welshii	Welsh's milkweed	Kaibab Reservation	Threatened
Erigeron rhizomatus	Zuni fleabane	Apache County in AZ	Threatened
Insects			
Pseudocopaeodes eunus obscurus	Carson wandering skipper	Washoe	Endangered
Mammals			
Mustela nigripes	Black-Footed ferret	Uintah & Ouray	Experimental Population, Non-Essential
Lynx canadensis	Canada Lynx	Uintah & Ouray	Threatened, Critical Habitat
Canis lupus	Gray wolf	Elko County, NV	Proposed for delisting
Panthera onca	Jaguar	Cochise, Pima and Santa Cruz counties in AZ	Endangered
Leptonycteris curasoae yerbabuenae	Lesser Long-Nosed bat	Southern AZ (8 counties, including Maricopa and Graham)	Endangered
Cynomys parvidens	Utah prairie dog	PITU-Cedar Band, Ind.Peaks	Threatened
Reptiles			
Gopherus agassizii	Desert tortoise	Moapa Reservation, Shivwits & Mohave County, AZ	Threatened (not Sonoran desert) & Critical Habitat
Thamnophis rufipunctatus	Narrow-headed garter snake	7 counties in northeast and central AZ.	Endangered
Thamnophis eques megalops	Northern Mexican garter snake	Most of AZ except Yuma & Maricopa counties.	Proposed Threatened
Snails			
Pyrgulopsis bruneauensis	Bruneau Hot springsnail	Duck Valley	Endangered
Physa natricina	Snake River Physa snail	Duck Valley	Endangered