Navajo Nation Integrated Weed Management Plan

BIOLOGICAL ASSESSMENT

October 2021

UNITED STATE DEPARTMENT OF THE INTERIOR

BUREAU OF INDIAN AFFAIRS NAVAJO REGION

NAVAJO NATION

ARIZONA DEPARTMENT OF TRANSPORTATION

NAVAJO NATION SOIL AND WATER CONSERVATION DISTRICTS

ANIMAL AND PLANT HEALTH INSPECTION SERVICE

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NAVAJO NATION INTEGRATED WEED MANAGEMENT PLAN
BUREAU OF INDIAN AFFAIRS, NAVAJO REGION

LOCATION:

The project covers lands administered by the BIA Navajo Regional Office (16.3 million acres), including all Navajo Indian Allotments and Indian trust land.

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1. Introduction

This Biological Assessment is being prepared by the Bureau of Indian Affairs (BIA) Navajo Regional Office to assess the effects from the Navajo Nation Integrated Weed Management Plan (IWMP) and Programmatic Environmental Impact Statement (PEIS) on Navajo Nation Department of Fish and Wildlife (NNDFW) and US Fish and Wildlife Service (USFWS) threatened, endangered, proposed, or sensitive species listed below. The biological assessment is prepared in compliance with legal requirements set forth under Section 7 of the Endangered Species Act (ESA) (16 U.S.C. 1536 (c)), and follows the standards established in the Bureau of Indian Affairs (BIA) and Navajo Nation Department of Fish and Wildlife (NNDFW) guidance.

The species considered in this document are outline in **Tables 1 - 4**. Tribal designations are developed by the Navajo Nation Division of Natural Resources, Department of Fish and Wildlife, approved by the Navajo Nation Resources Committee Resolution (No. RDCJA-01-20) (NNHP 2020), and include the following.

Group 1 (G1): Those species or subspecies that no longer occur on the Navajo Nation.

Group 2 (G2): & Group 3 (G3): "Endangered" – Any species or subspecies whose prospects of survival or recruitment within the Navajo Nation are in jeopardy or are likely within the foreseeable future to become so.

G2: A species or subspecies whose prospects of survival or recruitment are in jeopardy.

G3: A species or subspecies whose prospects of survival or recruitment are likely to be in jeopardy in the foreseeable future.

Group 4 (G4): Any species or subspecies for which the Navajo Nation Department of Fish and Wildlife (NNDFW) does not currently have sufficient information to support their being listed in G2 or G3 but has reason to consider them.

1.1 Threatened, Endangered, Proposed Threatened and Proposed Endangered

Table 1.Threatened (T) and Endangered (E) Species with Federal Endangered Species Act status that may occur in treatment areas within the project area. Tribal status of each species, as defined by NNDFW and based on populations that occur on the Navajo Nation, is also indicated. Exp. Pop. = nonessential experimental population.

Common Name (*Scientific Name*)	Federal Status	Tribal Status
Birds		
California condor (*Gymnogyps californianus)*	E; Exp. Pop.	G4
Southwestern willow flycatcher (*Empidonax traillii extimus)*	E	G2
Mexican spotted owl *(Strix occidentalis lucida)*	T	G3
Western yellow-billed Cuckoo (*Coccyzus americanus)*	T	G2
Invertebrates		
Kanab ambersnail (*Oxyloma kanabense*)	E	G4
Fish		

Common Name (*Scientific Name*)	Federal Status	Tribal Status
Colorado Pikeminnow (*Ptychocheilus lucius*)	E	G2
Humpback Chub (*Gila cypha*)	E	G2
Razorback Sucker (*Xyrauchen texanus*)	E	G2
Zuni Bluehead Sucker (*Catostomus discobolus*)	E	G2
Plants		
Brady Pincushion Cactus (*Pediocactus bradyi*)	E	G2
Fickeisen Plains Cactus (*Pediocactus pebblesianus ssp. fickeiseniae*)	E	G3
Mancos Milk-vetch (*Astragalus humillimus*)	E	G2
Mesa Verde Cactus (*Schlerocactus mesae-verdae*)	T	G2
Navajo Sedge (*Carex specuicola*)	T	G3
Welsh's Milkweed (*Asclepias welshii*)	T	G3
Zuni/Rhizome Fleabane (*Erigeron rhizomatus*)	T	G2

1.2 Candidate Species

Table 2.Candidate (C) Species with Federal Endangered Species Act status that may occur in treatment areas within the project area. Tribal status of each species, as defined by the NNDFW and based on populations that occur on the Navajo Nation, is also indicated.

Common Name (*Scientific Name*)	Federal Status	Tribal Status
Roundtail Chub (*Gila robusta*)	C	G2

1.3 Sensitive Species and Species of Concern – Navajo Listed Species

Table 3. Species with Navajo National Heritage Program Department of Fish and Wildlife tribal status that may occur in treatment areas within the project area.

Common Name (*Scientific Name*)	Tribal Status
Mammals	
Pronghorn (*Antilocapra americana*)	G3
Townsend's big-eared bat (*Corynorhius townsendii*)	G4
Chisel-toothed kangaroo rat (*Dipodomys microps*)	G4
Banner-tailed kangaroo rat (*Dipodomys spectabilis*)	G4
Navajo Mountain vole (*Microtus mogollonensis*)	G4
Arizona (Wupatki) pocket mouse (*Perognathus amplus cineis*)	G4
Kit Fox (*Vulpes macrotis*)	G4
Birds	
Bald Eagle (*Haliaeetus leucocephalus*)	G2
Golden Eagle (*Aquila chrysaetos*)	G3
Ferruginous Hawk (*Buteo regalis*)	G3
American dipper (*Cinclus mexicanus*)	G3
Northern goshawk (*Accipter gentilis*)	G4
Clark's grebe (*Aechmophorus clarkia*)	G4
Northern saw-whet owl (*Aegolius acadicus*)	G4
Burrowing owl (*Athene cunicularia*)	G4
Belted kingfisher (*Ceryle alcyon*)	G4
Mountain plover (*Charadrius montanus*)	G4
Dusky grouse (*Dendragapus obscurus)*	G4
Yellow warbler (*Dendroica petechia*)	G4
Hammond's flycatcher (*Empidonax hammondii*)	G4
Northern Pygmy owl (*Glaucidium gnoma*)	G4
Flammulated owl (*Otus flammeolus*)	G4
Band-tailed pigeon (*Patagioenas fasciata*)	G4
American three-toed woodpecker (*Picoides dorsalis*)	G4

Common Name (*Scientific Name*)	Tribal Status
Sora (*Porzana Carolina*)	G4
Tree swallow (*Tachycineta bicolor)*	G4
Gray vireo (*Vireo vicinior*)	G4
Invertebrates	
Great Basin silverspot (*Speyeris nokomis*)	G3
Rocky mountainsnail (*Oreohelix strigose*)	G4
Yavapai mountainsnail (*Oreohelis yavapai*)	G4
Fish	
Bluehead sucker (*Catostomus discobolus*)	G4
Amphibians and Reptiles	
Northern Leopard frog (*Lithobates pipiens*)	G2
Milk snake (*Lampropeltis triangulum*)	G4
Chuckwalla (*Sauromalus ater*)	G4
Plants	
Cutler's milkvetch (*Astragalus cutleri*)	G2
Gooding's onion (*Allium gooddingii*)	G3
Marble Canyon milk-vetch (*Astragalus cremnophylax* var. *hevronii*)	G3
Cronquist's milk-vetch (*Astragalus cronquistii*)	G3
Naturita milk-vetch (*Astragalus naturitensis*)	G3
Acoma fleabane (*Erigeron acomanus*)	G3
Round dunebroom (*Errazurizia rotundata*)	G3
Navajo bladderpod (*Physaria navajoensis*)	G3
Navajo Mountain penstemon (*Penstemon navajoa*)	G3
Alcove rock daisy (*Perityle specuicola*)	G3
Alcove bog-orchid (*Platanthera zothecina*)	G3
Alcove death camas (*Anticlea vaginatus*)	G3
Aztec gilia (*Aliciella formosa*)	G4
San Juan milkweed (*Asclepias sanjuanensis*)	G4
Heil's milkvetch (*Astragalus heilii*)	G4
Navajo saltbush (*Atriplex garrettii var. navajoensis*)	G4
Atwood's Camissonia (*Camissonia atwoodii*)	G4
Rydberg's thistle (*Cirsium rydbergii*)	G4
Utah bladder-fern (*Cytsopteris utahensis*)	G4
Sivinski's fleabane (*Erigeron sivinskii*)	G4
Sarah's buckwheat (*Eriogonum lachnogynum var. sarahiae*)	G4
Bluff phacelia (*Phacelia indecora*)	G4
Cave primrose (*Primula specuicola*)	G4
Marble Canyon dalea (*Psorothamnus arborescens var. pubescens*)	G4
Parish's alkali grass (*Puccinellla parishii*)	G4
Arizona rose sage (*Salvia pachyphylla ssp. eremopictus*)	G4
Brack hardwall cactus (*Sclerocactus cloverae brackii*)	G4
Welsh' American-aster (*Symphyotrichum welshii*)	G4

1.4 Critical Habitat

The action addressed by this biological assessment falls within Critical Habitat for Colorado pikeminnow, humpback chub, razorback sucker, Zuni bluehead sucker, and Navajo sedge; and proposed critical habitat for Fickeisen plains cactus. Final rulings on Critical Habitat for the species listed above and the date established by USFWS are listed below.

Table 4. Species with Federally designated critical habitat as per the Endangered Species Act within the project area and the date of the critical habitat determination.

Common Name	Date of Critical Habitat Determination
Colorado Pikeminnow (*Ptychocheilus lucius*	1994
Humpback Chub (*Gila cypha*)	1994
Razorback Sucker (*Xyrauchen texanus*)	1994
Zuni Bluehead Sucker (*Catostomus discobolus*)	2016
Fickeisen Plains Cactus (*Pediocactus pebblesianus ssp. fickeiseniae*)	2016
Navajo Sedge (*Carex specuicola*)	1985

2. Consultation to Date

Informal Section 7 consultation for the NNIWMP began with a National Environmental Policy Act (NEPA) scoping request dated December 19, 2012. The U.S. Fish and Wildlife Service (USFWS which will be address as the Service), Arizona Ecological Services Field Office responded to this request with a letter and species list dated June 28, 2012. On November 2, 2020, the Service reviewed and provided comments on the species conservation measures developed in 2014.

The Navajo Nation responded to this request with a letter dated October 19, 2012, and appointed Navajo Nation Department of Fish and Wildlife as the lead agency for the consultation. BIA submitted a data request for the project to NNDFW on February 11, 2014 to initiate consultation with NNDFW. The data request provided the list of Navajo Nation listed species, including the federally listed species, and their potential habitat. Extensive surveys for all listed species have not been conducted across the Navajo Nation; therefore, there is a dearth of information on species' status and distribution. The existing information on listed species was obtained by the NNDFW. On August 20, 2020, NNDFW sent a letter to BIA to accept the continued participation in the Navajo Nation IWMP and DPEIS project. An additional meeting between BIA and NNDFW occurred on January 12, 2021 to clarify the coverage of the Biological Evaluation (BE) being prepared for the PEIS and the mitigation measures.

BIA informally met with the Service and NNDFW over seven meetings from February 15, 2013 through February 27, 2014 to discuss the species conservation measures for Federal and Navajo Nation listed species and the potential effects of the methodology proposed. Both the "Recommended Protection Measures for Pesticide Applications in the Southwest Region of the U.S. Fish and Wildlife Service (RRMPA)" (White 2007) and the "Navajo Nation Endangered Species List Species Accounts (Version 3.08)" (NNHP 2008) were used to select the species conservation measures. In general, the most conservative species conservation measures of the two documents were selected to include in the BA with some revisions discussed during the meetings with USFWS and NNDFW. On October 23, 2020, BIA met informally with NNDFW and USFWS to discuss the updated Federal and Navajo Nation listed species and revised mitigation measures based on the "Navajo Nation Endangered Species List Species Accounts (Version 4.20)" (NNHP 2020).

3. Description of the Proposed Action

The BIA Navajo Regional Office proposes to authorize new weed treatments of up to 50,000 acres annually, for a total of up to 500,000 acres with repeat visits over 10 years to manage 45 noxious weed species (**Table 5**). Because the IWMP will be implemented across the Navajo Nation, a programmatic approach was developed to provide the BIA NRO with a strategic approach to prioritize projects, species, and treatment methods for project planning and management. Individual weed treatment projects will tier off the PEIS and will require individual environmental assessments with detailed impact analyses and information related to the site and each project's proposed methods. However, it was determined by NNDFW and USFWS that if the species mitigation measures were implemented (listed below) for each weed treatment project under this plan, it would be covered by this biological assessment determination.

The various methods analyzed under an integrated weed treatment approach (see Appendix A for more detailed descriptions) include:

- Manual: pulling, grubbing, or digging using hand tools;
- Mechanical: grubbing, tillage, mowing, prescribed burning, and heavy machinery;
- Cultural: grazing by livestock, use of weed and weed seed-free hay, crop rotation, mulching native plants, active and passive restoration of native plants
- Chemical: use of herbicide (cut stump, hand spraying, boom sprayer, aerial spraying); and
- Biological: use of U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) approved insects and pathogens.

The combination of methods used for each project will vary depending on site conditions and the species identified for treatment. Treatments will be applied across the Navajo Nation with priority areas including Navajo Nation, BIA, State, and County roads; riparian areas; Navajo Agricultural Products Industry (NAPI) lands; utility rights-of-way; designated farmlands, designated rangeland, and Navajo Nation Designated Community Development Areas. For a more detailed description of the priority areas see (Appendix A). This plan will cover a 10-year period, with a review after five years.

Table 5. Estimated annual acreage of each noxious weed treatment under the Proposed Action on the Navajo Nation. Acreages for cut stump treatments are counted in both mechanical and chemical treatment acres since both methods are utilized under this technique.

Treatment Type	Estimated Acreage of Treatment per Year
Manual	2,000
Mechanical	8,000
Cultural	5,000
Biological	5,000
Chemical	30,000
Total	**50,000**

Prevention, education, annual weed mapping, and early detection and rapid response will be implemented under the plan.

The use of biological controls will be discussed with NNDFW on a project-by-project basis. Under the IWMP, only biological control agents approved by APHIS will be used. For the list of proposed biological control agents see Appendix A. The total number of acres affected by biological control agents would be based on the total acres of the host plant available to the agent within a reasonable distance from the original released population. This would vary depending on the biocontrol agent used and the target weed species. Biological control agent would be used in combination with other weed treatment methods. The introduction of tamarisk leaf beetle (*Diorhabda* sp.) will not be considered as a biological agent for tamarisk (*Tamarix* sp.). APHIS terminated the program in 2010 due to its negative effects on nesting habitat for the endangered southwestern willow flycatcher (*Empidonax traillii extimus*). Due to the migration of the tamarisk leaf beetle from the site of introduction, near Moab, Utah, to the Navajo Nation, this species now exists across the Navajo Nation in tamarisk inhabited locations.

This BA covers the activities outlined in the IWMP for the BIA Navajo Regional Office and Cooperating Agencies including Arizona Department of Transportation (ADOT), Utah Department of Transportation (UDOT), Navajo Nation (NN), Navajo Nation Soil and Water Conservation Districts (NNSWCD), San Juan Soil and Water Conservation District (SJSWCD), USDA AZ Natural Resources Conservation Services (NRCS), and U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS).

3.1 Project Goals

The project goals developed for the Integrated Weed Management Plan include:

- Develop the best control techniques for the target weed species in a planned, coordinated, and economically feasible program to limit the impact and spread of noxious weeds.
- Use adaptive management strategies to incorporate successful projects from completed weed projects when developing new initiatives.
- Identify patterns and relationships to prevent the expansion of existing target weed species, and quickly prevent the spread of new high priority weed species through utilization of spatial technology.
- Coordinate weed removal efforts with adjacent landowners, land managers, and/or federal agencies to prevent the further spread of weeds.
- Provide and promote economic opportunities to the Navajo people to improve rangeland and farmland productivity and to remove noxious weeds.
- Develop a public education program focused on weed identification, prevention, and removal techniques for local communities and non-profit organizations.

3.2 Project Location

The Navajo Nation is in northeastern Arizona, southeastern Utah, and northwestern New Mexico and encompasses approximately 16.3 million acres (**Figure 1**). The BIA Navajo Region is divided into five BIA agencies including: Western Navajo Agency (Tuba City, AZ, 5.2 million acres), Eastern Navajo Agency (Crownpoint, NM, 2.3 million acres), Fort Defiance Agency (3.3 million acres), Shiprock / Northern Navajo Agency (2.7 million acres), and Chinle / Central Navajo Agency (1.4 million acres). The Navajo Partitioned Lands (Pinon, AZ, 910,000 acres) and the New Lands Area (310,000 acres) contain an additional 1.2 million acres. Navajo Partitioned Lands are managed by the BIA as part of the Navajo-Hopi Former Joint Use Area. At the date of this writing, New Lands is managed by the Office of Hopi and Navajo Indian Relocation but may come under the BIA in the foreseeable future. Thus, the New Lands Area is included in the project area. For this document, the project area refers to the entire Navajo Nation as described above and project sites refer to individual weed removal project locations.

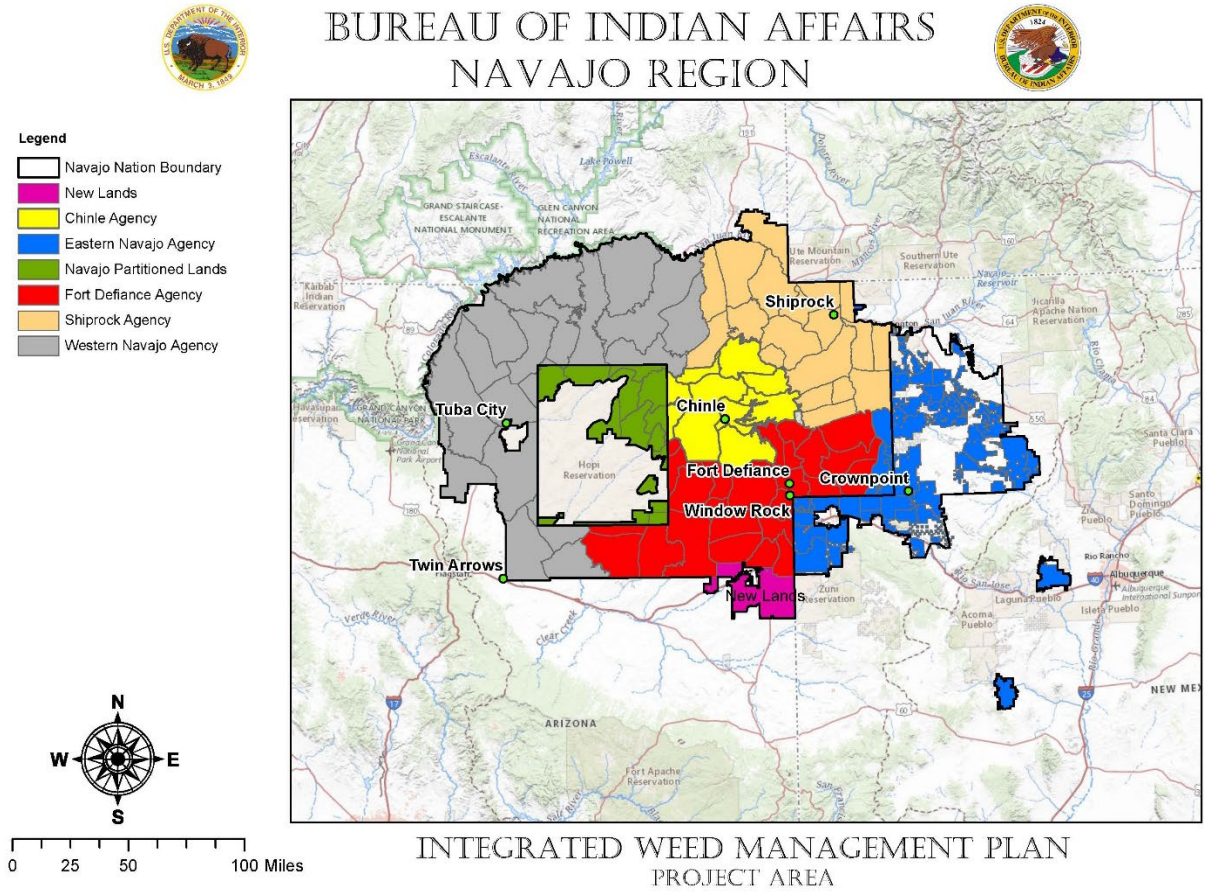

Figure 1. Project area of the Navajo Nation divided by BIA Navajo Regional Agencies.

3.3 Species Conservation Measures

The species conservation measures below are intended for the proposed action and serve as a guide for mitigating impacts to Navajo Endangered species (NESL) and Federally Threatened

and Endangered species when conducting weed treatments on Navajo Nation. However, the Navajo Natural Heritage Program (NNHP) encourages treatment of noxious weeds within sensitive species populations as a tool to improve habitat for NESL species, with proper consultation with NNHP and USFWS, as applicable. Therefore, if the goal of the weed treatment project is to improve habitat for threatened and sensitive species, the conservation measures below can be modified for individual species through consultation with NNHP and USFWS on a project-specific basis. Buffers for mechanical, cultural, manual (low impact), and non-aerial herbicide use can be modified on a project-by-project basis with approval from NNHP but will require the presence of a qualified Biologist on-site during all stages of project implementation. Flagging and fencing around listed plant species will also be required.

Species Conservation Measures (Project Design Features)
The Recommended Protection Measures for Pesticide Applications (RPR) in USFWS Region 2 (White 2007) and the Avoidance Measures listed in the Navajo Nation Endangered Species List, Species Accounts (NNDFW 2020) were used as a starting point for the conservation measures. The BIA requires the most conservative avoidance measures of the two documents be implemented for IWMP projects. BIA conducted nine informal discussions with the USFWS and the NNHP, NNDFW to help refine the conservation measures.

3.3.1 Federally Listed Species

General Project BMPs

1. Submit a Biological Consultant Data Request Form to the NNHP NNDFW to initiate the BRCF process prior to project implementation for background information on species habitat and occupancy (the form and instructions can be accessed here: https://www.nndfw.org/nnhp/drs.htm).

2. If preliminary analysis based on maps, aerial photos, and other knowledge of the project site indicates that potential habitat for listed species is present, a qualified biologist will conduct a habitat assessment and a qualified Biologist may be required on site during all stages of project implementation as determined by the BRCF process.

3. If suitable habitat is present, the project will apply the conservation measures, including buffers established for that species or a qualified biologist will conduct additional surveys for species' presence.

4. Obtain federally listed species permits from USFWS and Biological Investigations Permits from NNDFW prior to conducting species surveys on Navajo Nation land.

5. If the species is present at the site, the species-based protection measures will be employed. If protocol surveys do not detect the species, there will be no buffers.

6. Where specified, species breeding season timing restrictions and buffers apply to all treatment methods.

7. Where two or more species' habitats overlap, the more restrictive measures will take priority.

8. Consult Appendix B for the required protection measures for herbicide application in federally and NNDFW listed species habitat.

3.3.2 Navajo Nation Endangered Species List

General Project Best Management Practices (BMPs)

1. Include General Project BMPs species conservation measures listed above (2, 4-7).

2. If preliminary analysis based on maps, aerial photos, and other knowledge of the project site indicates that potential for habitat for Group 2 and 3 species is present, a qualified biologist will conduct species surveys.

3. Species surveys are preferred for Group 4 species but not required. A qualified biologist will conduct Group 4 species surveys concurrently with Group 2 and 3 species surveys.

4. Obtain Biological Investigation Permits from NNDFW prior to conducting species surveys.

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Table 6. Required species conservation measures for federally listed endangered and threatened and Group 2 and 3 Navajo Nation listed plant species.

Plants (Federally listed and NNHP G3) – Species Conservation Measures																					
USFWS Status	**E**			**T**				**T**	**Group 3**												
NNDFW Group	**G2**	**G3**	**G2**	**G2**	**G3**	**G3**	**G2**	**G2**													
Conservation Measure	**Brady pincushion cactus *(Pediocactus bradyi)***	**Fickeisen plains cactus *(Pediocactus peeblesianus* ssp. *fickeiseniae)***	**Mancos milk-vetch *(Astragalus humillimus)***	**Zuni (Rhizome) fleabane *(Erigeron rhizomatus)***	**Welsh' s milkweed *(Asclepias welshii)***	**Navajo sedge *(Carex specuicola)***	**Cutler' s milk-vetch *(Astragalus cutleri)***	**Mesa Verde cactus *(Sclerocactus mesae-verdae)***	**Aztec gilia *(Aliciella formosa)***	**Gooding' s onion *(Allium gooddingii)***	**Alcove death camas *(Anticlea vaginatus)***	**Marble Canyon milk-vetch *(Astragalus cremnophytax var. hevronii)***	**Cronquist' s milk-vetch *(Astragalus cronquistii)***	**Naturita milk-vetch *(Astragalus naturitensis)***	**Acoma fleabane *(Erigeron acomanus)***	**Round dunebroom *(Errazurizia rotundata)***	**Navajo Penstemon *(Penstemon navajoa)***	**Alcove rock daisy *(Perityle specuicola)***	**Navajo bladderpod *(Physaria navajoensis)***	**Alcove bog-orchid *(Platanthera zothecina)***	**Brack' s hardwall cactus *(Sclerocactus cloverae ssp. brackii)***
Low and high aerial spraying of herbicides requires a 1-mile (1.6 km) buffer from identified listed species locations.									X	X	X	X	X	X	X	X	X	X	X	X	X
Mechanical, cultural, chemical, and prescribed burn treatments require a 200 ft (60 m) buffer from identified listed plant species locations. A burn plan must be developed for each project using prescribed fire, which will include specific treatment buffers.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Manual treatments (low impact treatments) require a 20 ft (6 m) buffer from identified listed species locations.	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
When doing treatments, workers will place flagging, and/or fencing around listed or sensitive plant populations.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Conservation Measure	Brady pincushion cactus (*Pediocactus bradyi*)	Fickeisen plains cactus (*Pediocactus peeblesianus* ssp. *fickeiseniae*)	Mancos milk-vetch (*Astragalus humillimus*)	Zuni (Rhizome) fleabane (*Erigeron rhizomatus*)	Welsh's milkweed (*Asclepias welshii*)	Navajo sedge (*Carex specuicola*)	Cutler's milk-vetch (*Astragalus cutleri*)	Mesa Verde cactus (*Sclerocactus mesae-verdae*)	Aztec gilia (*Aliciella formosa*)	Gooding's onion (*Allium gooddingii*)	Alcove death camas (*Anticlea vaginatus*)	Marble Canyon milk-vetch (*Astragalus cremnophytax var. hevronii*)	Cronquist's milk-vetch (*Astragalus cronquistii*)	Naturita milk-vetch (*Astragalus naturitensis*)	Acoma fleabane (*Erigeron acomanus*)	Round dunebroom (*Errazurizia rotundata*)	Navajo Penstemon (*Penstemon navajoa*)	Alcove rock daisy (*Perityle specuicola*)	Navajo bladderpod (*Physaria navajoensis*)	Alcove bog-orchid (*Platanthera zothecina*)	Brack's hardwall cactus (*Sclerocactus cloverae ssp. brackii*)
The NNDFW botanist will be notified of rare plant survey results and if weed treatments will be conducted near listed or sensitive plants. If treatments occur buffers and other avoidance measures will be implemented in consultation with the NNDFW botanist.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vehicles will use only established roads for accessing project sites.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vehicles will be parked at previously disturbed parking areas located at least 20 ft (6 m) from known populations when treating. Parking areas will be near established Navajo-BIA, tribal, State, or County roads that receive moderate to heavy use.	X	X	X	X	X	X	X	X													
Treatments occurring in the Mesa Verde Biological Preserves require additional consultation with USFWS and the NNHP botanist. A qualified biological is required on-site to monitor all phases of implementation.								X													
Manual treatments (low impact treatments) require a 50 ft (15 m) buffer from identified listed species locations.								X													

Table 7. Recommended species conservation measures for NNHP Group 4 plants.

NNHP Group 4 Plants – Recommended Species Conservation Measures														
Conservation Measure	**San Juan milkweed** (*Asclepias sanjuanensis*)	**Heils milk-vetch** (*Astragalus heilii*)	**Navajo saltbush** (*Atriplex garrettii* var. *navajoensis*)	**Atwoods camissonia** (*Camissonia atwoodii*)	**Welchs American-aster** (*Symphyotrichum welshii*)	**Arizona rose sage** (*Salvia pachyphylla* ssp. *eremopictus*)	**Rydberg's thistle** (*Cirsium rydbergii*)	**Utah bladder-fern** (*Cystopteris utahensis*)	**Sivinski's fleabane** (*Erigeron sivinskii*)	**Sarah's buckwheat** (*Eriogonum lachnogynum* var. *sarahiae*)	**Bluff phacelia** (*Phacelia indecora*)	**Cave primrose** (*Primula specuicola*)	**Marble Canyon dalea** (*Psorothamnus arborescens* var. *pubescens*)	**Parish's alkali grass** (*Puccinella parishii*)
Low and high aerial spraying of herbicides require a 1-mile (1.6 km) buffer from identified listed species locations.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mechanical, cultural, chemical, and prescribed fire treatments require a 200 ft (60 m) buffer from identified listed plant species locations. A burn plan must be developed for each project using this technique, which will include specific treatment buffers.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Manual treatments (low impact treatments) require a 20 ft (6 m) buffer from identified listed species locations.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
When doing treatments, workers will place flagging, and/or fencing around listed or sensitive plant populations.	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 8. Required species conservation measures for Federally listed endangered, threated, and experimental population and NNHP Group 2 and 3 bird species.

Birds (NNHP G2, G3, and G4 Exp. Pop) – Species Conservation Measures								
USFWS Status	**T**	**E, Exp. Pop.***	**E**	**T**				
NNDFW Group	**G3**	**G4**	**G2**	**G2**	**G2**	**G3**	**G3**	**G3**
Conservation Measure	**Mexican spotted owl (*Strix occidentalis lucida*)**	**California condor (*Gymnogyps californianus*)**	**Southwestern willow flycatcher** (SWFL) (*Empidonax traillii extimus*)**	**Western yellow-billed cuckoo (YBCU) (*Coccyzus americanus*)**	**Bald Eagle (*Haliaeetus leucocephalus*)**	**Golden Eagle (*Aquila chrysaetos*)**	**Ferruginous hawk (*Buteo regalis*)**	**American dipper (*Cinclus mexicanus*)**
Breeding season is March 1 through August 31.	X							
All treatments require a ¼ mile (0.4 km) buffer from protected activity centers (PACs) and suitable nesting habitat during the breeding season. A PAC is approximately 600 acres (240 ha) around an owl activity center (nest, roost, or best roost habitat).	X							
Specified herbicides may be applied along road and utility rights-of-way in MSO PACS during the breeding season, but applicators should make sure that pesticide spray drift does not occur beyond rights-of-way.	X							
Contact NNDFW for background information on known nesting sites, suitable nesting sites, or known communal roosting sites in species habitat.		X						
Mechanical, prescribed fire, and ground application of herbicide treatments require a one-mile (1.6 km) buffer from known nesting sites, suitable nesting sites, or known communal roosting sites in species habitat of canyon lands and mountain ridges.		X						
Aerial applications of herbicides require a 1.5-mile (2.4 km) buffer from release sites, suitable nesting sites, or known communal roosting sites in species habitat of canyon lands and mountain ridges.		X						
If a condor is present all weed treatment activities will cease and NNDFW will be contacted. Field crews will avoid interacting with condors if present on site.		X						
All trash and debris will be disposed of properly off site.		X						
No new populations biological control for saltcedar on the Navajo Nation.			X					
A permitted biologist will confirm occupancy during the breeding season (May 15 through July 17, “SWFL Recovery Plan”) within a year prior to conducting treatments to determine suitable habitat, breeding habitat, important migration corridors, or potential territory for occupied habitat.			X					
A qualified SWFL biologist in coordination with NNDFW will determine breeding patch size for nesting areas per the “SWFL Recovery Plan” and identify sites on the ground prior to treatments.			X					
In occupied breeding areas, mechanical and mechanized and low and high aerial chemical treatments require a ¼ mile (0.4 km) buffer from the breeding patch boundary or suitable habitat.			X	X				

USFWS Status	**T**	**E, Exp. Pop.***	**E**	**T**				
NNDFW Group	**G3**	**G4**	**G2**	**G2**	**G2**	**G3**	**G3**	**G3**
Conservation Measure	**Mexican spotted owl (*Strix occidentalis lucida*)**	**California condor (*Gymnogyps californianus*)**	**Southwestern willow flycatcher** (SWFL) (*Empidonax traillii extimus*)**	**Western yellow-billed cuckoo (YBCU) (*Coccyzus americanus*)**	**Bald Eagle (*Haliaeetus leucocephalus*)**	**Golden Eagle (*Aquila chrysaetos*)**	**Ferruginous hawk (*Buteo regalis*)**	**American dipper (*Cinclus mexicanus*)**
Prescribed fires outside of a breeding patch will be conducted outside of the migrating and breeding season. Small pile burns will be conducted outside of the floodplain or 300 ft (90 m) buffer from edge of waterway.			X	X				
Manual treatments will be used up to the breeding patch boundary or suitable habitat.			X	X				
Important migratory corridors for SWFL will be buffered as listed above from May 15 to July 17.			X					
All projects within the riparian zone near occupied habitat will require restoration with native riparian/wetland vegetation following noxious weed removal.			X	X				
A permitted biologist will confirm occupancy during the breeding season (June 15 through August 15) within a year prior to conducting treatments. No activity will occur within ¼ mi (0.4 km) of potential habitat no survey information exists.				X				
A qualified yellow-billed cuckoo (YBCU) biologist, in coordination with NNDFW, will determine breeding patch size for nesting areas and identify sites on the ground prior to treatments.				X				
The breeding season for bald and golden eagles is January 15 – July 15 ('Navajo Nation Golden and Bald Eagle Nest Protection Regulations').					X	X		
Brief activities that occur for up to one hour per day and involve only personnel and passenger or maintenance vehicles (one hour of spot spraying, mechanical, or manual treatments) require a 0.4 mi (600 m) buffer from an active nest.					X	X		
Breeding season occurs March 1 – July 31 (Navajo Nation Endangered Species List: species accounts).							X	
Light activities that occur for up to one day in the same general area and involve up to five vehicles and up to ten personnel (mechanical treatments and mechanized ground chemical treatments) require a 0.5 mi (800 m) buffer from an active nest.					X	X	X	
Heavy activities that exceed at least one of the criteria for Light Activities that involve human activity of up to one visit per week (prescribed fire, low and high aerial chemical treatments) will be conducted outside of the breeding season and ¾ mi (1 km) from a nesting site.					X	X	X	
Brief activities that occur for up to one hour per day and involve only personnel and passenger or maintenance vehicles (one hour of spot spraying, mechanical, or manual treatments) require a ½ mile (0.8 km) buffer from an occupied nest.							X	

USFWS Status	**T**	**E, Exp. Pop.***	**E**	**T**				
NNDFW Group	**G3**	**G4**	**G2**	**G2**	**G2**	**G3**	**G3**	**G3**
Conservation Measure	**Mexican spotted owl (*Strix occidentalis lucida*)**	**California condor (*Gymnogyps californianus*)**	**Southwestern willow flycatcher** (SWFL) (*Empidonax traillii extimus*)**	**Western yellow-billed cuckoo (YBCU) (*Coccyzus americanus*)**	**Bald Eagle (*Haliaeetus leucocephalus*)**	**Golden Eagle (*Aquila chrysaetos*)**	**Ferruginous hawk (*Buteo regalis*)**	**American dipper (*Cinclus mexicanus*)**
Mechanical treatments require a 50–200 ft (15-60 m) buffer from occupied nesting habitat outside of breeding season.								X
No mechanical, mechanized ground, low or high aerial chemical treatments within 1/8 mile (0.2 km) from the active nest during March 15- August 15.								X
Spot chemical spraying or manual treatments require a buffer of 330 ft (0.1 km) from the active nest during March 15- August 15.								X
Small migratory birds- Class 2 or Class 3 herbicides require 30 ft (9 m) buffer for spot and mechanized ground application of herbicide, 150 ft (50 m) with low aerial chemical treatments, and 1/8 mi (200 m) for high aerial chemical treatments near the species habitat.								X

***Exp. Pop = Experimental Population**

****Southwestern willow flycatcher** (*Empidonax traillii extimus)*

Definitions (from "Southwestern Willow Flycatcher Recover Plan ("SWFL Recovery Plan)

Currently suitable habitat is defined as a riparian area with all the components needed to provide conditions suitable for breeding flycatchers. These conditions are generally dense, mesic riparian shrub and tree communities 0.25 acre (0.1 ha) or greater in size within floodplains large enough to accommodate riparian patches at least 33 ft (10 m) wide. Suitable habitat may be occupied or unoccupied.

Potentially suitable habitat is defined as a riparian system that does not currently have all the components needed to provide conditions suitable for nesting flycatchers, but which could – if managed appropriately – develop these components over time. Potential habitat occurs where the flood plain conditions, sediment characteristics, and hydrological setting provide potential for development of dense riparian vegetation.

Breeding Patch is the area used by breeding flycatchers. Breeding patches include all flycatcher territories, and most flycatcher breeding patches are larger than the sum total of the flycatcher territory sizes at that site.

Table 9. Recommended species conservation measures for NNHP Group 4 bird species and bird species protected under the Migratory Bird Treaty Act.

NNHP Group 4 Birds – Species Conservation Measures Protected under Migratory Bird Treaty Act																
Mitigation Measure	**Northern goshawk (*Accipiter gentilis*)**	**Clarks grebe (*Aechmophorus clarkia*)**	**Northern saw-whet owl (*Aegolius acadicus*)**	**Burrowing owl (*Athene cunicularia*)**	**Belted kingfisher (*Ceryle alcyon*)**	**Mountain plover (*Charadrius montanus*)**	**Dusky grouse (*Dendragapus obscurus*)**	**Yellow warbler (*Dendroica petechial*)**	**Hammond's flycatcher (*Empidonax hammondii*)**	**Northern pygmy-owl (*Glaucidium gnoma*)**	**Flammulated owl (*Otus flammeolus*)**	**Band-tailed pigeon (*Patagioenas fasciata*)**	**American three-toed woodpecker (*Picoides dorsalis*)**	**Tree swallow (*Tachycineta bicolor*)**	**Sora (*Porzana Carolina*)**	**Gray vireo (*Vireo vicinior*)**
All treatments require a ¼ mi (0.4 km) buffer from nest site during March 1- August 15 and within 0.20 mi (0.2 km) of nest site year-round.	X			X												
Mechanical treatments require 200 ft (60 m) buffer from lake-side vegetation or within the 100-yr floodplain, whichever is greater.		X														
Prescribed fire, target livestock grazing, and mechanized ground, low and high aerial chemical spraying require a 1/8-mile (0.2km) buffer from the active nest.		X*			X*	X*	X ∞								X ‡	
Chemical spot and manual treatments require a 330 ft (0.1 km) buffer from active nest.		X*			X*	X*	X ∞		X ϕ			X ‡	X ‡	X ‡	X ‡	X***
All treatments require a 1/8- mile (0.2 km) buffer from the nest site year-round or during nesting.			X					X**								
Pesticides that rate as Class 2 or Class 3 in the Predatory Avian, Small Mammal, or Terrestrial Arthropod toxicity groups should have a ½ mile (0.8 km) buffer from occupied nests.			X	X						X	X					
No treatments within nesting habitats year-round.					X	X										
Mechanical treatments require 1/8-mile (0.2 km) buffer from nest site year-round.							X				X					

Mitigation Measure	Northern goshawk (*Accipiter gentilis*)	Clarks grebe (*Aechmophorus clarkia*)	Northern saw-whet owl (*Aegolius acadicus*)	Burrowing owl (*Athene cunicularia*)	Belted kingfisher (*Ceryle alcyon*)	Mountain plover (*Charadrius montanus*)	Dusky grouse (*Dendragapus obscurus*)	Yellow warbler (*Dendroica petechial*)	Hammond' s flycatcher (*Empidonax hammondii*)	Northern pygmy-owl (*Glaucidium gnoma*)	Flammulated owl (*Otus flammeolus*)	Band-tailed pigeon (*Patagioenas fasciata*)	American three-toed woodpecker (*Picoides dorsalis*)	Tree swallow (*Tachycineta bicolor*)	Sora (*Porzana Carolina*)	Gray vireo (*Vireo vicinior*)
Mechanical, mechanized ground and low and high aerial chemical treatments require a 1/8-mile (0.2 km) buffer from habitat patches used for breeding or potential habitat year-round.								X	X	X		X	X	X		X
Chemical spot and manual treatments require a 1/8-mile (0.2 km) buffer from the nest site.										X∞	X #					
Mechanical treatments require 200 ft (60 m) buffer from lakes and Category I wetlands and 150 ft (45 m) of Category II wetlands, per Navajo Natural Heritage Program 1994.															X	

*- nesting period May 1- July 31,
**- nesting period April 15 – July 31
***- nesting period May 1 – August 31
∞- nesting period April 1- July 15
ϕ - nesting period May 15 – August 15
‡ - nesting period May 1 – August 1
# - nesting period May 1 – August 15

Migratory Birds – Species Conservation Measures

Mechanical treatments within the buffer zone will be conducted outside of the breeding season (March through August).
Non-endangered raptors - All treatments require a 490 ft (0.15 km) buffer from the active nest from March-August or until juveniles have left the nest.
Predatory birds - Spot and mechanized ground herbicide treatments with Class 2 or Class 3 liquid formulation herbicides require a 300 ft (90 m) buffer from the active nest from March- August or until juveniles have left the nest. Low and high aerial treatments require a 1/8 mi (200 m) buffer from the active nest.
Small migratory birds - Class 2 or Class 3 herbicides require 30 ft (9 m) buffer for spot and mechanized ground application of herbicide, 150 ft (50 m) with low aerial chemical treatments, and 1/8 mi (200 m) for high aerial chemical treatments near the species habitat.
Waterfowl - avoid using Class 2 or 3 herbicides in areas where waterfowl are concentrated and wait until birds have migrated for the season. Applications of liquid formulations of Class 2 and 3 herbicides require a 30 ft (9m) buffer for spot applications, 60 ft (20 m) for mechanized ground, 200 ft (60 m) for low aerial spraying, and 1/8 mi (200 m) for high aerial spraying.
Prescribed fires outside of a breeding patch will be conducted outside of the migrating and breeding season.

Table 10. Required species conservation measures for federally listed candidate and endangered and NNHP Group 2 fish species and recommended species conservation measures for NNHP Group 4 fish species.

Fish – Species Conservation Measures						
USFWS Status	**E**	**E**	**C**	**E**	**E**	
NNDFW Group	**G2**	**G2**	**G2**	**G2**	**G2**	**G4**
Mitigation Measure	**Colorado pikeminnow *(Ptychocheilus Lucius)***	**Razorback sucker *(Xyrauchen texanus)***	**Roundtail chub *(Gila robusta)***	**Humpback chub *(Gila cypha)***	**Zuni bluehead sucker *(Catostomus discobolus yarrowii)***	**Bluehead sucker *(Catostomus discobolus)***
Weed removal projects will require restoration of native vegetation to prevent erosion. Weed removal activities in the riparian zone will be conducted in patches to prevent erosion. Patch size will be determined in consultation with NNDFW.	X	X	X	X	X	X
Best Management Practices (see NNIWMP, BIA 2020) will be used to reduce sedimentation and chemical run-off from mechanical and chemical weed treatments along bank lines within the 100-year floodplain.	X	X	X	X	X	X
Pile burning and prescribed burning will be conducted 300 ft (90 m) outside of the floodplain.	X	X	X	X	X	X
Approved herbicides (aquatic formulations only): 2,4-D, Glyphosate, Triclopyr and Imazapyr will exclusively be used within 25 ft (7.6 m) of the daily high-water mark.	X	X	X	X	X	X
Herbicides with relatively low aquatic toxicity to fish require a 25 ft (7.6 m) buffer from the daily high-water mark in the riparian zone, including: Aminopyralid, Chlorsulfuron methyl, Clopyralid, Diflufenzopyr, Imazapic, and Thifensulfuron-methyl.	X	X	X	X	X	X
Non-aquatic approved and moderate to high aquatic toxicity herbicides require a 300 ft (90 m) buffer from the daily high-water mark (see NNIWMP, EPP 2020).		X	X	X	X	
No surface disturbance year-round within 98 – 200 ft (30 – 60 m) from the top of the stream bank. NNDFW fish biologist will determine exact distance on a case by case basis.					X	X
Only the cut-stump method will be used to remove large trees or shrubs in the floodplain. Debris will be piled outside of the floodplain.					X	
Heavy machinery (bulldozers/root plows) mechanical treatments require a 300 ft (90 m) buffer from edge of the waterway.					X	

Table 11. Required species conservation measures for federally listed endangered and NNHP Group 3 invertebrate species and recommended species conservation measures for NNHP Group 4 invertebrate species.

Invertebrates – Species Conservation Measures				
USFWS Status	**E**			
NNDFW Group	**G4**	**G3**	**G4**	**G4**
Mitigation Measure	**Kanab ambersnail (*Oxyloma kanabense*)**	**Great Basin silverspot (*Speyeria nokomis*)**	**Rocky mountainsnail (*Oreohelix strigosa*)**	**Yavapai mountainsnail (*Oreohelix yavapai*)**
Mechanized, manual and chemical spot treatments require a 200 ft (60 m) buffer from suitable habitat.	X			
Low aerial spraying requires a 150 ft (50 m) buffer and high aerial spraying requires a 1/8 mile (200 m) buffer from suitable habitat.	X			
Surveys will be conducted from August 1 - September 1.		X		
Avoidance measures will be applied to the host plant, violet.		X		
No chemical or mechanical treatments permitted within 200 ft (60 m) of occupied habitat year-round.		X		
No target livestock grazing in wet areas containing host plants during the mating season.		X		
No broadcast or aerial herbicide applications will be permitted within Great Basin silverspot habitat or in areas containing host plants.		X		
Mechanical and manual treatments require a 200 ft (60 m) buffer from occupied habitat year-round.			X	X

Table 12. Required species conservation measures for NNHP Group 2 amphibian and reptile species and recommended species conservation measures for NNHP Group 4 amphibian and reptile species.

Amphibians and Reptiles – Species Conservation Measures			
NNDFW Group	**G2**	**G4**	**G4**
Mitigation Measure	**Northern leopard frog (*Lithobates pipiens*)**	**Milk snake (*Lampropeltis triangulum*)**	**Chuckwalla (*Sauromalus ater*)**
Mechanized and manual treatments require a 200 ft (60 m) buffer from open water habitats.	X		
Prescribed fire requires a 200 ft (60 m) buffer zone from the edge of the wetland vegetation.	X		
No applications of herbicides will be used inside occupied or potentially occupied aquatic habitat.	X		
Mitigation measures will be applied in dispersal and migration corridors after rain events.	X		
All projects in riparian/wetland habitats near occupied habitat will require native riparian/wetland vegetation restoration following invasive species removal.	X		
Only herbicides labeled for aquatic use and the cut-stump method on tree species will be used in potential habitat.	X		
No target grazing will be used in the habitat.	X		
All equipment and boots will be cleaned with bleach before and after treatments within 200 ft (60 m) of occupied habitat to prevent the spread of chytrid fungus.	X		
No mechanical treatments (surface disturbance) within occupied habitats.		X	X

Table 13. Required species conservation measures for NNHP Group 3 mammal species and recommended species conservation measures for NNHP Group 4 mammal species.

Mammals – Species Conservation Measures							
NNDFW Group	**G3**	**G4**	**G4**	**G4**	**G4**	**G4**	**G4**
Mitigation Measure	**Pronghorn (*Antilocapra americana*)**	**Townsend's big-eared bat (*Corynorhinus townsendii*)**	**Chisel-toothed kangaroo rat (*Dipodomys***	**Banner-tailed kangaroo rat (*Dipodomys spectabilis*)**	**Navajo Mountain vole (*Microtus mogollonensis*)**	**Arizona (Wupatki) pocket mouse (*Perognathus amplus cineris*)**	**Kit fox (*Vulpes macrotis*)**
All treatments require a 1-mile (1.6 km) buffer from potential lambing areas from May 1 through June 15.	X						
All treatments require a 200 ft (60 m) buffer from occupied roost site during April 15- August 31.		X					
Mechanical and target grazing treatments require a 200 ft (60 m) buffer from occupied habitats year-round.			X	X	X	X	X
All treatments require a 1/8 mi (0.2 km) buffer from active den during December 1- August 31							X

Black-footed ferret (*Mustela nigripes)* and Northern river otter were extirpated from the Navajo Nation. Both species have been reintroduced in areas adjacent to the Navajo Nation. For black-footed ferret, reintroduction efforts have occurred at Babbitt Ranches, adjacent to the Navajo Nation, and may be considered for other areas within or around the Navajo Nation. Northern river otters were detected in southern Colorado, but no sightings have occurred on the Navajo Nation. If black-footed ferrets and Northern river otters are reintroduced or expand into the Navajo Nation the conservation measures, listed below, for this species would be initiated in addition to the regulations outlined in the reintroduction guidelines.

Table 14. Recommended species conservation measures for NNHP Group 1 mammal species.

Mammals (G1 Extirpated) – Species Conservation Measures		
Mitigation Measure	**Northern river otter (*Lontra canadensis*)**	**Black-footed ferret (*Mustela nigripes*)**
No activity year-round within 300 ft (100 m) of occupied habitat that could result in destruction of burrows/runways and take of individuals or prevent changes to water chemistry.	X	
Breeding season for black-footed ferret is from mid-March to August, with most sensitive period from mid-March to June. Only occur in medium to large active prairie dog towns (>198 acres (80 hectare (ha), and ≥20 burrows/ha).		X
Notify USFWS and NNDFW of any project that will impact prairie dog towns greater than 200 acres (80 ha).		X
Weed treatments will be scheduled outside of breeding season.		X
No disking, plowing or prescribed burns around habitat during the breeding season (March to September).		X
No herbicide limitations for this project per the RPMPA, pg. 109.		X

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4. Species Considered and Evaluated

All terrestrial and aquatic Threatened, Endangered, and Candidate species with the potential to occur on the Navajo Nation were considered in this evaluation. This Biological Assessment (BA) determines the effects of the NNIWMP, including all aspects of treatments outlined in the proposed alternative, on 17 plants and animals federally listed or proposed under the Endangered Species Act of 1973, as amended (**Table 1** and **Table 2**. Additionally, this BA considers 62 Navajo Natural Heritage Program Department of Fish and Wildlife listed plant and animal species (Resource Committee Resolution No. RDCJA-01-20) (**Table 3**). Tribally listed species are categorized into groups that are designated as extirpated from the Navajo Nation (G1); critically endangered (G2); endangered (G3); and sensitive (G4). This program of noxious and invasive weed treatments with its proposed conservation measures has no effect or is not likely to adversely affect the following Federal or Navajo Nation endangered, threatened, or candidate species or any designated critical habitat.

Black-footed ferret (*Mustela nigripes*) and Northern river otter (*Lontra canadensis*) are extirpated from the Navajo Nation. Reintroduction efforts are proposed to occur on and are occurring adjacent to the Navajo Nation, but no individuals have currently been detected on the Navajo Nation. If reintroduction efforts are initiated on and species are detected on the Navajo Nation mitigation measures will be implemented and the species effects will be evaluated on an individual project basis.

5. Species Accounts and Effects Findings

5.1 Federally Listed Species

5.1.1 Birds

California condor (Gymnogyps californianus)

Endangered Species Act Status: Endangered, 1967; Non-essential Experimental Population, 1996
Navajo Nation Endangered Species List: Group 4
Recovery Plan: Final, 1996
Critical Habitat: Final, 1976

Species Account

The California condor is the largest North American vulture. It is a strict scavenger and historically fed on the carcasses of deer, elk, and antelope. Condors spend much of their time roosting on cliffs or tall conifers. They nest on rock crevices, overhung ledges, or rarely in cavities in sequoia trees. They roost in snags or tall open branched trees near important foraging grounds. There is no critical habitat for California condors on the Navajo Nation.

Habitat Status

The historic distribution of the California condor was along the Pacific coast from British Columbia, Canada, to Baja California Norte, Mexico. By 1987, the range of the condor had been reduced to six counties north of Los Angeles, California. At that time, all existing condors were removed from the wild for captive breeding.

Currently there are four California condor release areas in the United States, three in California and one in Arizona. Condors were released at the Vermillion Cliffs site in Arizona in 1996. These released birds are part of a non-essential experimental population. As of April 2019, the total number of free-flying California condors in Arizona was 88 birds (AZGF 2020).

Existing Environment

Vermillion Cliffs, the release site for the non-essential experimental population in Arizona, is adjacent to the Navajo Nation. Condors use Marble and Grand Canyons for foraging and roosting, and to a smaller extent the Western Navajo Nation. Condors are now breeding in the wild in northern Arizona, and one nesting attempt was detected on the Navajo Nation (NNHP 2020).

Effects Analysis

California condors are uncommon visitors to the Navajo Nation and, if detected, mitigation measures would be implemented. Therefore, there will be no direct effects of noxious weed treatments on California condors. The bioaccumulation of pesticide residues in body tissue was formerly a major threat to California condors. However, none of the herbicides used for this weed management program will bioaccumulate in body tissue. It is unlikely that California condors will encounter herbicides from road-killed animals because they would have a low likelihood of exposure.

There would be a small likelihood for indirect effects. If some herbicides were consumed, there is a low risk from small amounts of ingestion. The potential for direct disturbance to roosting or nesting condors would be eliminated by prohibiting ground disturbing treatments, including mechanical, prescribed fire, and ground application of herbicide, within one mile (2.6 km) or aerial application of herbicides within 1.5 mile (2.4 km). The natural curiosity of California condors to humans and brightly colored materials may draw the attention of the condors to a treatment site. If a condor is present on a treatment site, all treatment activities would cease and the NNDFW will be contacted. Finally, all materials including waste will be cleaned up daily from a treatment site to prevent condors from removing and ingesting it. The combination of low herbicide toxicity, low potential for herbicide exposure, and protection from disturbance makes the possibility of adverse effects to the California condor insignificant. No synergistic or cumulative impacts are anticipated to occur. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan will not affect California condors.

Southwestern Willow Flycatcher (Empidonax traillii extimus)

Endangered Species Act Status: Endangered, 1995
Navajo Nation Endangered Species List: Group 2
Recovery Plan: Final, 2002
Critical Habitat: Final, 2013

Species Account

The southwestern willow flycatcher (SWFL) is one of five subspecies of the willow flycatcher. It is a neotropical migrant that breeds in the southwestern United States and winters in Mexico, Central America, and extreme northern South America. SWFL arrive on breeding grounds in Arizona and New Mexico in late April and early May. Nesting begins in late May and early June.

SWFL nest in lowland riparian communities typically where there are dense patches of willow, buttonbush, boxelder, and *Baccharis* spp., sometimes with a scattered overstory of cottonwood. Nesting habitat greatly varies in size and shape and may be as small at 0.8 ha but does not include linear riparian zones <10 m wide. Migrant flycatchers may use unsuitable breeding riparian and non-riparian areas in early spring. Nests are typically placed in trees where the plant growth is most dense, where trees and shrubs have vegetation near ground level, and where there is a low-density canopy. Some of the more common tree and shrub species currently known to comprise nesting habitat on the Navajo Nation include Goodding's willow (*Salix gooddingii*), coyote willow (*S. exigua*), arroyo willow (*S. lasiolepis*), red willow (*S. laevigata*), tamarisk (*Tamarix ramosissima*), and Russian olive (*Elaeagnus angustifolia*). In almost all cases, water that is still or slowly moving or saturated soils are present at or near the breeding site (USFWS 2002). SWFL feed on small to medium-sized insects. They use "sit-and-wait" foraging with long periods of perching interspersed with foraging bouts (USFWS 2002).

Habitat Status

The southwestern willow flycatcher (SWFL) was listed as endangered by the USFWS in 1995. Reasons for the decline of the SWFL have been attributed to fragmentation and modification of riparian breeding habitat, including loss of wintering habitat (Sogge et al. 1997, 2010 and USFWS 2002). Habitat modification has primarily occurred due to water management and land use practices such as dams and reservoirs, diversions and groundwater pumping, channelization and bank stabilization, phreatophyte control, livestock grazing, recreation, fire, agricultural development, urbanization. Fire is an increasing threat to willow flycatcher habitat, especially in monotypic saltcedar vegetation and where water diversions or groundwater pumping desiccates riparian vegetation. Feeding sites for cowbirds are enhanced by the presence of livestock and range improvements (such as water tanks and corrals), agriculture, urban areas, and trash areas. Coupled with habitat fragmentation, proximity of cowbird feeding areas to flycatcher breeding habitat may lead to an increase in cowbird parasitism of flycatcher nests. Additionally, SWFL is threatened by habitat loss due to tamarisk defoliation caused by tamarisk beetle (McLeod and Pellegrini 2013).

The Navajo Nation is located within the Upper Colorado River and Lower Colorado River Recovery Unit for the SWFL (USFWS 2002). The management units include San Juan and Powell in the Upper Colorado River Recovery Unit and the Little Colorado River in the Lower Colorado River Recovery Unit. Breeding may occur at any elevation (except possibly above 2600 m) throughout the Navajo Nation where appropriate habitat exists. Migrant flycatchers have been found in less dense or abundant riparian habitat across the Navajo Nation (NNHP 2020).

Due to extensive tamarisk defoliation from the tamarisk leaf beetle across the Navajo Nation, NNHP designated priority areas for noxious weed treatments. The Little Colorado and San Juan Rivers (500 m buffer) are "high" priority for noxious weed treatments and areas around perennial and intermittent streams (200 m buffer) lower than 2,600 m are a "moderate" priority (NNHP 2020a). After treatment in these areas, NNHP recommends that sites are replanted with native willow and cottonwood species.

Critical Habitat

A total of 737 river miles (totaling approximately 120,824 acres) across various counties in southern California, Arizona, New Mexico, southern Nevada, and southern Utah was included in the final critical habitat designation for SWFL (USFWS 2005). On the Navajo Nation critical habitat includes the riparian habitats of the San Juan and Colorado Rivers. The lateral extent of critical habitat includes areas within the 100-year floodplain. Primary constituent elements for SWFL are as follows (USFWS 2005):

1. Riparian habitat in a dynamic successional riverine environment (for nesting, foraging, migration, dispersal, and shelter) that comprises
    - Trees and shrubs that include, but are not limited to, willow species, box elder, saltcedar, Russian olive, cottonwood, stinging nettle, alder, ash, poison hemlock, blackberry, oak, rose, false indigo, Pacific poison ivy, grape, Virginia creeper, Siberian elm, and walnut.
    - Dense riparian vegetation with thickets of trees and shrubs ranging in height from 2 to 30 m (6–98 feet). Lower-stature thickets (2–4 m, or 6–13 feet tall) are found at higher elevation riparian forests, and tall-stature thickets are found at middle- and lower-elevation riparian forests;
    - Areas of dense riparian foliage at least from the ground level up to approximately 4 m (13 feet) aboveground or dense foliage only at the shrub level, or as a low, dense tree canopy;
    - Sites for nesting that contain a dense tree and/or shrub canopy (the amount of cover provided by tree and shrub branches measured from the ground) (i.e., a tree or shrub canopy with densities ranging from 50%–100%); or

- Dense patches of riparian forests that are interspersed with small openings of open water or marsh, or shorter/sparser vegetation that creates a mosaic that is not uniformly dense. Patch size may be as small as 0.1 hectare (0.25 acre) or as large as 70 hectares (175 acres).

2. A variety of insect prey populations found within or adjacent to riparian floodplains or moist environments, including flying ants, wasps, and bees; dragonflies; flies; true bugs; beetles; butterflies/moths and caterpillars; and spittlebugs.

Existing Environment

Breeding is known to occur along the San Juan and Colorado Rivers in the Upper Colorado River Management Unit (**Table 5**). In 2008, there were a total of 19 territories in both the Little and Lower Colorado River Recovery Units (Durst et al. 2008), however these do not necessarily occur on the Navajo Nation. Since 1985, 39 individuals have been detected on the Navajo Nation however territory data was not collected, and it is unknown if they were migrating or breeding (Brent Powers, Zoologist Navajo Nation Natural Heritage Program, personal communication). Recent surveys have not been conducted.

Table 15. Known number of SWFL breeding sites and territories in the Upper Colorado River and Lower Colorado River Recovery Units during 2007 (Durst et al. 2008). Number of territories does not indicate presence on the Navajo Nation.

Upper Colorado River Recovery Unit		
Management Unit	**Number of Sites**	**Number of Territories**
San Juan	5	10
Powell	0	0
Lower Colorado River Recovery Unit		
Little Colorado River	5	9

Effects Analysis

The project area contains suitable or potentially suitable habitat for migrating and nesting SWFL. Native vegetation in these areas will be retained during treatments. Saltcedar and Russian olive, which provides SWFL habitat, are priority noxious weeds in the IWMP. Implementing the conservation measures will minimize any impacts from treatments that might disturb SWFL or damage their habitat. These measures include timing restrictions during the migrating and breeding seasons; ¼ mile (0.4 km) buffers from breeding patch boundary or suitable habitat for mechanical and mechanized and low and high aerial chemical treatments; 300 ft (91 m) buffers for small pile burns from edge of the waterway; use of selective herbicides; and native species planting after noxious weed removal. Also, transferring tamarisk leaf beetle to novel areas is not permitted.

SWFL typically forage within the breeding patch, and no treatments will occur within the breeding patch. If an individual leaves the breeding patch to forage, the ¼ mile (0.4 km) buffer will prevent SWFL from contacting herbicides or other mechanical disturbances. Manual treatments will be allowed up to the breeding patch boundary or suitable habitat, which may cause disturbance to the foraging flycatcher from the administering personnel. However, manual

treatments have low weed treatment success without the use of herbicides or mechanical tools. It is unlikely that SWFL would ingest herbicide contaminated insects, or come into direct contact with herbicides, because the buffers will prevent the likelihood of this contact. SWFL will benefit from treatments by removing lower-quality beetle defoliated saltcedar habitat to planted native riparian species.

Cumulative impacts may occur in foraging habitats when weed control measures are implemented in tamarisk stands impacted by the tamarisk leaf beetle. The conservation measures will be implemented, and no treatments will occur in nesting areas as discussed above. While weed treatments will provide cumulative impacts to the habitat, there will be greater benefits from removing defoliated saltcedar and replacing riparian vegetation with native riparian vegetation. There are no anticipated synergistic effects. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan may affect, but is not likely to adversely affect the southwestern willow flycatcher.

Mexican spotted owl (*Strix occidentalis lucida*)

Endangered Species Act Status: Threatened, 1993
Navajo Nation Endangered Species List: Group 3
Recovery Plan: Final, 1995; First Revision, 2012
Critical Habitat: Final, 2004

Species Account

Mexican spotted owls are territorial, where a pair will defend a breeding territory (activity center) within a larger home range. A core area is a specific type of activity center that usually includes a minimum area for protecting special resources like trees and groves used for roosting, nesting, or rearing of young (USFWS 2012). They have high territory fidelity, and they will remain in these territories year after year (USFWS 2012). Mexican spotted owls are nocturnal predators that feed primarily on small mammals. Spotted owls in mountain ranges with forest-meadow interfaces take relatively more small mammals than in other areas (USFWS 2012).

Habitat Status

The Mexican spotted owl was federally listed as threatened due to habitat alteration from timber-management practices, habitat loss, degradation, and fragmentation. The Revised Recovery Plan (2012) identified that the primary threats to the Mexican spotted owl population in the U.S. have transitioned from timber harvest to an increased risk of stand-replacing wildland fire. Climate variability combined with current forest conditions may synergistically result in increased loss of habitat from fire. The intensification of natural drought cycles and the stress placed on forested habitats could result in even larger and more severe wildland fires in owl habitat (USFWS 2012). Spotted owls have low fecundity due to small clutch size, variability in nesting success, and delayed onset of breeding which contributes to decline of this species.

Critical Habitat

In 2004, USFWS designated approximately 3.5 million ha (8.6 million ac) of critical habitat for the Mexican spotted owl on Federal lands in Arizona, Colorado, New Mexico, and Utah (69 FR 53181). The primary constituent elements of critical habitat were listed as those habitat features recognized in the 1995 Recovery Plan as associated with Mexican spotted owl occupancy, as follows (USFWS 1995):

1. Primary Constituent Elements Related to Forest Structure:
    - A range of tree species, including mixed-conifer, pine-oak, and riparian forest types, composed of different tree sizes reflecting different ages of trees, 30-45% of which are large trees with a trunk diameter of ≥0.3 m (12 in) when measured at 1.4 m (4.5 ft) from the ground;
    - A shaded canopy created by the tree branches and foliage covering ≥40% of the ground; and,
    - Large, dead trees (i.e., snags) with a trunk diameter of at least 0.3 m (12 in) when measured at 1.4 m (4.5 ft) from the ground.
2. Primary Constituent Elements Related to Maintenance of Adequate Prey Species:
    - High volumes of fallen trees and other woody debris;
    - A wide range of tree and plant species, including hardwoods; and,
    - Adequate levels of residual plant cover to maintain fruits, seeds, and allow plant regeneration.
3. Primary Constituent Elements Related to Canyon Habitat (one or more of the following):
    - Presence of water (often providing cooler air temperature and often higher humidity than the surrounding areas);
    - Clumps or stringers of mixed-conifer, pine-oak, pinyon-juniper, and/or riparian vegetation;
    - Canyon walls containing crevices, ledges, or caves; and,
    - High percentage of ground litter and woody debris.

Existing Environment

The Navajo Nation is located in the Colorado Plateau Ecological Management Unit (CP EMU), in which tribal lands (Navajo Nation being the largest tribe) account for 27% of the total land ownership. The CP EMU accounts for approximately 15% of the known Mexican spotted owls in the U.S with the majority detected on USDI National Park Service Land (N=132) (USFWS 2012). This percentage is not specific to owl numbers on the Navajo Nation. Due to limited survey data on the Navajo Nation, current Mexican spotted owl numbers are unknown.

Mexican spotted owls use three distinct habitat types on the Navajo Nation: 1) mid-aged to mature mixed-conifer stands dominated by Douglas fir, typically on mountain slopes with moderate to dense canopies and multiple canopy layers; 2) steep-walled narrow canyons, or side and hanging canyons in wide canyons, often with riparian vegetation and cool microclimates;

and 3) moderately sloped drainages with Douglas fir in pinyon-juniper woodland (*e.g*. Black Mesa) (NNHP 2020). The species is not known to nest in ponderosa pine-oak forests on the Navajo Nation, but will use a variety of habitats, including pinyon-juniper and clearings when foraging. On the Navajo Nation, Mexican Spotted Owls are known to occur within, or adjacent to, the Chuska Mountain Range, Defiance Plateau, Canyon de Chelly, Black Mesa, and the extensive canyonlands to the north (NNHP 2020).

Effects Analysis

Rights-of-way and riparian areas are priority areas for weed treatments under this project which may pass through occupied Mexican spotted owl habitats. Linear corridors, such as roads, trails and easements are vectors for noxious weed infestations into PAC habitat from vehicles, boots, livestock, or wild animals. Many riparian areas are in canyons, which may include owl habitat. It is unlikely that Mexican spotted owls would come in contact with herbicides from direct application or from brushing against freshly sprayed vegetation because owls are nocturnal, and spraying would be completed during the day.

Owl prey, primarily rodents, tend to be nocturnal so they are also unlikely to be directly sprayed. Therefore, it is unlikely that owls would ingest herbicides when capturing prey where treatments have occurred. Mechanical treatments may provide some temporary noise disturbances; however, this would also be conducted during the day and would not affect the nocturnal owls. Owls near travel corridors are likely accustomed to noise impacts from vehicles and livestock and would not be disturbed by treatment noise. Also, mechanical, prescribed fire, and low and high aerial and mechanized chemical spraying require a ¼ mile (0.4 km) buffer from the protected activity center (PAC) during the breeding season, and manual or spot chemical treatments require an 80 ft (24 m) buffer from PAC. A PAC is approximately 600 acres (243 ha) around an owl activity center (nest, roost, or best roost habitat) (USFWS 2012). Along road and utility rights-of-way applicators will make sure that pesticide drift does not occur beyond the right-of-way. The herbicides that are chosen for use within Mexican spotted owl PACs are those with low ecotoxicity rating and with no eye irritation to predatory birds.

One of the concerns in the Mexican spotted owl Recovery Plan is the risk of wildfire to owl habitat. Noxious weed treated under the IWMP include species, such as tamarisk, that increase the risk of wildfire that could spread into owl habitat. Treating these noxious weed species would comply with the goals in the Recovery Plan and improve owl habitat. Also, treating weed species would allow native plants to recolonize, creating more favorable habitat for owl prey species.

There are no anticipated cumulative or synergistic impacts that would occur with this project. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan may affect, but is not likely to adversely affect the Mexican spotted owl.

Western yellow-billed Cuckoo *(Coccyzus americanus)*

Endangered Species Act Status: Threatened, 2014
Navajo Nation Endangered Species List: Group 2
Recovery Plan: No
Critical Habitat: Proposed Rule, 2020

Species Account

Western yellow-billed cuckoo nests occur in thick undergrowth or in trees, typically 4 to 8 feet above ground. Cuckoos rarely nest at sites less than 50 ac (20 ha) in size, and sites less than 37 ac (15 ha) are considered unsuitable habitat (Laymon and Halterman 1989). The optimal size of habitat patches for the species are generally greater than 200 ac (81 ha) in extent and have dense canopy closure and high foliage volume of willows (*Salix* sp.) and cottonwoods (*Populus* sp.) (Laymon and Halterman 1989) and thus provide adequate space for foraging and nesting.

Tamarisk (*Tamarix* sp.) is a component of cuckoo habitat in Arizona and New Mexico. As the proportion of tamarisk increases, the suitability of the habitat for the cuckoo decreases. Sites with a monoculture of tamarisk are unsuitable habitat for the species. Sites with strips of habitat less than 325 ft (100 m) in width are rarely occupied, which indicates that edge effects in addition to overall patch size influence cuckoo habitat selection for nesting. During movements between nesting attempts cuckoos are found at riparian sites with small groves or strips of trees, sometimes less than 10 ac (4 ha) in extent (Laymon and Halterman 1989).

Cuckoos usually gleans prey items from foliage or branches, sometimes while hovering, or sallying from a perch to capture prey on the wing (Ehrlich et al. 1992). Food items primarily consist of cicadas, katydids, caterpillars, tree frogs and lizards.

Habitat Status

The USFWS (2014) considers the yellow billed cuckoos in the western United States as a distinct population segment (DPS). Western yellow-billed cuckoo is a late neo-tropical migrant and summer resident in the Western United States and winters in South America. Habitat condition and food resources are variable within years which cause cuckoos to move between areas to take advantage of these resources. Cuckoos breed from June to August, with the peak of breeding occurring in mid-July to early August. They require large tracts of willow-cottonwood or mesquite forest or woodland for nesting season habitat. They prefer dense vegetation, which creates a humid environment. The moist conditions support riparian plant communities that provide cuckoo habitat typically and exist in lower elevation, broad floodplains, where rivers and streams enter impoundments. The species does not use narrow, steep walled canyons.

Critical Habitat

USFWS proposed to revise the western distinct population segment of the yellow billed cuckoo critical habitat to approximately 493,665 acres in Arizona, California, Colorado, Idaho, New Mexico, Texas, and Utah in 2020 (85 FR 11458). Critical habitat units within the geographical

area occupied by the yellow-billed cuckoo were proposed based on areas that have breeding or suspected breeding because they contain the physical or biological features essential to the conservation of the species. A breeding area was considered occupied by cuckoos if (85 FR 11458):

- Cuckoos were present in the area on one or more days between June 1 and September 30 in at least two years between 1998 and 2014; and
- If cuckoos were confirmed to be a pair and nesting (or evidence of nesting behavior) was observed in at least one year between 1998 and 2014 regardless of the time of year.

Some exceptions occurred for Arizona if there were only two cuckoo records from different years, one of which was in September, and no pairs were detected. Also, areas in the Southwest were not considered to be breeding areas if cuckoos that were previously detected were absent in all subsequent visits during the same breeding season (85 FR 11458). Once breeding areas were determined, critical habitat also included suitable habitat surrounding the breeding area until a vegetation break of 0.25 mi (0.62 km) and upland areas used for foraging. The San Juan River Units (Unit 46 and Unit 67) that occur on the Navajo Nation were removed from the new proposed critical habitat designation, therefore no critical habitat exists on the Navajo Nation.

Existing Environment

In Arizona cuckoos were historically widespread and locally common (Phillips et al. 1964 and Groschupf 1987). However, the cuckoo populations in Arizona have declined by 70 to 80 percent over the past 30 years (Halterman et al. 2016). On the Navajo Nation, Western yellow-billed cuckoos are known only to breed from several sections on the San Juan River (NNHP 2020). It is estimated that limited suitable habitat on the San Juan River could support no more than 15 pairs. Potential for breeding may also occur along the Little Colorado and Colorado rivers, within Canyon de Chelly, Chinle Valley, and other canyons or streams with appropriate habitat (NNHP 2020).

Effects Analysis

There is little potential for yellow-billed cuckoo to be directly impacted by noxious weed removal. While weed treatments are proposed for the San Juan River, this area does not occur in critical habitat. Implementation of the species conservation measures, including buffer distances from known nesting sites discussed above would reduce potential impacts on the population. If project activities are planned in potential habitat, impacts are expected to be short-term and minor, because follow up native vegetation planting will replace lower-quality noxious weed infested habitat with native riparian vegetation. Furthermore, noxious weed removal activities would be completed entirely outside the breeding season, reducing the potential impacts for this species.

Yellow-billed cuckoos typically have a large home range that they use for foraging and nesting. No treatments will occur within the breeding patch. If an individual leaves the breeding patch to

forage, the ¼ mile (0.4 km) buffer will prevent yellow-billed cuckoos from coming into contact with herbicides or other mechanical disturbances. Manual treatments will be allowed up to the breeding patch boundary or suitable habitat, which may cause disturbance to the foraging cuckoos from the administering personnel. However, manual treatments are low-impact and will not use herbicides or mechanical tools. It is unlikely that yellow-billed cuckoos will ingest herbicide contaminated insects, or come into direct contact with herbicides, because the buffers will prevent the likelihood of this contact.

The conversion of native habitat into noxious weed dominated habitat is a major threat to yellow-billed cuckoos. Tamarisk, the dominant noxious weed in southwestern riparian corridors, is wide-spread in yellow-billed cuckoo habitat. Tamarisk dominated habitat does not provide essential food resources and adequate thermal cover for the yellow-billed cuckoo. Focusing on tamarisk removal efforts, and re-planting with native species, such as cottonwood and willow, would ultimately result in long-term beneficial impacts for yellow-billed cuckoo by potentially increasing the likelihood of residency and/or nesting in the project area. There are no synergistic or cumulative impacts anticipated. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan may affect, but is not likely to adversely affect the Western yellow-billed cuckoo.

5.1.2 Invertebrates

Kanab ambersnail (*Oxyloma haydeni kanabense)*

Endangered Species Act Status: Endangered, 1992
Navajo Nation Endangered Species List: Group 4
Recovery Plan: Final, 1995
Critical Habitat: Proposed Rule, 1991

Species Account

The Kanab ambersnail, *Oxvloma haydeni kanabensis*, is a rare endemic snail restricted to permanently wet areas within small wetlands of the Colorado Plateau. The Three Lakes site contains a series of spring-fed ponds and wet meadows, at the base of sandstone cliffs in the Kanab Creek drainage (USFWS 1995). At this site, Kanab ambersnails occupy wet meadow and marsh habitat that surrounds the Three Lakes ponds (USFWS 1995). Cattail (*Typha domingensis*), marshes, and sedge (*Juncus* spp.) meadows dominate the Three Lakes habitat. In contrast, the Vasey's Paradise site consists of a cool dolomitic spring that flows directly from Redwall limestone (USFWS 1995; Stevens et al. 1997). Large patches of mixed vegetation composed primarily of native crimson monkeyflower (*Mimulus cardinalis*), nonnative watercress (*Nasturtium officinale*), and native water sedge (*Carex aquatilus*) characterize Vasey's Paradise habitat (Stevens et al. 1997). Within this habitat, Kanab ambersnails often inhabit the dead and decaying monkeyflower litter and live watercress stems and leaves.

Kanab ambersnails live up to 15 months (Stevens et al. 1997). Peak reproduction occurs in mid-summer (Stevens et al. 1997; Nelson 2001). Kanab ambersnails lay eggs on the undersides of

host plant stems and leaves, or in moist soil (Nelson 2001). They begin winter dormancy in October and emerge from dormancy in March (Stevens et al. 1997). During winter dormancy, the snails attach the aperture of their shells to a firm substrate such as host plant stems and leaves, rocks, sticks, or bark. Kanab ambersnail mortality rates are 25-80% during dormancy (Stevens et al. 1997; IKAMT 1998).

The Kanab ambersnail, *Oxvloma haydeni kanabensis*, is proposed for removal from the Federal List of Endangered and Threatened species based on scientific evidence that it is not a valid subspecies (50 CFR Part 17). One study found that gene flow occurred among 12 populations of ambersnails, indicating that the Kanab ambersnail is not a valid subspecies (Culver et al. 2013). USFWS needs to confirm genetic sampling prior to approving the delisting of this species, therefore the Kanab ambersnail is included in this analysis.

Habitat Status

The species is known to exist in three populations, including one in southern Utah near Three Lakes and one in Grand Canyon (Vasey's Paradise). In 1998, Arizona Game and Fish Department translocated Kanab ambersnails from Vasey's Paradise to upper Elves Canyon, which is now considered a viable population. Kanab ambersnails occur in marshes and wetlands created from springs and seeps at the base of sandstone or limestone cliffs of the Colorado Plateau (Clarke 1991). With limited distribution this species is threatened by habitat destruction, decline, and disturbance including trampling by tourists, drying up due to climate change, and managed floods that decrease habitat along the Colorado River.

Critical Habitat

Proposed critical habitat for the Kanab ambersnail includes the site containing the Three Lakes Canyon population, located approximately 6 miles north northwest of Kanab, Utah, in the wet meadows and marshes surrounding the "Three Lakes". This habitat is watered by seeps from the adjacent sandstone cliffs. This area comprises an area of up to 12 hectares (29 acres), including the "Three Lakes" ponds (USFWS 1991, 50 CFR Part 17).

Existing Environment

Currently, Kanab ambersnails occur at three locations, including: one in southern Utah (Three Lakes) and two in Grand Canyon National Park, Arizona (Vasey's Paradise and Upper Elves Canyon). Kanab ambersnails have not been detected on the Navajo Nation. Potential for the species is likely restricted to the western Navajo Nation, including tributaries of the Colorado and Little Colorado Rivers, springs on Echo Cliffs, and creeks north and west of Navajo Mountain (NNHP 2008).

Effects Analysis

No known populations of Kanab ambersnail occur on the Navajo Nation. If Kanab ambersnails are detected on the Navajo Nation, no aquatic weed treatments are proposed under the IWMP; therefore, there will be no direct effect on the population. If surveys detect this species, the species conservation measures outlined above for potential habitat of the species will remove the

potential for indirect effects. Also, the appropriate buffers and weather-related restrictions on terrestrial applications, will remove all potential for impacts from the project design. No synergistic or cumulative impacts are anticipated to occur. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan will not affect the Kanab ambersnail.

5.1.3 Fish

Colorado Pikeminnow *(Ptychocheilus lucius)*

Endangered Species Act Status: Endangered, 1973 and Experimental Population, Non-Essential, 1985
Navajo Nation Endangered Species List: Group 2
Recovery Plan: Final, 1978, Recovery Goals 2002
Critical Habitat: Final, 1994

Species Account

Colorado pikeminnow spawn over clean cobbles and rubble in relatively swift waters. Preferred temperatures for embryo development, juvenile growth, and adult spawning are from 20.0-26.0°C (68.0-78.8°F) (Berry 1988). Juveniles utilize slackwater, backwater, and side channel areas with low or no current velocity and silt/sand substrates. Larger individuals, greater than 200mm (7.9 in.) occur in turbid, deep, and strongly flowing waters (Sublette et al. 1990). Adults use backwaters and flooded riparian areas during spring runoff and migrate large distances (15-64 km) in the San Juan River to spawn in riffle-run areas with cobble/gravel substrates.

Young pikeminnow eat crustaceans and aquatic fly (Diptera) larvae. Aquatic and terrestrial insects make up most of the diet as fish exceed 50 mm (1.97 in.). Fishes predominate in the diets of squawfish larger than 100 mm (3.9 in.) (Minckley 1973). Condition of young fish entering winter periods may have a role in determining their overwinter survival. Low fat stores and poor condition may result in low overwinter survival of age-0 squawfish (Thompson et al. 1991).

Habitat Status

The Colorado pikeminnow was first listed as endangered following a period of dam construction throughout the Colorado River Basin. Total Colorado pikeminnow habitat lost to reservoir inundation in the upper basin is about 435 miles, including Flaming Gorge on the Green River (99 miles), Lake Powell (199 miles on the Colorado River and 75 miles on the San Juan River), and Navajo Reservoir on the San Juan River (62 miles) (USFWS 2011a). Cold-water releases have eliminated most native fishes from river reaches immediately downstream of dams. This species has been extirpated from the lower basin states, including Arizona, California, Nevada and New Mexico.

Streamflow regulation and associated habitat modification are identified as the primary threats to Colorado pikeminnow populations. Dams have blocked migration routes (Tyus 1991) and cold-water temperatures affect embryonic development and survival. Recommended flow on the

upper basin reaches has been implemented to promote adequate spawning habitat and appropriate spawning ques, adequate nursery habitat, and adequate juvenile and adult habitat. Other factors that may affect the continued survival and success of reintroduced populations of pikeminnow include interactions with non-native fishes, including channel catfish, smallmouth bass, and flathead catfish (AGFD 2002).

Critical Habitat

Critical habitat for Colorado pikeminnow includes six reaches of the Colorado River System. These reaches total 1,848 km (1,148 mi) as measured along the center line of each reach to the 100-year floodplain. This represents about 29 percent of the historical habitat of this species. Critical habitat is designated in portions of the Colorado, Green, Yampa, White, and San Juan Rivers in the Upper Basin. In the San Juan River Subbasin critical habitat includes 290km (180 mi) from State Route 371 Bridge at Farmington to Neshahai Canyon in the San Juan arm of Lake Powell (59 FR 13374).

Existing Environment

The Navajo Nation is located in the San Juan sub-basin where the Colorado pikeminnow is known to occur as a wild population. It has been documented throughout the San Juan River, from Shiprock to Lake Powell; the mouth of the Mancos River is used during the spring runoff period. Only 17 wild adults were captured in the San Juan River between 1991 and 1995 and estimated at fewer than 20 individuals by 2001. Colorado pikeminnow are stocked in the San Juan to meet the delisting requirements in the San Juan River. During 2004-2008, about 983 stocked pikeminnow were recaptured from the San Juan River (Ryden 2009). In 2014, 496 individuals were captured, however 98% were stocked without pit tags (typically at age 0) (Durst 2015). In 2018, approximately 180 adults were estimated in the San Juan River subbasin (USFWS 2020).

On the Navajo Nation, many adults use the stretch from 11 km downstream of Shiprock (RM142) to just downstream of Four Corners (RM117), and spawn in 'The Mixer Area' (RM131-132); young-of-year have primarily been found within the lower 26 km of the San Juan River, just upstream from Lake Powell (NNHP 2008).

Effects Analysis

Colorado pikeminnow will not be directly impacted since the IWMP treats only terrestrial weed species. Indirect impacts to pikeminnow include increased turbidity during mechanical treatments using heavy machinery and prescribed burning within the riparian areas adjacent to their habitat. These effects would be reduced when implementing erosion control mitigation measures, including erosion control measures to stabilize and limit erosion along bank lines in riparian areas. Also, the San Juan River has naturally high turbidity of 10 Nephelometric Turbidity Unit (NTU) due to high sediment loads from tributaries in Arizona and New Mexico during thunderstorms in April – June and the highly erodible geology (USBR 2002). Additional impacts from turbidity caused by mechanical impacts would be minimal and temporary. Pile

burning and prescribed fire would require a site-specific burn plan and would be conducted 300ft outside of the floodplain. Also, long term measures include planting native vegetation to stabilize soils and prevent noxious weed re-growth after weed treatments.

Another indirect effect may occur from herbicide overspray. However, only herbicides that are practically non-toxic to fish species will be used within the riparian zone. Only aquatic formulations of 2,4-D, glyphosate, triclopyr and imazapyr will be used exclusively within 25 feet of the daily high-water mark. Herbicides that are practically non-toxic to fish and mollusks (White 2007) require a 25 feet (8 m) buffer from the daily high-water mark, including: aminopyralid, chlorsulfuron methyl, clopyralid, diflufenzopyr, imazapic, and thifensulfuron-methyl. These herbicides have shown no risk to fish even if there is an accidental direct spray or spill to the aquatic habitat (BLM 2007). Non-aquatic and moderate to high aquatic toxicity herbicides (White 2007) require a 300 feet (90 m) buffer from the daily high-water mark. Only aquatic approved herbicides will be used for aerial applications by either fixed wing or rotary aircraft in riparian areas. All herbicide applications will follow required protection measures. Implementing these features will minimize herbicide exposure to such small levels that the effect would be immeasurable to the species or its habitat. The long-term benefits to habitat and critical habitat floodplain areas and its riparian vegetation include improved function, reduced erosion, and an improved invertebrate foodbase due to the return of the native riparian vegetation.

Aquatic treatments are not proposed under this plan, and, therefore, no synergistic effects or cumulative impacts are anticipated by the proposed treatments. Cumulative impacts may occur if there is an indirect effect of herbicide overspray by adding additional chemicals to the San Juan River. This is unlikely to have a major impact, since only aquatic approved herbicides will be used within 25 ft of the daily high-water mark. Organochlorine pesticides are found in low concentrations from agriculture along the San Juan River; however, they are not in significant enough concentrations to affect fish and wildlife (USGS 1998). Elevated contaminants shown to affect fish reproduction and overall health and detected in the San Juan River include aluminum, arsenic, copper, selenium, zinc and polynuclear aromatic hydrocarbons (PAH) (SJRIP 1999). Aluminum is associated with the sediment geology and increases with higher flows. Selenium is naturally occurring in alkaline soils and outcrops of selenium bearing rocks of Cretaceous marine origin; however, levels tend to be higher near irrigated farmlands, uranium mining, and oil refineries (USBR 2002). PAH occurs naturally and are byproducts from combustion engines, coal fired generation plants and forest and agricultural fires (USBR 2002). Zinc occurs from mine tailing in the Upper Animas River (USBR 2002). Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan will not affect Colorado pikeminnow.

Humpback Chub *(Gila cypha)*

Endangered Species Act Status: Endangered, 1973
Navajo Nation Endangered Species List: Group 2
Recovery Plan: Final, 1978, Recovery Goals 2002

Critical Habitat: Final, 1994

Species Account

Populations of humpback chub are restricted to deep, swift, canyon-bound regions of the mainstem and large tributaries of the Colorado River Basin. Adults require eddies and sheltered shoreline habitats maintained by high spring flows. These high spring flows maintain channel and habitat diversity, flush sediments from spawning areas, rejuvenate food production, and form gravel and cobble deposits used for spawning. Spawning occurs on the descending limb of the spring hydrograph at water temperatures typically between 16 and 22°C (USFWS 2002b). Young require low-velocity shoreline habitats, including eddies and backwaters, that are more prevalent under base-flow conditions.

Habitat Status

This species originally declined due to habitat changes caused by dam impoundments and the competition with and predation by introduced fish. Dams created population fragmentation, which restricted gene flow between isolated populations. Dams also altered flows and created clear and cold-water conditions (USFWS 1990). Other threats to this species include parasitism, hybridization with other *Gila* spp., and pesticides and pollutants (USFWS 2002b).

Critical Habitat

The USFWS designated seven reaches of the Colorado River system as critical habitat for humpback chub. These reaches total 610 km (380 mi) as measured along the centerline of the subject reaches. This represents approximately 28 percent of the historic habitat of the species. Critical habitat for the humpback chub is designated for portions of the Colorado, Green, and Yampa Rivers in the Upper Basin and the Colorado and Little Colorado Rivers in the Lower Basin. Critical habitat occurring on or adjacent to the Navajo Nation includes the Colorado River and Little Colorado River in Grand Canyon National Park.

Existing Environment

The Grand Canyon population has had a stable core of 11,500-12,000 adults in the Little Colorado River since 2008 (USFWS 2018). In addition to this core population, there are approximately 250 adults, several hundred juveniles and sub-adults distributed throughout the mainstem Colorado River, indicating reproduction (USFWS 2018). Finally, translocation efforts in the Little Colorado River and Havasu Creek expanded the range of the species to new habitats. In the lower basin, Humpback chub have high quality habitat, connectivity to mainstem habitats, and high genetic diversity. The key factors controlling this population are river flow, water temperature, food supply, and predation/competition. No humpback chub populations are known to occur on the Navajo Nation.

Effects Analysis

The IWMP will not result in direct impacts to humpback chub since it does not propose any treatments for aquatic weed species. Indirect impacts to chub include increased turbidity during mechanical treatments and prescribed fire in the riparian areas upstream of their habitat on the

Little Colorado River. Additional impacts from turbidity caused by mechanical impacts will be minimal and temporary. Pile burning and prescribed fire will require a site-specific burn plan and will be conducted 300 ft outside of the floodplain. The mitigation measures within riparian areas require erosion control measures to stabilize and limit erosion along bank lines. The Colorado and Little Colorado Rivers receive high sediment inputs following precipitation events, which is much greater than the estimated inputs from mechanical treatments. Also, this species evolved in high turbidity waters and will not likely be impacted by an increase in turbidity. Finally, long-term measures include planting native vegetation to stabilize soils and prevent noxious weed re-growth after weed treatments occur.

Another indirect effect to humpback chub may occur from herbicide contamination from upstream treatments. However, only herbicides that are practically non-toxic to fish will be used within the riparian zone. Many of these herbicides will degrade as they moved downstream. Only aquatic formulations of 2,4-D, glyphosate, triclopyr and imazapyr will exclusively be used within 25 feet of the daily high-water mark. Herbicides that are practically non-toxic to fish and mollusks (White 2007) require a 25 feet (8 m) buffer from the daily high-water mark, including: aminopyralid, chlorsulfuron methyl, clopyralid, diflufenzopyr, imazapic, and thifensulfuron-methyl. Chlorsulfuron, imazapic, imazapyr, and herbicides have shown no risk to fish even if there is an accidental direct spray or spill to the aquatic habitat (BLM 2007). Non-aquatic approved and moderate to high aquatic toxicity herbicides (White 2007) require a 300 feet (90 m) buffer from the daily high-water mark. Only aquatic approved herbicides will be used for aerial applications by either fixed wing or rotary aircraft in riparian areas. All herbicide applications will follow required protection measures. Implementing these features will minimize herbicide exposure to such small levels that the effects would be immeasurable to the species or its habitat. The long-term benefits to habitat and critical habitat floodplain areas and its riparian vegetation include improved function, reduced erosion, and an improved invertebrate foodbase due to the return of the native riparian vegetation.

Treatment of aquatic weeds are not proposed under this plan, and, therefore, no synergistic effects or cumulative impacts are anticipated by the proposed treatments. No cumulative impacts will occur to water quality from indirect impacts of mechanical and chemical treatments. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan will not affect the humpback chub.

Razorback Sucker *(Xyrauchen texanus)*

Endangered Species Act Status: Endangered, 1991
Navajo Nation Endangered Species List: Group 2
Recovery Plan: Final, 1998, Recovery Goals 2002
Critical Habitat: Final, 1994

Species Account

Razorback suckers are most common in low-velocity habitats such as backwaters, floodplains, flatwater river reaches, and reservoirs. Spring migrations of adult razorback sucker were associated with spawning in historic accounts, and a variety of local and long-distance movements and habitat-use patterns have been documented. The species is tolerant of wide-ranging temperatures, high turbidity and salinity, low dissolved oxygen, and flow conditions. Cobble or rocky substrate is preferred for spawning, but they have successfully spawned over clay beds at a wide range of water temperatures (typically greater than 14°C) (USFWS 2002c, 2018). Spawning also occurs in reservoirs over rocky shoals and shorelines. Young require nursery environments with quiet, warm, shallow water such as tributary mouths, backwaters, or inundated floodplain habitats in rivers, and coves or shorelines in reservoirs. Irrigation canals and ponds connected to the San Juan River may be potential habitat.

Habitat Status

The species is endemic to the Colorado River Basin of the southwestern United States. Decline of this species coincided with dam construction and non-native fish introductions that left only small, fragmented populations. These and other threats continue to impact the species, including water diversions, degraded water quality, and habitat modification (USFWS 2002c). Although razorback sucker are long-lived species (40+ years), persistent recruitment failure has depleted and extirpated numerous populations (USFWS 2002c). Current risks to this species include climate change, hybridization, reductions in diversity, habitat changes, and predation and competition from nonnative and invasive fish species. Overutilization, parasites, diseases, and pollutants were considered but considered least impactful risks.

Critical Habitat

The USFWS designated 15 reaches of the Colorado River system as critical habitat for the razorback sucker. These reaches total 2,776 km (1,724 mi) as measured along the centerline of the river within the subject reaches. This represents approximately 49 percent of the historical habitat for the species. In the Upper Basin, critical habitat is designated for portions of the Green, Yampa, Duchesne, Colorado, White, Gunnison, and San Juan Rivers. Portions of the Colorado, Gila, Salt, and Verde Rivers are designated in the Lower Basin. Critical habitat occurring on or adjacent to the Navajo Nation includes the San Juan River.

Existing Environment

Historically, razorback suckers were widely distributed in warm water reaches of larger rivers of the Colorado River Basin from Mexico to Wyoming. Currently, razorback suckers are found in the Green River, Upper Colorado River, and San Juan subbasins (Upper Colorado River Basin Recovery Unit) (USFWS 2002c). The Navajo Nation is included in the Upper Colorado River Basin Recovery Unit within the San Juan subbasin. Wild razorback suckers were extirpated from the San Juan River; however, the San Juan River Basin Recovery Implementation Basin stocks 11,400 razorback sucker annually (Bestgen et al. 2009, USFWS 2018a). Since stocking has occurred, a small percentage of razorback sucker spawning has been documented throughout the

San Juan River. Additionally, juvenile recruitment has rarely been documented, and without stocking, this population would eventually become extinct. There is an abundant wild population of razorback sucker in Lake Powell, but a waterfall provides a barrier for the fish moving upstream into the San Juan River.

The Navajo Nation operates the NAPI (Navajo Agricultural Products Industry) rearing ponds to rear razorback suckers for augmentation and recovery efforts in the San Juan River basin (Cheek 2014). The fish reared in the NAPI ponds accounted for 40.6% of the 15,362 razorback suckers stocked by the San Juan River Basin Recovery Implementation Program in 2013. NAPI pond raised fish were introduced to the San Juan River at Bloomfield, Hatch Trading Post, PNM Fish Passage, Montezuma Creek, UT, Berg Park, and Animas River Park.

Effects Analysis

The IWMP will not result in direct impacts to razorback sucker since it does not include treatment for aquatic weed species. Indirect impacts to razorback suckers include increased turbidity during mechanical treatments using heavy machinery and prescribed fire in the riparian areas adjacent to their habitat. Razorback suckers show to have a high tolerance for a variety of turbidity levels; however, this may impact spawning habitat as sediment settles on the cobble substrate. Razorback suckers have shown to clean sediment off cobbles to spawn (USFWS 2018a). Turbidity impacts from mechanical treatments will be minimal, temporary, and almost eliminated from implementing erosion control mitigation measures. The mitigation measures within riparian areas require erosion control measures to stabilize and limit erosion along bank lines. Also, long term measures include planting native vegetation to stabilize soils and prevent noxious weed re-growth after weed treatments occur along the San Juan. Pile burning and prescribed burns will require a site-specific burn plan and will be conducted 300ft outside of the floodplain.

Another indirect effect may occur from herbicide overspray. Only herbicides that have been determined to be practically non-toxic to fish species will be used within the riparian zone. Aquatic formulations of 2,4-D, glyphosate, triclopyr and imazapyr will exclusively be used within 25 feet of the daily high-water mark. Only aquatic approved herbicides will be used for aerial applications by either fixed wing or rotary aircraft within riparian areas. All herbicide applications will follow required protection measures. Implementing these features will minimize herbicide exposure to such small levels that the effect would be minimal to the species or its habitat. The long-term benefits to habitat and critical habitat floodplain areas and its riparian vegetation include improved function, reduced erosion, and an improved invertebrate foodbase due to the return of the native riparian vegetation.

Treatment of aquatic weeds is not proposed under this plan, and, therefore, no synergistic effects or cumulative impacts are anticipated by the proposed treatments. Cumulative impacts may occur if there is an indirect effect of herbicide overspray by adding additional chemicals to the San Juan River. The Species Status Report prepared by USFWS (2018a) determined that

pollutants were considered a least impactful risk. Spot treatments of Dichlobenil were used in the NAPI rearing ponds to control vegetation and to prevent disease outbreak in razorback suckers (Cheek 2014). This exposure to chemical from the rearing ponds may cumulatively impact razorback if they experience herbicide over spray when introduced into the San Juan River. However, this is a minor impact, since only aquatic approved herbicides will be used within 25 ft of the daily high-water mark. Organochlorine pesticides are found in low concentrations from agriculture along the San Juan River; however, are not significant enough to affect fish and wildlife (USGS 1998).

Elevated contaminants that have been shown to affect fish reproduction and overall health and are detected in the San Juan River include aluminum, arsenic, copper, selenium, zinc and polynuclear aromatic hydrocarbons (PAH) (SJRIP 1999). Contaminant levels are within the range that is least likely to affect fish and wildlife. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan will not affect the razorback sucker.

Zuni Bluehead Sucker *(Catostomus discobolus yarrowi)*

Endangered Species Act Status: Endangered, 2014
Navajo Nation Endangered Species List: Group 2
Recovery Plan: None
Critical Habitat: Final Rule, 2016

Species Account

The Zuni bluehead sucker typically inhabit small desert stream systems including isolated headwater springs with clean, hard substrate, hard substrate, flowing water, and abundant riparian vegetation (Carman 2008, Gilbert and Carman 2011). Zuni bluehead suckers occupy habitat with abundant shade in pools, runs and riffles with water velocities ranging from 0-0.35 m/sec (1.15 ft/sec) or less and ranging in depth from 0.2 – 2.0 m (8-79 in) (Hanson 1980, Propst and Hobbes 1996, Gilbert and Carmon 2011). Water temperatures in sucker habitat vary from -2-23°C (Gilbert and Carmen 2011). The Zuni bluehead sucker is a benthic forager (eating food from the stream bottom) that scrapes algae, insects, and other organic and inorganic material from the surface of rocks (USFWS 2014b). Zuni bluehead sucker spawn from early April to early June when water temperatures are 6 to 15°C (43 to 59°F) peaking around 10°C (50°F) (Propst 1999, Propst et al. 2001). They require clean gravel substrate with minimal silt for spawning because silt covers eggs and leads to suffocation and decreased prey (Maddux and Kepner 1988).

Habitat Status

Zuni bluehead suckers were greatly reduced in the Zuni River watershed due to 27 chemical treatments during the 1960's to remove green sunfish and fathead minnow from the Rio to establish a rainbow trout sport fishery in reservoirs on the Zuni pueblo (Winter 1979). This eliminated the sucker from most of the Zuni River watershed. The current threats to the Zuni

bluehead sucker include water withdrawal, sedimentation, impoundments, development, non-native species, wildfire, and climate change (USFWS 2014). Overgrazing has created unstable bank line conditions and has increased sedimentation into the streams on the Navajo Nation (Selby and Kitcheyan 2020). Saltcedar and Russian olive were identified as a threat to this species because of the tendency to invade riparian habitats and dry out perennially flowing streams and their removal is a priority management action (NNDFW 2020). Genetic information determined that the bluehead suckers detected in the lower San Juan River were bluehead suckers and not Zuni bluehead suckers (USFWS 2014b) and were removed from the final listing rule.

Critical Habitat

Zuni bluehead sucker critical habitat encompasses 55.7 km (34.6 mi) in the Zuni River Watershed, including Agua Remora, Rio Nutria, Tampico Draw, and Tampico Spring in McKinley, and Cibola Counties, New Mexico (50 CFR 17). Critical habitat includes adjacent floodplains within 91.4 lateral m (300 lateral ft) on either side of bankfull discharge, except in areas bound by canyon walls. A few populations of Zuni bluehead sucker exists in perennial streams of the Defiance Plateau (Kin Li Chee Creek, Black Soil Wash, and Scattered Willow Wash) on the Navajo Nation (Selby and Kitcheyan 2020); however, this habitat is not federally designated critical habitat.

Navajo Nation Fisheries Management Plan

Navajo Nation manages Zuni bluehead sucker populations on their lands, with management criteria outlined in the Navajo Nation Fisheries Management Plan (2020a) which was developed as a joint effort between the NNDFW and BIA. One objective outlined in the plan is to identify and protect existing Zuni bluehead sucker populations and their habitats. This objective includes the specific tasks of monitoring populations, re-establish Zuni bluehead suckers in reclaimed streams, reduce or eliminate nonnative fishes or crayfish, cattle exclosures, restore habitat conditions, construction of nonnative fish barriers, identify facilities or refugium sites to maintain isolated populations, develop and implement fire and drought contingency plans, and participate in the Zuni bluehead sucker Recovery Team (Selby and Kitcheyan 2020). The Kinlichee Creek Watershed within Navajo Nation is designated as a Highly Sensitive Area, which are the most protected habitats, but still allow minimal development.

Existing Environment

It is estimated that the present range of the Zuni bluehead sucker is 5% or less of its historic range (USFWS 2014). On the Navajo Nation, Zuni bluehead suckers are found in Kinlichee Creek, Black Soil Wash, and Scattered Willow Wash in the Defiance Plateau. In 2012, collections occurred in Black Soil Wash and Kinlichee Creek, with 664 and 92 Zuni bluehead suckers detected, respectively (Kitcheyan and Mata 2013). It is unlikely that the entirety of the Kinlichee Creek watershed is occupied because the streams are susceptible to drying during drought.

Effects Analysis

No direct impacts would affect Zuni bluehead sucker because no aquatic weed treatments are proposed under this plan. Zuni bluehead suckers are sensitive to increased sedimentation in their habitat and could receive indirect impacts from mechanical or prescribed burning treatments. Conservation measures and best management practices are required to minimize ground disturbance during noxious weed treatments. These impacts would be minimal and temporary. Pile burning and prescribed fire will require a site-specific burn plan and will be conducted 300 ft outside of the floodplain. Mitigation measures in riparian areas require erosion control measures to stabilize and limit erosion along bank lines. Also, long term measures include planting native vegetation to stabilize soils and prevent noxious weed re-growth after weed treatments occur. Target grazing is not proposed for areas where Zuni bluehead suckers occur, as overgrazing could destabilize banks and increase erosion.

Another indirect effect may occur from herbicide overspray. Only herbicides that have been determined to be practically non-toxic to fish species will be used within the riparian zone. Aquatic formulations of 2,4-D, glyphosate, triclopyr and imazapyr will exclusively be used within 25 feet of the daily high-water mark. Herbicides that are practically non-toxic to fish and mollusks (White 2007) require a 25 feet (8 m) buffer from the daily high-water mark, including: aminopyralid, chlorsulfuron methyl, clopyralid, diflufenzopyr, imazapic, and thifensulfuron-methyl. Chlorsulfuron, imazapic, imazapyr, and herbicides have shown no risk to fish even if there is an accidental direct spray or spill to the aquatic habitat (BLM 2007). No aerial spraying will occur in habitats with Zuni bluehead sucker. All herbicide applications will follow required protection measures. Implementing these features will minimize herbicide exposure to such small levels that the effect will be minimal to the species or its habitat. The long-term benefits to habitat and critical habitat floodplain areas and its riparian vegetation include improved function, reduced erosion, and an improved invertebrate foodbase due to the return of the native riparian vegetation.

There are no proposed aquatic treatments under this plan, and, therefore, no synergistic effects or cumulative impacts are anticipated by the proposed treatments. Cumulative impacts may occur if there is an indirect effect of increased sedimentation from mechanical treatments in areas where overgrazing has already destabilized bank lines. Destabilized bank lines provide increased erosion particularly during high water events. Conservation measures will be implemented to prevent increased erosion during treatments and will be maintained until native vegetation re-growth occurs. Noxious weed treatments will temporarily decrease vegetation at a site but will stabilize bank lines in the long-term from planting activities. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan may affect, but is not likely to adversely affect the Zuni bluehead sucker.

5.1.4 Plants

Brady Pincushion Cactus *(Pediocactus bradyi)*

Endangered Species Act Status: Proposed Endangered, 1979
Navajo Nation Endangered Species List: Group 2
Recovery Plan: Final 1985
Critical Habitat: None

Species Account

This cactus is restricted to habitat composed of Kaibab limestone chips overlaying soils derived from Moenkopi shale and sandstone. It is typically found on gently sloping benches and terraces with sparse vegetation from mid-March to late April. Populations are known from 1,170-1,368 m (3,861 – 4,488 ft.) in elevation (USFWS 1985b).

In the summer and winter months, Brady pincushion cactus spends most of its time below ground level covered by loose limestone fragments along the Marble Canyon plateaus of the Colorado River. The cacti typically respond to summer rainfall events by expanding above the soil (Heil et al. 1981). If the conditions are favorable the cacti will flower typically between March and April (Spence 2008). By May the cactus responds to drought conditions and rising temperatures by retracting into the soil.

Species reproduction is cross-pollinated and self-incompatible, meaning the pollen transferred between flowers on the same plant will not self-fertilize (Spence 1992 and Tepedino 2000). The cactus is insect-pollinated with sweat bees (*Dialictus spp.)* being the primary pollinators (Tepedino 2000).

Habitat Status

Brady pincushion cactus (*Pediocactus bradyi*) is a narrow endemic, occupying distinctive restricted habitats on the Colorado Plateau. It is known from a geographical area of about 70 km^2 (17,000 acres) in Coconino County, Arizona (USFWS 1985b). The species was first discovered in 1958, and since then, there has been a marked reduction in the number of plants due to collecting, off-road vehicles (OHV), uranium mining, and livestock grazing (USFWS 1985b). The current threats to Brady pincushion cactus, particularly on the Navajo Nation, include OHVs, livestock trampling and grazing, development of roads along with traffic associated with tourism, and herbivory (Roth 2004). Collection and uranium mining are a minor threat. An extensive evaluation of the extant population of this cactus has not occurred (USFWS 2011c). Additionally, two nonnative, annual grasses (*Bromus rubens* and *Schismus barbatus*) are abundant at Brady pincushion monitoring sites and along the Marble Canyon rim, but it is unknown if these species impact the cactus (Nora Talkington, Botanist, Navajo Natural Heritage Program, personal communication on March 10, 2021). Climate change may have a significant impact on this species in the future.

Existing Environment

The distribution of the species comprises an area approximately 23 km (15 mi) in length, north to south, and varies in width from 1.6 km (1 mi) to 4.58 km (3 mi). The range of Brady Pincushion cactus is limited to plateaus on both sides of the Colorado River along both rims of Marble Canyon. On the Navajo Nation, there are three populations of Brady's pincushion cactus, which are located on designated "Highly Sensitive" areas according to the Biological Resource Land Use Clearance Policies and Procedures (RCP).

The Navajo Nation Heritage Program (NNHP) has two demography monitoring plots for this species on the Navajo Nation (Jackass Canyon and Cave). In 2018, there were approximately 87 individuals detected at the Jackass site and 115 individuals at the Cave site. In a summary study of Brady pincushion cactus from 2009-2014, two sites at the Jackass Canyon site were monitored (campsite and ridgetop sites). This study showed that the campsite population was stable with 23 individuals detected in 2009 and 24 individuals detected in 2014. The ridgetop site showed significant declines in the population from 121 individuals recorded in 2009 to 84 individuals in 2014 (Hazelton 2015). Reproductive success of these species was highest during 2012 and 2013 (Hazelton 2015), and the ridgetop population had a high proportion of small size classes (<2 cm diameter) which indicated recent recruitment. There is almost no recruitment of cacti in the campsite plots, with only two individuals smaller than 2 cm detected throughout the 5 years of monitoring (Hazelton 2015).

Effects Analysis

Prior to weed treatments, surveys by a trained biologist will be conducted to identify the locations of Brady pincushion cactus within potential habitat in the project area. The 200 ft buffer from Brady pincushion cactus populations identified in the species conservation measures will be marked with flagging to prevent weed treatment field crews from entering the buffer zone.

There will be no direct effects to Brady pincushion cactus since weed treatments are not proposed to occur within 200 ft of the population. Indirect effects include herbicide drift from chemical treatments. The likelihood of herbicide drift is reduced by implementing the 200 ft buffer for chemical treatments. Also, herbicides will not be applied when wind speeds exceed 10 miles per hour, temperatures are greater than 80° F (26.7° C), and humidity is high. Other methods such as mechanical (including prescribed fire) and cultural treatments require a 200 ft buffer from Brady pincushion cactus populations. All vehicles used to access sites will follow established roadways and will be parked in previously disturbed sites.

Livestock can be a threat to Brady pincushion cactus from grazing and trampling effects. Livestock impacts are primarily a result of unmanaged grazing. Cultural treatments, which include targeted grazing with specific planning parameters and mitigations, are proposed for Community Development Areas and agricultural fields. If Brady pincushion cactus is present in

these locations, a fence would be established around the site to ensure the 200 ft buffer is enforced.

Cactus borer beetles can have negative impacts on Brady pincushion cactus (Roth 2008). No biological control agents are proposed to control cactus, and none of the proposed agents are in the same genus as the cactus borer beetle (*Moneilma)*. Therefore, the proposed biological controls will not have any impacts on this species.

Herbicide overspray and trampling during treatments may provide a cumulative impact combined with the known threats, including livestock grazing and trampling, and herbivory in Brady pincushion cactus habitat. Trampling and herbicide overspray will exacerbate the effects from the current threats to cactus populations due to the small size of the population. Management actions have been implemented in some areas where the cactus occurs to minimize the impacts of these threats, however some still occur. Herbicide overspray and trampling will be minimized by implementing the conservation measures and best management practices. These impacts are expected to synergistically affect the cactus population as the climate changes. Herbicide overspray and trampling combined with climate change will provide a synergistic effect and increase mortality and decrease plant vigor. Again, synergistic effects will be avoided or minimized by implementing the conservation measures and best management practices.

Even though noxious weeds have not been identified as a threat to this species, the removal of noxious weeds around Brady pincushion cactus habitat may benefit its population. This biological assessment does not cover treatments within 200 ft of Brady pincushion cactus. Removing dense root structures of some noxious weed species, especially grasses, will promote seed establishment and reduce the risk of catastrophic wildfire. Since the cactus is small and often grows underneath other bushes, the removal of noxious weeds will enhance pollination by making the plant more visible to insect pollinators. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan may affect, but is not likely to adversely affect the Brady pincushion cactus.

Fickeisen Plains Cactus *(Pediocactus peeblesianus ssp. fickeiseniae)*

Endangered Species Act Status: Endangered, 2013
Navajo Nation Endangered Species List: Group 3
Recovery Plan: None
Critical Habitat: 2016

Species Account

The Fickeisen plains cactus is a narrow endemic restricted to exposed layers of Kaibab limestone on the Colorado Plateau in Coconino and Mohave Counties of northern Arizona. Most populations occur on the margins of canyon rims, flat terraces, limestone benches, or on the toe of well-drained hills, typically with limestone chips scattered across the surface (NNHP 2008). Plants are found primarily on slopes of 0 to 5 percent but some also occur on slopes up to 20 percent at elevations between 1,280 to 1,814 m (4,200 to 5,950 ft) (ARPC 2001; USFS 2013b).

At maturity, the Fickeisen plains cactus are the size of a quarter making them difficult to locate even when their location is known. The lifespan of the Fickeisen plains cactus is estimated to be between 10 to 15 years (Phillips et al. 1982). It is a cold-adapted plant with contractile roots that enables the plant to retract into the soil during the winter (cold) and summer (dry) seasons, and during periods of drought (Phillips et al. 1982). When ambient air temperatures rise in the spring and adequate rainfall occurs, plants emerge from beneath the soil surface to flower in mid-April. Solitary bees from the genus *Agapostemon* pollinate Fickeisen plains cactus; however, a pollinator study showed that pollinator visitation rates are low indicating there may be a specialized pollinator with low density and diversity (USFWS 2020a).

Habitat Status

Fickeisen plains cactus is threatened by the current and ongoing modification and destruction of its habitat and range from livestock grazing, on-going drought, and warmer winters (USFWS 2013b). Small mammal predation is also an important threat to the species. Small population size likely exacerbates the effects of these threats on the Fickeisen plains cactus.

On the Navajo Nation, livestock impacts have been observed in the three largest populations, including Hellhole Bend, Salt Trail Canyon, and Blue Spring (Hazelton 2011a). Noxious weeds are a potential threat to this species by increasing fire frequency and intensity and competition. Off-road vehicle use may become a threat to the cactus. Dirt roads lead to most of the known populations on the Navajo Nation. While traffic is light, NNHP have documented damage to the cactus from trampling from car tires and foot traffic. (NNHP 1994). Commercial development and tourist activities are a threat to the cactus and may become a greater threat if commercial development is proposed to occur in one of the larger populations.

Critical Habitat

A total of 17,456 acres are designated critical habitat for Fickeisen plains cactus in six units including: Hurricane Cliffs, Sunshine Ridge, Clayhole Valley, South Canyon, House Rock Valley, and Gray Mountain in Coconino and Mohave Counties, Arizona (50 CR Part 17, FWS-R2-ES-2013-0025; 4500090023). The Navajo Nation is on the boundary of the Gray Mountain critical habitat subunit which is primarily comprised of a private ranch. Three individuals were found in this subunit by Navajo Natural Heritage Program.

No federally designated critical habitat for this species exists on the Navajo Nation. Fickeisen plains cactus is a Group 2 listed species by NNDFW, and Tribal laws protect species in Group 2. Title 17 § 507 of the Navajo Tribal Code makes it unlawful for any person to “take, possess, transport, export, process, sell or offer for sale or ship any species or subspecies” on the Navajo Endangered Species List. Navajo Nation Department of Fish and Wildlife works cooperatively with USFWS to conserve and protect this species on Navajo Nation lands (USFWS 2013c). To conserve this species, NNHP conducts regular surveys and maintains habitat quality database that includes status and occurrence of the Fickeisen plains cactus.

Existing Environment

The plant's known range covered 200 linear km (125 mi) of land, extending from Mainstreet Valley of the Arizona Strip to House Rock Valley; along the canyon rims of the Colorado River and Little Colorado River; the area of Gray Mountain; and along the canyon rims of Cataract Canyon on the Coconino Plateau (USFWS 2013b).

The current population on the Navajo Nation includes 1,572 individuals within 22 populations from surveys completed in 2019 (USFWS 2020a). This shows an increase in abundance from 2013, which may be due to different monitoring methodologies (USFWS 2020a). Some of the sites showed population declines. The Salt Trail Canyon showed a 58% reduction in individuals from 2006 to 2018, with between 0-6 seedlings per year indicating low recruitment (USFWS 2020a). The suspected cause of the decline was likely due to below average precipitation (Hazelton 2011a). At the Hellhole Bend site live plant populations increased by 20% from 2013 to 2018, but few individuals were comprised of seedlings indicating low and variable recruitment (USFWS 2020b).

Effects Analysis

There are significant population declines due to poor reproduction and little recruitment. Threats include habitat disturbance from livestock grazing, small mammal predation, and its small population size compounded by long-term drought. Noxious weeds were evaluated as a threat by the U.S. Fish and Wildlife Service in their final listing but were determined that while they are stressors on the landscape, they do not have enough evidence that noxious weeds negatively affect Fickeisen plains cactus (USFWS 2013b). If weed treatments do occur near Fickeisen plains cactus suitable habitat, the species conservation measures will require a 200 ft buffer from cactus and will be marked with flagging to prevent field crews from entering the buffer zone. Much of the suitable habitat on the Navajo Nation has not been surveyed for the cactus, therefore prior to weed treatments, surveys by a trained biologist will be conducted to determine if the species is present. The NNDFW will be notified immediately if the species is detected. There will be no direct effects to Fickeisen plains cactus because the conservation measures will be implemented.

Indirect effects include herbicide drift from chemical treatments. The likelihood of herbicide drift is reduced by implementing the 200 ft buffer for chemical treatments. Also, herbicides will not be applied when wind speeds exceed 10 miles per hour, temperatures are greater than 80° F (26.7° C), and humidity is high. Other methods such as mechanical (including prescribed fire) and cultural treatments require a 200 ft buffer from Fickeisen plains cactus populations. All vehicles used to access sites will follow established roadways and will park in previously disturbed sites.

Livestock can be a threat to Fickeisen plains cactus from grazing and trampling. Livestock threats are primarily a result of unmanaged grazing, which will not be considered cultural control under this action. Cultural treatments are proposed for Community Development Areas and

agricultural fields. If Fickeisen plains cactus is present in these locations, a fence will be established around the site to ensure the 200 ft buffer is enforced.

Cactus borer beetles in the genus *Moneilma* have only been observed to affect one individual of Fickeisen plains cactus in 1991 (USFWS 2013b). No biological control agents are proposed to control cactus, and none of the proposed agents are in the same genus as the cactus borer beetle. Therefore, the proposed biological controls will not have any impacts on this species.

The reproductive capacity for the Fickeisen plains cactus is considered naturally low (e.g., seed dormancy, low seed production, poor dispersal mechanisms, and slow growth) (USFWS 2013b). Therefore, introduced external factors that may place additional stress on the life history characteristics of these populations may further inhibit population growth. Herbicide overspray and trampling during treatments may provide a cumulative impact on the species when combined with current stressors of feral livestock trampling, tourism, small mammal consumption and OHV use due to low reproductive capacity and small population size. Herbicide overspray and trampling will be minimized by implementing the conservation measures and best management practices. These impacts would synergistically affect the cactus population as the climate changes. It is predicted this species would be highly impacted by climate change. Herbicide overspray and trampling combined with climate change will provide a synergistic effect and increase mortality and inhibit population growth. Again, synergistic effects will be avoided or minimized by implementing the conservation measures and best management practices.

Even though noxious weeds were not identified as a threat to this species, the removal of noxious weeds around Fickeisen plains cactus habitat may benefit its population. The proposed action does not cover treatments within 200 ft of Fickeisen plains cactus. However, by removing dense root structures of some noxious weed species in areas adjacent to Fickeisen plains cactus habitat, especially grasses, would promote seed establishment and reduce the risk of catastrophic wildfire. Since the cactus is small and often grows underneath other bushes, the removal of noxious weeds would enhance pollination by making the plant more visible to insect pollinators. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan will not affect the Fickeisen plains cactus.

Mancos Milk-vetch (*Astragalus humillimus*)

Endangered Species Act Status: Endangered, 1985
Navajo Nation Endangered Species List: Group 2
Recovery Plan: Final 1989
Critical Habitat: None

Species Account

Mancos milk-vetch flowers in late April and early May (USFWS 1989). Larger plants may produce over 100 flowers in a growing season and fruits mature by mid-June (USFWS 1989). In New Mexico, monitoring results revealed that it takes two growing seasons for seedlings to mature with flowering into the third or fourth year as compared to other species of *Astragalus*,

which typically take one growing season to bloom (NMSFD 2008). Mancos milk-vetch plants produce viable fruit by outcrossing and self-pollination (Tepedino 2002). This species often requires native bee pollination to produce seeds. Mancos milk-vetch germination and initial seeding survival are positively related to the death of older plants, which may be due to moisture and shade availability (NMSFD 2008). This may be due to increased precipitation events Mancos milk-vetch forms highly localized populations; occupied habitat ranges from 1.5 to 7.6 hectares in size, where plants can be concentrated in densities as high as 40 plants per square meter (Sivinski 2008).

Mancos milk-vetch typically occur on sandstone substrate ledges and mesa tops in cracks or shallow bowl-like depressions (tinajas) that accumulate sandy soils and rainfall (USFWS 1989; NMSFD 2008). Potential habitat corresponds to rimrock outcrops of the Point Lookout and Cliffhouse members of the Mesa Verde sandstone series with flat or gently sloping surfaces at an average elevation of 1,854 m (5,650 ft) (USFWS 1989). Overall cover is very low (<5%), and resource competition for these species is minimal (USFWS 1989).

Habitat Status

Mancos milk-vetch was listed as a federally endangered species due to narrow distribution and low tolerance for disturbance (USFWS 1985a). Mancos milk-vetch populations and their habitat have been negatively impacted by crushing from vehicles and equipment, direct removal and destruction from energy-related activities, and indirect effects from climate change and unauthorized traffic on roads constructed by oil and gas companies and transmission lines, OHVs. Current threats recorded in 2017 included livestock grazing, trampling, powerlines, invasive weeds, wood cutting, and oil and gas development (NNDFW 2019).

Existing Environment

Mancos milk-vetch is a narrow endemic known only from the Four Corners region of New Mexico, San Juan County, and adjacent Montezuma County, Colorado. Species distribution closely follows a narrow band of Mesozoic (Point Lookout and Cliff House) sandstone along a 10-mile section of the Hogback geologic formation (USFWS 1989). Most populations are located on Navajo Nation lands in San Juan County, New Mexico on Palmer Mesa east to the Hogback area and south of the San Juan River, to a hogback east of Little Water (Roth 2008a, USFWS 2011d). Monitoring data indicate that population trends for Mancos milk-vetch are highly variable between years; however, Navajo Nation range-wide numbers have declined approximately 67-71 percent since the late 1980’s /1990’s tallies (NNHP 2019).

The Navajo Natural Heritage Program monitors 13 Mancos milk-vetch populations. Surveys conducted during 2007 and 2008 in the Hogback and Palmer Mesa areas found 12 of the original populations including one new population and one extirpated population (USFWS 2011d). Historic records indicate that during the 1980s, the total known population size was approximately 7,600 individual plants on Navajo Nation lands. By 2008, less than 400 plants were found in 12 populations and only 2 of the 12 populations (17 percent) had more than 50 live

plants (NNHP 2008a; NNDFW 2009). In 2017, 11 populations were relocated and three were shown to have increasing populations (NNHP 2019). Below is a table of the survey results from known locations of Mancos milk-vetch in 2017 as compared to historic data (**Table 16**).

Table 16. Historic and current population estimates for 12 populations of Mancos milk-vetch occurring at least partially on the Navajo Nation during 2013 and 2017 surveys by NNHP staff (NNHP 2019). Counts with asterisks are estimated populations.

Site Name	Approximate Population Extent (acres)	Year of First Survey	Number of Plants	Year of Last Survey	Number of Plants
Burnt Squash Draw	16.8	1997	Few plants*	2017	78
Coal Mine Creek	16.6	1986	4200*	2017	100
Hogan	11.2	1985	200*	2017	188
Hogback	16.8	1997	30	2017	66
Little Water Hogback	41.4	1997	Hundreds*	2017	40
Long Point	35	1986	200*	2017	57
North Long Point	19.8	1986	500*	2017	205
Oil Tanks	14	1997	17	2017	5
SE Palmer Mesa	0.5	2008	1	2017	5
West Palmer Mesa	286.7	1989	1700*	2017	1414
West Rim	42.5	1986	500*	2017	120
Little Water South	15.12	2013	130	NA	NA

During the 2017 monitoring season, seedlings comprised 57% of the plants observed in the NNHP plots (NNHP 2019). Also, only 37% of the Mancos milk-vetch had seed pods indicating poor reproduction (NNHP 2019).

Effects Analysis

Mancos milk-vetch is threatened by noxious weeds, particularly from cheatgrass (NNHP 2019). If weed treatments occur near Mancos milk-vetch suitable habitat, the species conservation measures will require a 200 ft buffer from the species and will be marked with flagging to prevent field crews from entering the buffer zone. Prior to weed treatments in suitable habitat for the species, surveys by a trained biologist will determine if the species is present. The NNDFW will be notified immediately if the species is detected. There will be no direct effects to Mancos milk-vetch because the conservation measures will be implemented.

Indirect effects include herbicide drift from chemical treatments and trampling. The likelihood of herbicide drift is reduced by implementing the 200 ft buffer for chemical treatments. Also, herbicides will not be applied when wind speeds exceed 10 miles per hour, temperatures are greater than 80° F (26.7° C), and humidity is high. Chemical treatments may affect pollinators required for Mancos milk-vetch reproduction or their host plants. Weed treatments are anticipated to occur on a relatively small scale, except for agricultural fields. NAPI agricultural fields are within miles of some Mancos milk-vetch populations, and aerial spraying may occur in these areas. Implementing the mitigation measures will reduce the potential for chemical drift. Other methods such as mechanical, including control burn, and cultural treatments require a 200 ft buffer from Mancos milk-vetch populations. All vehicles used to access sites will follow established roadways and will be parked in previously disturbed sites.

Spider mite (*Tetranychus* genus), seed weevils (*Acanthoscelides* sp., *Apion* sp., *and Tychius* sp.), and Lepidoptera larvae herbivory have been reported to occur at insignificant levels during years with favorable rainfall years and can cause mortality during drought periods when the plant is already stressed (NMSFD 2008). These events are rare but may increase during drought. No biological control agents are proposed to control *Astragalus* sp., and none of the proposed agents occur within the genus of the spider mite, seed weevil and Lepidoptera. Therefore, the proposed biological controls will not have any impacts on this species.

This species has a small population size, which is likely due to low fecundity and reduced genetic variability (Allphin et al. 2005). Therefore, introducing external factors that may place additional stress on the life history characteristics of these populations may further inhibit population growth. Herbicide overspray and potential human or car tire trampling during treatments may provide a cumulative impact on the species when combined with current stressors of trampling from oil and gas, transmission line and OHV traffic due to low fecundity and small population size. Herbicide overspray and trampling will be minimized by implementing the conservation measures and best management practices. Water is critical for Mancos milk-vetch germination and development. Therefore, continued drought, as anticipated with climate change, threatens this species' continued existence (USFWS 2011d). Herbicide overspray and trampling combined with climate change would provide a synergistic effect and increase mortality and inhibit population growth. Again, synergistic effects would be avoided or minimized by implementing the conservation measures and best management practices. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan may affect, but is not likely to adversely affect the Mancos milk-vetch.

Mesa Verde Cactus *(Schlerocactus mesae-verdae)*

Endangered Species Act Status: Threatened, 1979
Navajo Nation Endangered Species List: Group 2
Recovery Plan: Final, 1984
Critical Habitat: None

Species Account

Mesa Verde cactus is a perennial desert plant that grows slowly and has a lifespan of approximately 20 years (CNAP 2005). Mesa Verde cactus can self-fertilize; however pollination occurs more frequently and more successfully by insect pollinators. Recruitment and mortality events occur at infrequent (greater than 10 year) intervals (CNAP 2005) and are associated with rainfall. Since 2003, germination and recruitment have been documented in some populations, but they have occurred at relatively low levels (USFWS 2011e). During severe dry periods, individual plants shrink and retract back into soils to minimize desiccation or dehydration (Heil and Porter 1994). Vegetation cover in Mesa Verde cactus habitat is sparse and has the appearance of a nearly barren badland.

Habitat Status

The primary threats identified by the U.S. Fish and Wildlife Service (USFWS) include poaching; highway and transmission line construction; and off-highway vehicle activity (USFWS 1979). The Mesa Verde Cactus Recovery Plan identifies additional threats, all related to the "destruction or modification of its habitat:" coal mining; oil and gas exploration and development; commercial and residential development; livestock grazing and trampling; pesticide use; and natural causes such as erosion and interspecific competition (USFWS 1984). The most recent 5-year review of the species' status also discusses climate change and insect predation as threats (USFWS 2011e). Finally, *Halogeton* sp. is present at Mesa Verde cactus monitoring sites but its effect on the cactus is uncertain (Nora Talkington, Botanist, Navajo Natural Heritage Program, Personal Communication on March 10, 2021).

The total range of this species is an area of approximately 75 x 30 miles (120 x 48 km), stretching from near Naschitti in southern San Juan County, New Mexico to about 10 miles north of the New Mexico border in Montezuma County, Colorado (USFWS 1984). Distribution within this range is sporadic and widely scattered. The topography consists of eroded badlands from numerous small, dry drainages between low hills and ridges at elevations between 4,800 and 6,560 ft. Density varies greatly within populations with as many as 20 cacti in 50 m^2 (538 ft^2) or as few as a single cactus located several hundred meters from any others (Sivinski 2000). The highest known concentration is a 40 km (25 mi) swath around Shiprock, New Mexico, which may be an artifact of numerous botanical surveys conducted due to increased development pressures (Sivinski 2000). Of the known populations of Mesa Verde cactus, at least 80 percent occur on Navajo Nation lands, 15 percent on Ute Mountain Ute lands, and 5 percent on small blocks of BLM and New Mexico State lands (Sivinski 2000).

Navajo Nation Conservation Areas

On Navajo Nation lands, Conservation Areas (CAs) were officially designated to protect Mesa Verde cactus and potential habitat, including El Malpais, Many Devils Wash, Rattlesnake, and Monument Rocks Conservation Areas (Hazelton 2013). El Malpais Conservation Area (7,416 ac) was established in 2008 as a mitigation bank for the Western Administrative Power Authority (WAPA). Since its creation, the site has been monitored annually expect for 2010. At this site, total Mesa Verde cacti numbers slightly declined over five years from 2008 – 2013 (**Table 17**). Mortality during 2011occurred due to unknown causes, and from 2012 - 2013 mortality occurred due to feral horse and vehicle trampling (Hazelton 2013).

Table 17. Total number of cactus, new cactus, and dead cactus censused at El Malpais Conservation Area on the Navajo Nation from 2008 – 2013. No data was recorded during 2010 (Hazelton 2013).

Year	Total # of Cactus	# New Cactus	# Dead Cactus
2008	87	-	-
2009	91	4	0
2011	86	2	7
2012	81	3	8
2013	76	2	7

Existing Environment

In 2004, 56 known natural population sites of Mesa Verde cactus were found and resurveyed over approximately 1,911 ha (4,723 ac) on Navajo Nation lands (NNHP 2004). Most plants were found within a 12 km (20 mi) radius around the town of Shiprock. Surveys were expanded to cover larger areas around the town of Shiprock, including Malpais Arroyo, the Fairgrounds, Many Devils Wash, and an area southwest of the town of Cudie. Navajo Natural Heritage Program found approximate population totals of 6,700 cacti on 37 of the 45 sites prior to 2002 with many sites with only one cactus and a few others as high as 1,500 individuals (NNHP 2004). Following the significant mortality caused by a severe drought and insect predation during the 2002-2003 growing season, only a few sites supported 20 or more cacti (NNHP 2004). In 2004, the total number of plants in 56 surveyed sites was 948 live cacti, 428 dead cacti, and 20 damaged cacti (NNHP 2004). This total included 7 newly surveyed sites, which totaled 175 cacti (125 live, 50 dead). At one site, Mesa Verde cactus experienced a 99% decrease from 1,500 or more individuals reported in 1989 to 4 plants in 2004. Surveys were conducted at Sheep Springs in 1986 where 50 cacti were found and in 1990 an estimated 122 cacti were detected (USFWS 2011e). After the severe drought in 2002-2003, no Mesa Verde cactus were detected at the site by 2004. In 2019, NNHP surveyed the WAPA site and detected 170 individuals which was up from 114 individuals in 2018.

Other surveys conducted but not monitored by the Navajo Nation have detected populations of Mesa Verde cactus. Along the Navajo Transmission Project right-of-way and through the Malpais Conservation Area, a total of 1,377 live and 475 dead cacti were found along 25.7 km (16 mi) of suitable habitat (Ecosphere Environmental Services 2007). For the existing Lost Canyon and Kayenta – Shiprock Transmission Line, 45 km (28 mi) of suitable habitat was surveyed; 436 live and 148 dead cacti were found (Ecosphere Environmental Services 2007). From 2009 to 2011, Bureau of Reclamation (BOR) contracted Ecosphere Environmental Services to inventory for Mesa Verde cactus on Navajo Nation lands in potential cacti habitat along Navajo Route N-36 and U.S. Highway 491 for the Navajo-Gallup Water Supply Project. Results from 2009 and 2010, which covered the same survey area each year, indicate an increase in mature and juvenile cacti as well as increased mortality with a slight reduction in offshoots.

In 1986, USFWS transplanted 35 Mesa Verde cactus within a 24 km (15 mi) radius of the urban community of Shiprock, New Mexico with little success (USFWS 2011e). In 1989, fewer than 10 cacti were found at the site, which may have been contributed to lack of mapping and documentation (Hazelton 2011a). Twenty-nine cacti were transplanted in 1995, however after the drought of 2002 and infestation of cutworms in 2003 only four cacti remained in 2004 (Roth 2004a). In 2001, an additional 54 cacti were transplanted within non-development zones on the Northern Navajo Fairgrounds near Shiprock. In 2019, 31 cacti were detected at this site with only 8 of the transplanted cacti remaining in the plots (Nora Talkington, Botanist, Navajo Natural Heritage Program, Personal Communication on March 10, 2021).

Effects Analysis

Noxious weeds were not identified as a threat to Mesa Verde cactus; however, they have been detected during recent surveys (USFWS 2011e, Hazelton 2011a). NNHP has noted that noxious weed treatments within Mesa Verde cactus Conservation Areas could be beneficial to the species. If weed treatments occur within the Conservation Areas, additional consultation with NNHP staff would be required on a project-by-project basis. If weed treatments are conducted near Conservation Areas or near Mesa Verde cactus suitable habitat the species conservation measures will eliminate direct impacts on the species. A 200 ft buffer from cactus will be required and each individual will be marked with flagging to prevent weed treatment field crews from entering the buffer zone. The NNDFW will be notified immediately if the species is detected.

Indirect effects include herbicide drift from chemical treatments and trampling. The likelihood of herbicide drift is reduced by implementing the 200 ft buffer for chemical treatments. Also, herbicides would not be applied when wind speeds exceed 10 miles per hour, temperatures are greater than 80° F (26.7° C), and humidity is high. Chemical treatments may affect pollinators required for Mesa Verde cactus reproduction or their host plants. Weed treatments are anticipated to occur on a relatively small scale, however implementing the mitigation measures and best management practices will reduce the potential for chemical drift. Other methods such as mechanical, including prescribed fire, and cultural treatments require a 200 ft buffer from cactus populations. All vehicles used to access sites would follow established roadways and will be parked in previously disturbed sites.

Livestock grazing is considered a threat to Mesa Verde cactus from grazing and trampling. Cultural treatments are proposed for Community Development Areas and agricultural fields. If Mesa Verde cactus is present in these locations, a fence will be established around the site to ensure the 200 ft buffer is enforced.

The native longhorn cactus beetle (*Moneilema semipunctatum*) and nonnative army cutworms (*Euxoa spp*.) consume Mesa Verde cactus often causing mortality. Mortality from invertebrate consumption is more significant during drought conditions (USFWS 2014b). No biological control agents are proposed to control cactus, and none of the proposed agents occur within the longhorn cactus beetle and army cutworm genus, which eliminates the possibility of a species attacking a native species. Therefore, the proposed biological controls would not have any impacts on this species.

The reproductive capacity for the Mesa Verde cactus is considered naturally low (germination and recruitment) (USFWS 2011e). Therefore, introducing external factors may place additional stress on the life history characteristics of these populations and further inhibit population growth. Herbicide overspray and potential human or car tire trampling during treatments may provide a cumulative impact on the species when combined with its current stressors of livestock trampling and consumption, oil and gas development, transmission line easements, insect

consumption and OHV use due to low reproductive capacity and small population size. Herbicide overspray and trampling will be minimized by implementing the conservation measures and best management practices. These impacts would synergistically affect the cactus population with warmer and drier climates. It is predicted that this species would be highly impacted by climate change as observed in the monitored populations after the drought of 2002, where some populations experienced a 99% reduction in population size. Insect consumption of cacti is increased during dry periods. The combination of climate change, insect consumption, herbicide overspray and trampling combined would provide synergistic effects that could increase mortality and inhibit population growth. Synergistic effects would be avoided or minimized by implementing the conservation measures and best management practices.

Even though noxious weeds were not identified as a threat to this species, the removal of noxious weeds around Mesa Verde cactus habitat may benefit its population. The proposed action does not cover treatments within 200 ft of the cactus. However, removing dense root structures of some noxious weed species near Mesa Verde cactus habitat, especially grasses, would help promote seed establishment and reduce the risk of wildfire. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan may affect, but is not likely to adversely affect the Mesa Verde cactus.

Navajo Sedge *(Carex specuicola)*

Endangered Species Act Status: Threatened, 1985
Navajo Nation Endangered Species List: Group 3
Recovery Plan: Final, 1987
Critical Habitat: Final, 1985

Species Account

Navajo sedge is a wetland obligate of springs or hanging gardens, typically in alcoves associated with Navajo sandstone, Cedar Mesa, DeChelly, Kayenta, and Wingate formations on cliffs of varying height and slope (often vertical) at 1,280 to 2,300 m (4,200-7,600 ft) elevation in piñon-juniper woodland (USFWS 2014a, USFWS 2019). This species rarely occurs on level terrain; however, three sites were located on the canyon floor in Sheik Canyon, Utah (USFWS 2014a). Water supporting Navajo sedge is generally low in mineral content.

The nature of Navajo sedge habitat (springs on cliffs in arid environments) indicates its distribution pattern as uncommon, scattered, and isolated (USFWS 2014a). Monitoring results for 10 Navajo sedge populations (15 hanging gardens) on the Navajo Nation found that average plant vigor increased at six and decreased at two of the gardens from 2003 to 2011 (NNHP 2012). Of the six gardens with increased plant vigor, one had a decrease in grazing pressure, two experienced both a decrease in grazing pressure and an increase in water availability, and three experienced no change in either stressor. Additionally, NNHP ranked 16 of 32 population in good or excellent viability, and the rest were ranked poor (NNHP 2012).

Navajo sedge reproduction is mostly vegetative, but no species-specific reproduction studies have been completed. Pollination is likely by wind, as is common among sedges (Linder and Rudall 2005). Flowering and fruit set occur from late June through September (NNHP 2008), which is the only time Navajo sedge can be positively identified. Suitable habitat can be identified year-round. Preliminary results from a small sample of nine sites indicates cover of Navajo sedge within occupied hanging gardens is not correlated with site aspect or soil moisture level (Rink and Hazelton 2014).

Habitat Status

The largest threats to Navajo sedge populations include grazing, trampling by livestock, and water development. Climate change may be a potential threat in the future due to drying of springs. Noxious weeds have been recorded in hanging gardens on the Navajo Nation where Navajo sedge occurs, including cheatgrass, red brome, saltcedar, and Russian olive (NN). There is concern these noxious weeds could outcompete native species for resources. From 2000 to 2003, 23% of known populations on the Navajo Nation had medium or heavy impacts from grazing. Additionally, 37% showed signs of drought stress such as high mortality rates, no water discharge/dry soils, and sloughing vegetation mats (NNHP 2004a). In 2010 and 2011, grazing pressure did not appear to increase at any gardens, and decreased at three, indicating that the amount, distribution, and suitability of Navajo sedge habitat is not changing significantly due to impacts from livestock, water development, and changes in water availability (NNHP 2012).

Critical Habitat

Critical habitat for Navajo sedge was designated at three sites where which the plant was known to occur at the time of its listing on May 8, 1985. The locations are all in Coconino County, Arizona. Each location is approximately 40 x 5 meter (about 200 square meters) rectangular areas with long axes in the direction of seep spring flow. The total area designated comprises about 809 square meters (about 0.15 acres) and contains all known occupied habitat from 1985. Constituent elements are moist sandy to silty soils at shady seep-springs within the Navajo Sandstone Formation (Phillips et al. 1981a). Since the time of listing additional Navajo sedge populations have been detected, however; critical habitat has not been updated.

Existing Environment

At the time of listing in 1985, this species was only known from 3 springs along the trail from Inscription House Trading Post to Inscription House Ruin on the Navajo Nation in Coconino County, Arizona (Howell 1949). These three sites are considered one population or “element occurrence record” (ERO) (NNHP 2004a). An ERO refers to Navajo sedge occupying one or more hanging gardens within a single canyon and within one kilometer of each other. Currently, there are 160 sites, in 64 EROs, across Arizona and Utah, spanning an area about 120mi (190km) by 110mi (175km) (USFWS 2019). There are 43 populations on the Navajo Nation documented from the Navajo Creek drainage in Coconino County; east to the Tsegi Canyon Watershed in Navajo County; south to Rock Point, Mexican Water, and Canyon de Chelly National Monument in Apache County, Arizona. Despite the survey effort to document these populations, much of this

species' potential habitat has not been surveyed due to the difficult terrain that limits access to sites (USFWS 2014).

Effects Analysis

Prior to weed treatments, surveys by a trained biologist would be conducted to identify the locations of Navajo sedge within potential habitat in the project area. The 200 ft buffer from Navajo sedge populations identified in the special conservation measures would be marked with flagging to prevent weed treatment field crews from entering the buffer zone.

There will be no direct effects to Navajo sedge since weed treatments are not proposed in hanging garden sites. Indirect effects include herbicide drift from chemical treatments. The likelihood of herbicide drift is reduced by implementing the 200 ft buffer for chemical treatments. Also, herbicides would not be applied when wind speeds exceed 10 miles per hour, temperatures are greater than 80° F (26.7° C), and humidity is high. Finally, many hanging gardens with Navajo sedge in remote and inaccessible areas where it is unlikely weed treatments will occur, and, if they do occur, wind drift herbicide would not reach the populations. Other methods such as mechanical, including prescribed fire, and cultural treatments require a 200 ft buffer from Navajo sedge populations. Due to the remote nature of hanging gardens, it is unlikely that heavy machinery would be used to treat weeds in these areas. Chainsaws may be used for cutting stump treatments but would focus on woody trees.

Livestock have shown to be a threat to Navajo sedge from grazing and trampling effects. Cultural treatments are proposed for Community Development Areas and agricultural fields. If Navajo sedge is present in these locations, a fence would be established around the hanging garden to ensure the 200 ft buffer is enforced.

Herbicide overspray to Navajo sedge habitat may provide a cumulative impact with the known threats to Navajo sedge habitat, including livestock grazing and trampling and water development for livestock. If Navajo sedge populations are compromised due to these outside pressures, herbicide overspray may further impact these susceptible populations. The effect of grazing, trampling, climate change, and water development at hanging gardens with Navajo sedge fluctuates from year to year. Surveys conducted in 2010-2011 note that grazing pressure had not increased at 15 hanging gardens, and that it decreased at three of them (NNHP 2012). Of 32 populations with enough information to assess populations improvements over 20-30-year periods, 16 were assigned a rank of good or excellent viability. The rest were of fair viability, indicating some reason for concern.

Removing noxious weeds species from areas adjacent to Navajo sedge populations would help protect these populations from the identified threat of noxious weed invasion. The implementation of mitigation measures, including buffers identified for each treatment, and best management practices would eliminate the risk to Navajo sedge and make weed treatments not likely to adversely affect the species.

Welsh's Milkweed (*Asclepias welshii*)

Endangered Species Act Status: Threatened, 1987
Navajo Nation Endangered Species List: Group 3
Recovery Plan: Final, 1992
Critical Habitat: Final, 1987

Species Account

Welch's milkweed only grows in active dunes and thrives in disturbed conditions with no competing vegetation (USFWS 2015). This species flowers from June to July with seed development and dispersal from July to early September (NNHP 2020). To produce fruit and seeds this species requires pollinators for germination. Juvenile plants have long, linear leaves, different from the ovate or rounded leaves of the adult so they are often misidentified. Welch's milkweed populations are widely dispersed suggesting that while the species spreads clonally, seeds may be dispersed by wind (USFWS 2016). Populations are hard to monitor due to shifting winds making population viability determinations challenging. Also, since this species is rhizomatous, it is hard to discern the number of individuals. It grows from an extensive underground root system comprised of a taproot and horizontal runners connecting stem clusters.

Habitat Status

Suitable habitat consists of active sand dunes derived from Navajo sandstone in sagebrush, juniper, and ponderosa pine communities (NNHP 2020). Known populations occur from 5,000 to 6,230 ft elevation. Populations on the Navajo Nation are distributed across large dune fields with multiple, highly spaced stands of stems (USFWS 2015).

Due to the limited range and specialized habitat of this species, it is threatened by off-road vehicle use, and the potential for oil and gas development in its critical habitat. On the Navajo Nation, this plant is threatened by grazing, trampling and drought.

Critical Habitat

Critical habitat includes sand dunes within the Coral Pink Sand Dunes in Kane County, Utah; Sand Hills, Kane County, Utah; and Sand Cove on the Kane County, Utah and Coconino County, Arizona border (USFWS 1992). Approximately, 32% of Welsh's milkweed critical habitat on BLM-administered land in CPSD is protected from OHVs. No critical habitat on the Navajo Nation exists.

Existing Environment

Welsh's milkweed currently occurs in eight populations, with two (Tuba City and Comb Ridge) on the Navajo Nation, Arizona (USFWS 2015). The Comb Ridge population, consisting of the Kayenta and Capitan Valley populations, is approximately 3,200 acres with a partial estimate of 200 individuals in 2011 (USFWS 2015). The Tuba City population, consisting of the Kaibito Plateau and Tonalea populations, is 960 acres with a partial estimate of 200 individuals in 2011 (USFWS 2015). Partial estimates are based on a visual survey of approximately 30% of the dune field surveyed at each site. The entire dune was not surveyed, making it likely that more stems

exist. These population estimates are similar to the estimates made in 2001-2002, but the data is inadequate to establish as a trend. These populations are remote and have good to excellent viability (Holmgren and Holmgren 2015).

Effects Analysis

This species is a rare endemic that occurs on a very dynamic and specialized habitat: sand dunes. The dynamic nature of sand dunes prevents other native or noxious plant species from establishing. Therefore, it is unlikely that weed treatments will occur in Welsh's milkweed habitat and there would be no direct impacts to the species. This species may be impacted by indirect effects from trampling, mechanical equipment impacts, and herbicide overspray from adjacent habitats. These effects would be reduced or eliminated by implementing the species conservation measures and best management practices. Flagging or fencing the species in the treatment area will prevent mechanical or human foot traffic from trampling the species. Herbicides will not be sprayed during high wind or humid conditions to prevent the potential for overspray.

Implementing the conservation measures would also eliminate synergistic effects. The largest threat to this species is human impact from off- road recreational vehicles and livestock grazing. Trampling from off-road vehicle use and livestock in combination with herbicide overspray may cause a synergistic effect to the species. OHV and livestock trampling may reduce the population through trampling and weed treatments may further those impacts. However, the known populations occurring on the Navajo Nation are located in remote areas that are not heavily impacted by off-road vehicles. Also, due to the sparse vegetation occurring on active sand dunes, it is unlikely that cattle would graze in these areas. The implementation of the conservation measures would reduce the potential of herbicide overspray, mechanical and trampling impacts.

Climate change may be another threat to Welsh's milkweed populations. As the climate warms and drought continues, this species will be impacted by reduced water availability in its habitat. The driest areas, such as in Welsh's milkweed habitat, are anticipated to have the largest impacts from climate change. Climate change, with the combination of herbicide overspray, mechanical impacts or trampling, may cause cumulative impacts to the population. Implementing the conservation measures would reduce the potential of herbicide overspray, mechanical and trampling impacts.

Zuni/Rhizome Fleabane (*Erigeron rhizomatus*)

Endangered Species Act Status: Threatened, 1984
Navajo Nation Endangered Species List: Group 2
Recovery Plan: Final, 1988
Critical Habitat: None

Species Account

Zuni fleabane habitats are outcrops of coarse-textured shales on the Baca Formation in west-central New Mexico and the Chinle Formation in northwestern New Mexico and northeastern

Arizona (USFWS 2007). These soils often have a strong odor of selenium and sometimes support species of seleniphytic plants. Occupied habitats range in elevation from 7,500 to 8,400 feet and in size from less than 1 acre to 260 acres (USFWS 2007). Shaley outcrops of suitable habitat are often nearly barren but occur within and contain scattered vegetation from piñon-juniper woodland to lower transitional forest of ponderosa pine and Douglas fir.

Habitat Status

Zuni fleabane is a rare regional endemic with three known, widely scattered population centers in Arizona and New Mexico (USFWS 2020b). On the Navajo Nation, Zuni fleabane is known in the Chuska Mountains on nearly barren slopes and scree. This species is geologically associated with the Chinle and Baca formations, which are known uranium deposits and mining claims. Therefore, mineral exploration and development and climate change are the two most significant threats to this species. The Dine Natural Resources Protection Act of 2005 eliminated uranium mining activities on Navajo Nation land, particularly in Zuni fleabane habitat (USFWS 2020b). Climate change, through drought and increased temperatures, may exacerbate already limited moisture availability and impact this species. Additional threats to this species on the Navajo Nation are residential housing development, off-road vehicle use, and recreational impacts (USFWS 2020b). Noxious weeds are not recognized as a threat to this species on the Navajo Nation (Nora Talkington, Botanist, Navajo Natural Heritage Program, personal communication, March 10, 2021).

No critical habitat was listed for this species.

Existing Environment

Zuni fleabane is known from three populations. On the Navajo Nation it has been recorded in 18 subpopulations on the slopes of the Chuska Mountains from Lukachukai and west of Red Valley in Apache County, Arizona south to Navajo in McKinley County, New Mexico. There is potential for the species to occur on the Navajo Nation in the Chuska Mountains and in suitable habitat in the pinyon-juniper associations between Lupton in Apache County, Arizona and Prewitt in McKinley County, New Mexico (NNHP 2020). In 2004, surveys in the Chuska Mountains estimated a Zuni fleabane population size of approximately 5,725 individuals in 15 subpopulations (Christie 2004). Surveys completed in 2019 documented a 14% increase in Zuni fleabane population size from 2004 in 18 known populations (Christie and McBride 2020). Despite the detection of three additional populations in 2019, there was a 43% decrease in subpopulation size and an incomplete total count of 4,984 plants (Christie and McBride 2020). The population trend is stable to increasing and populations are generally healthy.

Effects Analysis

Zuni fleabane is a rare, regional endemic that occurs on specialized soil type, including coarse-textured shales on the Baca Formation and the Chinle Formation. Noxious weeds are not recognized as a threat in Zuni fleabane habitat on the Navajo Nation. Therefore, it is unlikely this species will receive direct impacts from weed treatments. This along with implementing

conservation measures would prevent direct impacts to the species from weed control activities. This species may be impacted by indirect effects from trampling during treatments and herbicide overspray. These effects would be reduced or eliminated by implementing the species conservation measures and best management practices. Flagging or fencing the species in the treatment area would prevent mechanical or human foot traffic from trampling the species. Herbicides would not be sprayed during high wind or humid conditions to prevent the potential for overspray. Other methods such as mechanical, including prescribed fire, and cultural treatments require a 200 ft. buffer from fleabane populations. All vehicles used to access sites will follow established roadways and would be parked in previously disturbed sites. There are no documented predators or pathogens that affect Zuni fleabane (USFWS 2007). Also, no proposed biological controls target fleabane species. Therefore, there are no anticipated effects that will occur from the proposed biological controls.

While cattle do not eat fleabane, it may be trampled when it occurs in a grazing allotment. However, this is not identified as a major threat. Herbicide overspray and trampling from weed treatments may cause synergistic effects when combined with cattle trampling. However, the known populations occurring on the Navajo Nation are located in remote areas that are sparsely vegetated. The implementation of the conservation measures would reduce the potential of herbicide overspray, mechanical and trampling impacts. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan will not affect the Zuni/Rhizome fleabane.

5.2 Candidate Species

Roundtail Chub *(Gila robusta)*

Species Account

Roundtail chub is a Group 2 listed species on NNHP Threatened and Endangered species list (NNHP 2020) and were proposed for protection under the Endangered Species Act, but this rule is proposed for withdrawal because it was determined that the headwater chub and the roundtail chub DPS were not discrete taxonomic entities (82 FR 16981).

Roundtail chub are found in cool to warm waters of rivers and streams, and often occupy the deepest pools and eddies present in streams (Minckley 1973; Brouder et al. 2000). Adult roundtail chub favor slow moving, deep pools. They use large rocks, undercut banks, and woody debris for cover (Bezzerides and Bestgen 2002). Young-of-the-year (fish species younger than one year) roundtail chub occupy shallow (less than 50 cm (20 in) depth) and low-velocity waters with vegetated shorelines (Brouder et al. 2000, Lanigan and Berry 1981). Juveniles use habitat similar to young-of-the-year but with depths less than 100 cm (40 in). Water temperatures for habitats occupied by roundtail chub vary seasonally between 0–32 °C (32–90 °F) (Bezzerides and Bestgen 2002, Bonar et al. 2011).

Roundtail chub spawning occurs from February to June in pool, run, and riffle habitats with slow to moderate water velocities (USFWS 2013a). Roundtail chubs are omnivores, consuming foods proportional to their availability, including aquatic and terrestrial invertebrates, aquatic plants, detritus, and fish and other vertebrates.

Habitat Status

Roundtail chub populations have declined due to habitat loss and degradation related to dams, diversions, groundwater pumping, mining, development, recreation, improper livestock grazing, and competition and predation from non-native fishes (Miller 1961, Bezzerides and Bestgen 2002, and Voeltz 2002). Areas where roundtail chub still occur have been significantly altered by these and other factors, including mining, improper livestock grazing, wood cutting, recreation, urban and suburban development, groundwater pumping, dewatering, dams and dam operation, contaminants, and other human actions (USFWS 2013a).

Existing Habitat

Historically, roundtail chub occurred throughout the Colorado River basin from Wyoming to Arizona and likely into Mexico, and in the mainstem and most large tributaries (USFWS 2013a). On the Navajo Nation, the roundtail chub is extirpated from the Colorado River in the Grand Canyon but occurs in the San Juan and Mancos Rivers (NNDFW 2020). Roundtail chubs have rarely been encountered in recent surveys; however, they have been found from Shiprock to near Lake Powell, with most occurrences located between Shiprock and Aneth (RM 107- 140) (NNHP 2020).

Fish surveys in the late 1980s on the San Juan River and its tributaries produced 19 roundtail chub specimens, of which 15 were juveniles (Platania 1990). Although the presence of young fish confirmed reproduction, no adult fish was captured. Since that survey, few roundtail chubs have been collected from the San Juan River basin and very few of these fish were adults (Ryden 2003). A small population occurs in the San Juan River upstream of Navajo Reservoir (Carmen 2006). During surveys conducted in 2013, no roundtail chub were collected on the San Juan River, however, a total of 13 chub were captured on the Navajo River (Gilbert 2013). Four of the fish were measured at total length <100 mm and classified as juveniles, indicating natural recruitment (Gilbert 2013). A total of 3,500 roundtail chub have been reintroduced into Navajo River, and 3,500 fish were allocated to the Southern Ute Division of Natural Resources for stocking on Southern Ute land on the Navajo River and the San Juan River (Gilbert 2013).

Effects Analysis

Few roundtail chub occur in the San Juan River or other rivers adjacent to the Navajo Nation. With reintroduction efforts in the upper Colorado River basin, the San Juan River or tributaries may become occupied in the future. If the San Juan and tributaries become occupied, there will be no direct impacts to roundtail chub because no aquatic treatments are proposed under this plan. Indirect impacts may occur if habitats are occupied, include increased turbidity during mechanical treatments using heavy machinery and prescribed fire in the riparian areas adjacent

to their habitat. These impacts would be minimal and temporary. Also, the implementation of the mitigation measures would require erosion control measures to stabilize and limit erosion along bank lines. Also, long term measures include planting native vegetation to stabilize soils and prevent noxious weed re-growth after treatments occur along the San Juan.

Indirect effects from herbicides would be minimal since only herbicides determined to be practically non-toxic to fish species will be used within the riparian zone and would follow protection measures. Implementing these features would minimize herbicide exposure to such small levels that the effects would be immeasurable to the species or its habitat. The long-term benefits to habitat, critical habitat floodplain areas, and riparian vegetation include improved habitat function, reduced erosion, and an improved invertebrate food base due to the return of the native riparian vegetation. There are no proposed aquatic treatments under this plan, and, therefore, no synergistic effects or cumulative impacts are anticipated by the proposed treatments. Based on the effects analysis and implementation of the species conservation measures, the Integrated Weed Management Plan will not affect the roundtail chub.

5.3 Sensitive Species and Species of Concern – Navajo Listed Species

5.3.1 Mammals

Pronghorns *(Antilocapra americana)*

Species Account

Pronghorns are found in grasslands or desert scrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees (typically juniper and sagebrush). Once common throughout the grasslands of the United States, unregulated markets, subsistence hunting, and overgrazing by livestock dramatically decimated populations.

Navajo Department of Fish and Wildlife permits special hunts of pronghorn in NNDFW Big Game Management Unit 16 in New Lands, south of Sanders, AZ. Pronghorn population numbers have been declining in the Southwest due to various threats that decrease and fragment habitat. Habitat loss due to human population growth has affected their overall range. Habitat fragmentation from urban sprawl and highway construction have dramatically impacted dispersal and migration of pronghorn herds (AGFD 2013). Loss of habitat from the expansion of juniper of other shrub species due to a lack of fire suppression have affected range quality and habitat suitability. Grazing and historic fencing practices have reduced habitat quality and created barriers that prevent pronghorn crossings. Finally, drought and predation have also affected pronghorn populations. The introduction and spread of many noxious weed species within rangelands and pastures on the Navajo Nation may also affect forage quality, replacing native forbs and herbaceous species with less palatable species. Pronghorn antelope are browsers that prefer shorter plants, with grass being a minor food source (AGFD 2013).

Existing Habitat

Pronghorn range on the Navajo Nation includes the New Lands area, the southwestern portion north of Flagstaff, and checkerboard lands in New Mexico.

Effects Analysis

It is likely that weed management treatments would occur within suitable habitat for pronghorn. Implementation of best management practices and the species conservation measures would minimize or eliminate many direct impacts from weed treatments. Mechanical, manual, and biological control techniques would have the least impacts for pronghorn. Such techniques would require a 1-mile buffer around known lambing areas and would be done in a manner to minimize disturbance to individuals.

Cultural control methods, such as planting native species, mulching, or conservation of native plants are not expected to impact pronghorn. Targeted grazing, however, would require the installation of fencing around treated areas. Fencing may affect pronghorn by preventing herds from moving across their range. Installation of wildlife friendly fencing, where smooth wires are used on the bottom, would reduce impacts from fencing and reduce how fencing may prevent pronghorn movements.

The use of herbicides does pose the risk of some direct impacts to pronghorn. Pronghorn may graze on herbicide-treated plants, and while most of the proposed pesticides are not considered toxic to large mammals, a few do pose some concern. Fluazifop-p-butyl and 2,4-D are known to impact large mammals' reproductive issues in wildlife species. There is also evidence that atrazine can affect the androgen receptors in mammalian species. Such risks are most concerning for pregnant or nursing females, or offspring. Enforcement of the 1-mile buffer zone around pronghorn lambing areas would minimize the risk of pronghorn eating contaminated vegetation. Restrictions on the use of all herbicides during high temperatures, humid conditions, and within 24 hours of a precipitation event would also reduce the risk of herbicide contamination in adjacent non-treatment areas. Thus, use of herbicides is not likely to adversely affect pronghorn populations on the Navajo Nation.

Cumulative impacts may occur for pronghorn populations already stressed by habitat fragmentation, low population densities, poaching, and predation. Such impacts may increase the susceptibility of populations to negative effects from weed treatments, such as herbicide exposure. Implementation of conservation measures and best management practices would reduce the risk of synergistic effects on populations by avoiding treatments where herds are present and around lambing areas. However, the removal of noxious weeds from forage habitats would also improve the availability of native forage species and reduce the risks of injury from many noxious weed species. Such improvements would allow these habitats to better support wild and domesticated ungulates.

Townsend's Big-eared Bat *(Corynorhinus townsendii)*

Species Account

The Townsend's big-eared bat roosts, raises young, and hibernates primarily in sandstone or limestone caves, lava tubes, mine tunnels, and other man-made structures. These bats prefer open ceilings and do not use cracks or crevices (AGFD 2003a). The bats use a variety of habitats for foraging, including coniferous forests and pinyon-juniper woodlands, deciduous riparian woodlands, and desert lands. During spring and summer, females form maternity colonies of < 100 adults in warm parts of mines and caves (AGFD 2003a); males are solitary. During winter, they hibernate alone or in small groups in colder parts of mines and caves, near entrances and in well-ventilated areas. This species primarily feed on moths (Lepidoptera), with some evidence that they may show a preference for food found along edge habitats (riparian and forested areas) (AGFD 2003a, NMDGF 2014).

The Townsend's big-eared bat is most sensitive to human disturbance and alterations to suitable habitat, most notably in mines. Vandalism, recreation, and reclamation of mines in the western United States are the biggest threats. Grazing is thought to affect bat populations due to the alterations to foraging habitat and conversions from mesic to xeric landscapes (BLM 2003, NMDGF 2014). Pesticides may also impact bats due to bioaccumulation and loss of prey habitat (BLM 2003).

Existing Habitat

Only two roost caves are known on the Navajo Nation: near Shiprock and Page. Distribution is likely limited to areas with suitable roost sites. The species is reportedly common in coniferous forests but has not yet been documented from the Chuska Mountains or the Defiance Plateau (NNHP 2008).

Effects Analysis

While weed treatment are not proposed in caves or mines, treatments may impact habitat used by Townsend's big-eared bat for food. Weed treatments where field crews would be present (i.e. mechanical, manual, and revegetation of native species) would be performed during the day, avoiding potential encounters with bats in foraging habitat. The use of biological control agents would likely not affect bat populations.

While the use of pesticides to treat and control weeds may present some concerns for indirect impacts to the bat, only 2,4-D has shown evidence of bioaccumulation. Because of the close association between Townsend's big-eared bat and riparian areas, only the use of aquatic-approved 2,4-D would be permitted in known foraging habitat. This formulation of 2,4-D has less persistence in the environment and is less likely to result in bioaccumulation in insectivores like the bat. Preference for other herbicides proposed in the weed management plan would also further reduce the risk of bioaccumulation. However, bats are not likely to use recently disturbed areas, which would decrease the risk of consuming insects affected by herbicides. Further, implementing avoidance buffers around roosting sites, restrictions on herbicide use during

periods of high humidity, precipitation events, and high temperatures would also reduce the risk of herbicide overspray and drift to non-target vegetation and treatment areas.

Grazing is considered a potential threat to the Townsend's big-eared bat. However, targeted grazing is only proposed in recognized Community Development Areas and designated rangelands and farmlands, which currently do not serve as forage habitat. Thus, the implementation of the integrated weed management plan is not likely to adversely affect the Townsend big-eared bat directly or indirectly.

There may be cumulative impacts to populations of Townsend's big-eared bats already impacted by mine reclamation, vandalism, or destruction. While weed treatments would not be permitted within roosting habitat, some populations may be more sensitive to potential impacts in forage areas. The implementation of species conservation measures and best management practices would avoid and reduce the potential for impacts to the bat in light of the additional stressors. Additionally, the treatment and control of many target weed species would improve plant diversity and support a broader array of insects and moths in forage habitats. This would be a long-term benefit to the bat by increasing prey availability.

Chisel-toothed Kangaroo Rat *(Dipodomys microps)*

Species Account

The chisel-toothed kangaroo rat is a small to medium-sized kangaroo rat native to the Great Basin area of the western United States. It is a general granivore, which is also known to feed extensively on saltbush leaves. It stores seeds and leaves in burrows for use during dry periods (AGFD 2001). Mating season occurs May to September and is thought to be related to the availability of certain nutrients in perennial shrub leaves or winter annuals (Johnson 1988). Common predators include rattlesnakes, gopher snakes, owls, and less commonly coyotes, bobcats, house cats, and raptors.

The species constructs burrow systems with multiple entrances on a discrete raised mound (2-4 m in diameter) in desert scrub habitat with open sandy areas and vegetation dominated by sparse grasses, shadscale, four-wing saltbush, or blackbrush. Preferred habitat has surface soils with a rock or gravel component and is relatively undisturbed by cattle grazing.

Major threats to the chisel-toothed kangaroo rat include grazing, agricultural land use, and predation by feral cats. Agricultural land use and grazing require the removal of shrubs from the landscapes, eliminating an important component of the kangaroo rat's diet. Unmanaged grazing in the region is believed to further exacerbate the availability of these shrubs, especially near water sources (AGFD 2001).

Existing Habitat

Chisel-toothed kangaroo rat is limited to Marble Canyon and House Rock Valley of Coconino County, Arizona, and is only known on the Navajo Nation near the Navajo Bridge of Marble Canyon; potential range is likely restricted to the upper Marble Canyon area (NNHP 2020).

Effects Analysis

Since the chisel-toothed kangaroo rat is only known to occur in a small portion of the Navajo Nation, it is unlikely that weed treatments would have an impact on the species. This species will not be directly impacted by treatments since it is most active the first few hours after sunset when weed treatments would not occur. Indirect effects may occur from contaminated food sources and smoke impacts during prescribed fire; however, buffer zones would reduce these impacts. Best management practices to reduce herbicide overspray would also prevent non-target plant species from impacts; therefore, herbicide use will not adversely affect kangaroo rats. Targeted grazing is not anticipated to affect the chisel-toothed kangaroo rat as it is restricted to Community Development Areas and agricultural areas, which do not currently occur in the rat's habitat. There will be no cumulative impacts or synergistic effects.

Banner-tailed Kangaroo Rat *(Dipodomys spectabilis)*

Species Account

The banner-tailed kangaroo rat is listed as a candidate species (Group 4) by the Navajo Nation. However, its designation as G4 only applies to populations in Arizona and Utah (NNHP 2020). Populations in the Chuska Mountains are not listed or protected as these populations are stable. Threats to this species, particularly in Arizona and Utah, include habitat loss and degradation. Damage to habitat burrows can occur in the event of heavy rainstorm events, which can impact seed stores and lead to major population declines. The expansion of dense woody vegetation in southwest grasslands is also thought to impact important food sources for banner-tails (NatureServe 2016h).

The banner-tailed kangaroo rat constructs elaborate and distinctive burrow systems, usually with 3-12 burrow openings on a discrete and raised (≤1.2 m tall) mound (1.5-4.5 m diameter), in Great Basin Desert grassland or desertscrub, preferring areas with heavier soils than other *Dipodomys* (NNHP 2020). Presence of grasses is necessary, but habitats at the extremes of vegetation density and height are avoided.

While they are nocturnal, this species does not hibernate and is sometimes known to forage during daylight hours in times of drought. Predators include snakes, badgers, foxes, bobcats, and great horned and barn owls (AGFD 2014a). The species consumes seeds of grass and other plants, and at times, green and succulent plants. Seeds are stored in burrows to carry them over periods of scarcity (AGFD 2014a).

Existing Habitat

Its occupied range on the Navajo Nation includes small remnant populations just west of Chinle and possibly near Navajo Mountain, with patches of desert lands in New Mexico. Potential range includes all desert lands east of the Chuska Mountains, northeast of Black Mesa in Apache Co., Arizona, and San Juan Co., Utah (NNHP 2020).

Effects Analysis

The banner-tailed kangaroo rat is only known to occur in a small portion of the Navajo Nation, making it unlikely that weed treatments would have a significant impact on the species. However, surveys conducted in potential habitat by a qualified biologist would determine if any populations were present in proposed treatment sites. Any populations found would have avoidance buffers placed at least 200 ft away from their habitat to prevent direct effects while implementing weed treatments. Indirect effects may come from herbicide overspray and smoke impacts during prescribed burning. Some of the proposed herbicides may negatively impact important food sources for the kangaroo rat, but buffer zones and preference for selective application methods near kangaroo rat habitat would reduce the risk of rats ingesting herbicide. Best management practices to reduce herbicide overspray would protect non-target plant species from impacts; therefore, herbicide use would not adversely affect kangaroo rats. Implementing the conservation measures would eliminate the indirect effects from smoke from prescribed fire. Targeted grazing is not anticipated to affect the chisel-toothed kangaroo rat as they are restricted to community development areas and agricultural areas, which are largely avoided by the kangaroo rat.

Cumulative impacts may occur if weed treatments are proposed in areas where woody plant invasions have led to significant reductions in important food sources for the banner-tailed kangaroo rat. Such populations may be sensitive to potential impacts from weed treatments due to stress from these additional factors. If conservation measures are implemented, treatments would not occur in areas inhabited by the kangaroo rat. There would be no synergistic effects.

Navajo Mountain Vole *(Microtus mogollonensis)*

Species Account

The Navajo Mountain vole is active both day and night, year-round. Their runways are 1.5 to 2 inches wide, extending from one burrow entrance to another and to feeding sites (Kime 1994). Breeding occurs primarily in May – October. Their nest is constructed of dried grass and forbs and is placed in a dense clump of vegetation, under a log or rock, in a depression in the ground, or in a chamber in its burrow (AGFD 2003). Fresh green vegetation may stimulate breeding, and poor quality of vegetation may reduce successful reproduction.

The greatest threat to Navajo Mountain voles is loss or degradation to suitable habitat. Livestock grazing on Navajo Mountain is a continuing threat to vole habitat (Spicer 1987). Periodic droughts and heavy grazing have prevented grass or forb establishment. The population trends of

this species are unknown; however, the data available suggests that the population is declining (AGFD 2003).

Existing Habitat

Navajo Mountain voles typically occupies dry, grassy vegetation in conifer forests, with variations including dense prostrate shrub patches in ponderosa pine forests (Navajo Mountain); monotypic sagebrush stands, thick grasses in greasewood/desert-olive stands and juniper stands, shrubby tamarisk thickets and chained pinyon and juniper woodlands (Black Mesa); and clear-cut pine flats with regenerating grasses and scattered oak (Chuska Mountains) (NNHP 2020). Ground cover vegetation is necessary.

The vole's range extends from Williams, Arizona to Mesa Verde, Colorado, including four locations on the Navajo Nation: Navajo Mountain, Black Mesa, Defiance Plateau, and the Chuska Mountains (NNHP 2020). Population numbers are unknown because Navajo Nation-wide sampling efforts have not been conducted.

Effects Analysis

Direct effects to the Navajo Mountain voles include destruction of potential habitat from mechanical treatments. Since this is a G4 species, species conservation measures are recommended but if the 200 ft buffer is implemented around occupied habitat these direct impacts would not occur. Indirect effects to voles include herbicide overspray. Most of the proposed herbicides are slightly to moderately toxic to small mammals, and paraquat is highly toxic to small mammals. Heavy machinery during mechanical control and trampling during manual control may compact potential habitat and destroy burrows; however, these effects would be temporary. Noxious weed removal would improve overall habitat for the voles in the long-term by promoting the growth of native grasses and forbs. Revegetating the habitat with native grass and forb seeds would help further encourage the growth of native species.

Livestock grazing is a threat to the vole due to trampling and consumption of preferred native grass and forbs. In vole habitats where grazing occurs cumulative impacts may occur when mechanical, manual, or chemical treatments would impact food resources and burrows. Disturbance may also introduce secondary noxious weeds, which would further impact native grass and forbs and potentially spread to vole habitat. This is unlikely to occur when implementing mitigation measures, including the seeding or planting of native species to replace noxious weeds. No anticipated synergistic effects are expected.

Arizona (Wupatki) Pocket Mouse *(Perognathus amplus cineris)*

Species Account

Pocket mice are typically solitary and are most active at night but may occasionally forage during the day. When temperatures cool in autumn, this species retreats to its burrows, remaining inactive until temperatures warm again in the spring. Population sizes of the species tend to fluctuate from year to year, depending on the amount of precipitation from the previous winter

and the availability of seeds. This correlation with precipitations suggests that food limits the population of the Wupatki pocket mouse (AGFD 2014b).

The mouse is threatened by habitat degradation and loss from land use and development (Rieck et al. 2015). The majority of the Wupatki pocket mouse range, outside of Wupatki National Monument, is exposed to differing levels of land use, including livestock grazing. Studies suggest heavy grazing can limit the distribution of Wupatki pocket mouse as the abundance and diversity of shrubs and forbs are altered in favor of grasses (Rieck et al. 2015).

Existing Habitat

Wupatki pocket mouse occupies a small disjunct range including a narrow swath of the western Navajo Nation from the northern Echo Cliffs south to Wupatki National Monument near Flagstaff, AZ. The Arizona pocket mouse occupies Great Basin Desert scrub habitat, usually with sparse ground cover of greasewood, snakeweed, rabbitbrush, ephedra, shortgrass, and possibly, short junipers. The species' range includes the southwestern half of Arizona and extreme northwestern Mexico.

Potential range on the Navajo Nation likely extends from the Colorado River (Marble Canyon) east to Kaibito Plateau and south through Cameron to the Leupp area (NNHP 2020). The Wupatki pocket mouse currently only has range along Echo Cliffs from the Colorado River to the Little Colorado River and south of Wupatki National Monument (AGFD 2014b).

Effects Analysis

The Wupatki pocket mouse is found on only a small portion of the Navajo Nation, while the suitable and occupied habitat for the Arizona pocket mouse is more widespread. Because of the limited size of habitat for the Wupatki pocket mouse, it is unlikely that weed treatments would have a direct impact. Prior to the start of any projects in potential pocket mouse habitat, surveys are required by a qualified biologist to determine if mice are present. If mice are present, a 200 ft buffer would be placed around the occupied habitat for all weed treatment techniques. This avoidance buffer would eliminate or reduce the potential for direct impacts associated with mechanical, manual, cultural, and biological techniques. Additionally, the use of targeted grazing, which has the most potential to impact mice populations, would only be implemented in community development areas and designated agricultural areas (farmland and rangeland). Because such areas have been altered by human use and disturbance, they do not currently serve as suitable habitat for the pocket mouse, making it unlikely that targeted grazing would adversely impact the species.

Herbicide use has the potential to impact the pocket mouse and its food sources. Herbicides can negatively impact non-target plant species and present an acute risk to small mammals. The herbicides that pose the greatest risk are clopyralid, fluazifop-p-butyl, and metribuzin, which show a high risk for acute toxicity in small mammals from broadcast applications (USEPA 1998, SERA 2014, BLM 2007). These risks are the result of directly spraying products onto the

animals and from consuming herbicide on non-target plants. However, under the proposed action, broadcast applications would not be permitted within occupied habitat for the pocket mouse, reducing the potential for directly spraying animals. Additionally, since the avoidance measures apply to occupied habitat for the pocket mouse, it also reduces the potential for herbicide spray on non-target plants that may be used as food for existing populations. The implementation of mitigation measures and best management practices for herbicides would further reduce the risk of direct impacts from herbicides. These measures include the preference for more selective application techniques, restrictions on herbicide applications during periods of high humidity, within 24 hours of a precipitation event, and during periods of high temperatures. These restrictions would reduce the risk of herbicide drift and over spray. Thus, it is not likely that herbicide treatments would adversely affect the Arizona (Wupatki) pocket mouse.

Cumulative impacts may occur for populations already impacted by habitat loss and destruction, especially those impacted by grazing. The implementation of weed treatments in these areas may further stress populations, resulting in synergistic effects. Such land use should be taken into consideration when developing a plan of action these areas by selecting control methods that reduce the potential for negative impacts. The implementation of the species conservation measures, and the best management practices would further reduce the potential for adverse effects for already impacted populations. It is not anticipated that climate change would pose a significant impact on the pocket mouse. Current modeling suggests climate change would increase the amount of suitable habitat for the mouse at higher elevation (Rieck et al. 2015).

Overall, the control and management of noxious weeds in Arizona pocket mouse habitat would benefit the species. Noxious weed removal would improve plant diversity and abundance of many native shrub and forb species in the Arizona pocket mouse's habitat. Such impacts would result in improved forage potential in the pocket mouse's habitat, increasing habitat quantity and quality.

Kit Fox (*Vulpes macrotis*)

Species Account

The kit fox inhabits dens excavated in desert scrub or desert grasslands with soft, alluvial or siltly-clay soils, and often with sparse saltbush, shadscale, greasewood, sagebrush, and grasses (NNHP 2020). There is little information on the kit fox throughout its range to estimate its population size or population trends for this species. This species is threatened throughout its range by development, particularly the conversion of desert habitats to agriculture or large-scale solar projects.

Existing Habitat

The kit fox is known from the Navajo Nation east of the Chuska Mountains and Chinle Valley in Arizona and Utah; however, potential exists within all desert lands on the Navajo Nation (NNHP 2020). It occurs in elevations ranging from 400 m to 1900 m.

Effects Analysis

No direct effects would occur to kit foxes because the conservation measures would be implemented, and all treatments would require a 200 ft buffer from occupied habitats year-round. Also, kit foxes and their prey are nocturnal so herbicide overspray would not directly impact the species, because treatments would occur during the day.

Mechanical clearing using heavy machinery or trampling from manual techniques could indirectly impact kit fox potential habitat. The species conservation measures including buffers to occupied habitats year-round would prevent the effect of mechanical and manual clearing on this species' dens and habitat. Weed treatment effects would be short term and temporary and, in the long-term, would improve habitat for the kit fox and its prey. There are no synergistic effects or cumulative impacts anticipated to occur.

5.3.2 Birds

Bald Eagle *(Haliaeetus leucocephalus)*

Species Account

The bald eagle typically nests within trees in forested areas, especially mature and old-growth stands, adjacent (usually <2 km) to large bodies of water with suitable forage for waterfowl and fish; bald eagles rarely use cliff faces adjacent to large bodies of water. Eagles winter roost in large trees in forests, river bottoms, or near canyon rims, usually within a few miles of ponds, lakes, and rivers with adequate prey. Ponds and lakes are used until completely iced over and prey availability is reduced.

Bald eagles tend to stay near their nesting locations throughout the year as long as food is available, and the weather is bearable. If they do vacate an area, they tend to travel the distance necessary to find adequate food and shelter. Younger birds tend to travel extensive southern migration routes from northern regions. As birds get older, northern populations will migrate south later and return earlier (AGFD 2010). Because of these migratory patterns, there is potential for some individuals to remain present on the Navajo Nation year-round, depending on age, nesting status, and resource needs.

Threats to bald eagle populations include habitat loss, reduction in prey, and reproductive impairment from pesticides and heavy metals. Losses have also been attributed to illegal shooting, trapping, poisoning, electrocution from powerlines, collision, and various accidents (AGFD 2010)

Existing Habitat

There are few nesting records on the Navajo Nation, and migrants use various lakes, including (but not limited to): Wheatfields, Tsaile, Many Farms, Morgan, Red, Black Lakes, and various lakes in the Chuska Mountains. Wintering eagles occur along the San Juan and Colorado Rivers (NNHP 2020).

Effects Analysis

There is little potential for bald eagles to be directly impacted by noxious weed treatments. The species conservation measures, including buffer distances outlined in NNDFW 2020, would eliminate potential impacts on nesting eagles. The steep cliff habitats occupied by eagles also eliminates the risk of direct impacts of the treatments on non-nesting eagles. Mechanical, including prescribed fire, and mechanized chemical treatments may impact non-nesting eagles due to noise impacts. However, these impacts would be temporary, and eagles would likely disperse from a site with disturbance. Prescribed fire and aerial herbicide spraying would not occur during the breeding season and would require a ¾ mile (1.2 km) buffer from a nesting site during non-breeding season.

Eagles may encounter indirect effects from herbicide by consuming a prey that either consumed sprayed vegetation or was directly sprayed. This is unlikely since the primary prey eagles consume are nocturnal. Weed treatments would not occur at night. Herbicide drift may indirectly impact non-nesting eagles, however non-nesting eagles are more likely to disperse from a site with disturbance. Also, best management practices minimize herbicide drift. Biological control will have no effect on eagles. No synergistic or cumulative impacts are anticipated.

Weed treatments in eagle foraging habitat would enhance the plant community and provide beneficial habitat for prey species. This would be a long-term beneficial impact to golden eagles by increasing prey availability.

Golden Eagles *(Aquila chrysaetos)*

Species Account

Golden eagles nest on steep cliffs, typically ≥ 30 m in height, although shorter cliffs (≥ 10 m) are infrequently used. Nests are located in a variety of different habitats, including low elevation deserts and rugged mesas, and high elevation woodlands and forests (Stahlecker et al. 2009). Nesting cliffs are usually adjacent to foraging habitat consisting of desert grasslands or desert scrub, ponderosa pine and pinyon pine and juniper. These areas provide habitat for their primary prey, cottontail and jackrabbits, and to a lesser extent prairie dogs. Nests are usually constructed in the middle to upper parts of cliffs on sheltered ledges, potholes, or small caves, which provide protection from the elements.

Existing Habitat

On the Navajo Nation, golden eagles are widespread year-round residents. Nesting occurs at nearly all elevations across the Navajo Nation, and on nearly all types of cliff substrates including sandstone, limestone, and those of volcanic origin (NNHP 2020).

Effects Analysis

There is little risk for golden eagles to be directly impacted by noxious weed removal. The species conservation measures, including buffer distances outlined in NNDFW 2020, would eliminate the potential impacts on nesting eagles. The steep cliff habitats occupied by eagles also

eliminates the risk of direct impacts of the treatments on non-nesting eagles. Mechanical, including prescribed fire, and mechanized chemical treatments may impact non-nesting eagles due to noise impacts. However, these impacts would be temporary, and eagles would likely disperse from a site with disturbance. Prescribed fire and aerial herbicide spraying would not occur during the breeding season and would require a ¾ mile (1.2 km) buffer from a nesting site during non-breeding season.

Eagles may encounter indirect effects from herbicide by consuming prey that either consumed sprayed vegetation or was directly sprayed. This is unlikely since the primary prey species eagles consume are nocturnal. Weed treatments would not occur at night. Herbicide drift may indirectly impact non-nesting eagles, however non-nesting eagles are more likely to disperse from a site with disturbance. Also, best management practices minimize herbicide drift. Biological control will have no effect on eagles. No synergistic or cumulative impacts are anticipated.

Weed treatments in eagle foraging habitat would enhance the plant community and provide beneficial habitat for prey species. This would be a long-term beneficial impact to golden eagles by increasing prey availability.

Ferruginous Hawk *(Buteo regalis)*

Species Account

On the Navajo Nation, most nests are located on clay or rock pinnacles, small buttes, or short cliffs (< 30 m high); fewer are placed on top of juniper trees or on the ground (NNHP 2020). Habitat surrounding nest sites must support populations of their preferred prey: cottontails, jackrabbits, prairie dogs, ground squirrels, and gophers. They typically hunt early in the morning or late in the afternoon. The ferruginous hawk is threatened by long-term population decline, human disturbance, overgrazing and past and present habitat destruction and modification. Their population is directly linked to the presence of prey items.

Existing Habitat

The Navajo Nation is used by ferruginous hawks year-round; most hawks (>90%) breed and winter in northwestern New Mexico, but also occur in Chinle Valley and Dilkon area (NNHP 2020). They occur in open areas of desert grasslands with scattered trees, rocky mounds or outcrops, and shallow canyons that overlook open valleys. They may occur along streams and agricultural areas during migration.

Effects Analysis

Ferruginous hawks would not experience direct effects from any treatments during the breeding season, because the conservation measures would be implemented around nest sites. However, ferruginous hawks may be directly impacted by weed removal activities outside of the breeding season. Weed control activities may occur in foraging habitat using chemical, mechanical, and manual methods. The herbicides proposed, including metsulfuron, chlorosulfuron, clopyralid, 2,4-D, glyphosate, isobaxen, and thifensulfuron-methyl are slightly to moderately toxic eye

irritants to predatory birds. Dichlobenil, metribuzin, paraquat, and pendimethalin are slightly to moderately toxic to predatory birds, which may affect ferruginous hawks if directly sprayed. Hawks may experience indirect effects if ingesting prey sprayed by herbicides. Implementing the species conservation measures would reduce the risk of contamination and disturbance to this species during the nesting season.

Mechanical and manual treatments may provide some habitat disturbances. Nests would be protected from the disturbances by the buffer distances outlined in the species conservation measures. Ferruginous hawk prey may be affected by manual and mechanical noxious weed treatments through trampling or crushing of burrows from heavy machinery. However, the removal of noxious weeds and replanting of native grass species would provide more beneficial habitat for small mammal prey species, which would benefit ferruginous hawks. There are no synergistic or cumulative impacts anticipated for this species.

American Dipper *(Cinclus mexicanus)*

Species Account

American dippers nest near clear, unpolluted water in mountain, coastal and desert streams of the West. Rivers and streams are typically comprised of a variety of riffles, pools, and waterfalls with substrates of rocks, sand, and rubble. Nests are placed on ledges, or in crevices, on stream bank structures of small cliffs, large rocks, fallen logs and tree roots. Dippers feed on aquatic insects and their larvae by dipping their head in the water.

Dippers may be impacted by road construction in nest locations. Also, dam construction threatens to flood dipper habitat, and logging, mining, and agriculture can affect water quality and reduce the availability of their aquatic insect prey (Kingery 1996).

Existing Habitat

Dippers are present on the Navajo Nation on the east and west faces of the Chuska Mountains, upper Canyon de Chelly, the Little Colorado River, and upper Piute Canyon near Navajo Mountain (NNHP 2020). This species may occur anywhere on the Navajo Nation where perennial streams have the appropriate habitat parameters.

Effects Analysis

Nesting American dippers would not receive direct impacts from noxious weed treatments due to the implementation of buffers listed in the conservation measures. American dippers may be impacted by chemical, mechanical and manual noxious weed removal outside of the breeding season. Only herbicides registered for aquatic use would be used in riparian areas and all are practically non-toxic to small birds and their aquatic invertebrate prey (White 2007). No herbicide treatments of aquatic weeds would be conducted; therefore, water quality will not be affected. Dippers rely on clear streams to harvest prey. Trampling or habitat disturbance may occur to dipper habitat during mechanical or manual treatments. These actions may impact water quality, but would be short in duration and minimal. Dippers would be displaced temporarily

during treatments outside of the nesting season. They would benefit from the long-term effects of noxious weed removal and native species planting by creating more habitat for dippers and improving water quality. It is anticipated that there would be no cumulative impacts or synergistic effects.

Northern Goshawk *(Accipiter gentilis)*

Species Account

The goshawk is a forest habitat generalist that uses a wide variety of forest seral stages. A variety of forest types, ages, and successional stages often surround nest sites and are used extensively by recently fledged young. It preys on small to medium size birds and mammals, which it captures on the ground, in trees, or in the air (Reynolds et al. 1992).

Existing Habitat

On the Navajo Nation, goshawks occupy the Chuska Mountain Range, Defiance Plateau, and Black Mesa (NNHP 2020). This species occupies ponderosa pine, mixed species, and spruce-fir forest types in the Southwest, usually above 6000 ft. In Arizona, goshawks primarily nest in mature conifers and cottonwoods located in drainages, canyon bottoms, or north-facing forested slopes with ponderosa pine stands composed of large mature trees and high (60-90%) canopy closure (NNHP 2020). They also inhabit mixed-species, spruce-fir, and aspen stands.

Effects Analysis

There is little risk for goshawks to be directly impacted from noxious weed removal treatments. The species conservation measures, including buffer distances, would eliminate potential impacts on nesting goshawks. Goshawks may be indirectly impacted by herbicide drift from chemical treatments; however, the proposed chemicals are practically non-toxic to predatory birds (White 2007). Also, best management practices would minimize herbicide drift. Mechanical treatments, including prescribed fire and mechanized chemical treatments, may impact goshawks due to noise impacts. These impacts would require a buffer to nest sites year-round. This impact would be temporary, and foraging goshawks would likely disperse from a site with noise disturbance.

Goshawks may encounter indirect effects from herbicide by consuming a prey that either consumed sprayed vegetation or was directly sprayed. This would be limited by the treatment buffers required around nest sites year-round. No synergistic or cumulative impacts are anticipated to occur.

Weed treatments within goshawk habitat would enhance the plant community and provide beneficial habitat for prey species. This would be a long-term beneficial impact to goshawks by increasing prey availability.

Clark's Grebe *(Aechmophorus clarkia)*

Species Account

Clark's grebe construct their nests in the water, typically anchored to a submerged snag or built from a collection of plant material from the bottom to the water surface. Occasionally, mating couples will build their nests on land, but will be close to the water to transport young to the water (AGFD 2013a).

Clark's grebe has been threatened by alterations in water availability and by habitat degradation from recreational use, which can impact the backwaters and coves used for breeding (USFS 2007, AGFD 2013a). Recreational use can make nesting pairs vulnerable, as those who approach nests too closely can cause adults to flush, leaving nests open to gulls and other predators. Impaired water quality is also a potential threat, which is linked to pesticide use and oil spills in habitats (LaPorte et al. 2013).

Existing Habitat

Clark's grebe nest on fresh-water lakes and marshes with extensive areas of open water bordered by emergent vegetation. They use lakes and occasionally small ponds during migration.

Its breeding range includes most of the western U.S. and Canada and east to the Great Lakes. The grebe winters along the Pacific Coast of the U.S., northern Mexico, and inland on open waters from California east to southern Texas.

On the Navajo Nation, this species has only been documented at Morgan Lake, but there is potential for the species on open waters throughout the Navajo Nation (NNHP 2020).

Effects Analysis

The Clark's grebe has only been identified in one location on the Navajo Nation at Morgan Lake, however many of the wetlands and lakes found on the Navajo Nation could be used during migration. While treatments are not proposed for any aquatic noxious weeds, treatments proposed for noxious weeds adjacent to open waters pose the most risk of impacting the grebe. Of greatest concern, would be nesting pairs that may build their nests on land next to open water bodies. Prior to the start of any weed treatments, surveys by a qualified biologist are required near potential habitat to determine if the species occurs in the proposed treatment site. If it is determined that the grebe occurs within the proposed project site, the species conservation measures proposed above would be implemented to avoid and minimize direct impacts to the species related to noxious weed management.

Because the grebe is an aquatic bird species, one of the largest concerns regarding weed treatment are techniques that could impact water quality in suitable habitat. Herbicide use, as proposed under the plan, would require mixing of all herbicides at designated staging areas at least 300 ft away from open water. Fueling of equipment and vehicles would also take place in these areas to minimize the risk of fuel spills. A spill contingency plan is required for any projects using herbicides. Aerial herbicide applications would require additional measures to

avoid potential impacts to the grebe, such as considerations for formulation and wider buffer distances away from occupied habitat and nesting areas. As part of this plan, all aerial applications that occur in areas with rivers or lakes require the use of only aquatic-approved herbicides. Such formulations are safer to use in aquatic environments and have limited persistence in water, reducing the potential for long-term impacts. These measures would likely allow weed treatments to not adversely impact the Clark's grebe.

Since Morgan Lake, the one location where the Clark's grebe is known to occur on the Navajo Nation, is also a popular recreation site for fishing, there is potential for cumulative impacts. These populations may be under additional stress from recreational use of the lake, which may make them more susceptible to impacts from weed treatments. However, the species conservation measures and best management practices would minimize the risk for direct and indirect impacts on the grebe. Overall, management of noxious weeds are not likely to adversely impact the Clark's grebe.

Northern Saw-whet Owl (*Aegolius acadicus*)

Species Account

Northern saw-whet owls roost during the day in thick vegetation; next to tree trunks of small trees in dense scrubby thickets or near a lower branch of larger trees, especially overhung by another branch. Their prey consist primarily of small mammals, such as deer mice, shrews, and voles, but will eat squirrels, moles, bats, birds, and some insects. They hunt almost entirely at night from perches on low branches, shrubs or fence posts in forest openings and other habitat edges. The greatest threat to northern saw-whet owls is destruction of habitat, particularly nesting snags. Logging has reduced suitable breeding habitat.

Existing Habitat

Northern saw-whet owls prefer coniferous forests but can be found in deciduous woodlands and riparian zones. They nest in tree cavities in relatively open ponderosa pine, Douglas-fir, or mixed conifer forests; they may also nest in old-growth riparian woodlands (NNHP 2020). Foraging habitat includes in sagebrush habitats. The owls' wintering habitat is variable, but dense vegetation is critical.

The northern saw-whet owl's breeding range includes most of the northern and western U.S., Canada, and central Mexico. There is no documented breeding on the Navajo Nation, but potential exists in forests and wooded canyons of the Chuska Mountains, Defiance Plateau, Black Mesa, and Navajo Mountain (NNHP 2020).

Effects Analysis

There is little potential for Northern saw-whet owls to be directly impacted by noxious weed treatments. Owls are active at night and treatments would occur during the day. Prior to completing weed treatments in owl habitat, surveys would be conducted to determine the presence of the species. If present, mitigation measures would be implemented. The best

management practices would also eliminate overspray to roosting owls during the day. The proposed herbicides are slightly to moderately toxic to predatory birds (White 2007). The species conservation measures, including buffer distances, would eliminate potentials impact on nesting owls. Northern saw-whet owls may encounter indirect effects from herbicides by consuming prey that either consumed sprayed vegetation or was directly sprayed.

Mechanical treatments may impact owls due to noise impacts. However, these impacts would be temporary and minimal, particularly in native habitats. Mechanical impacts for grassland habitats would be minimal on the owls since they would not use these habitats during treatments. Owls disturbed by noise would likely disperse from a site with disturbance. No cumulative impacts or synergistic effects are anticipated to occur.

Weed treatments in owl foraging habitats would enhance the plant community and provide beneficial habitat for prey species. This would be a long-term beneficial impact to owls by increasing prey availability.

Burrowing Owl *(Athene cunicularia)*

Species Account

Burrowing owls are small, ground-dwelling owls. They nest in ground burrows (often deserted prairie-dog burrows), typically in dry, open grasslands or desert scrub. However, grasslands with sparse junipers may be used on the Navajo Nation; presence of a suitable nest burrow is critical. They hunt in flight, from perches, and on the ground, with the ability to take prey midair, or by hovering above their prey and then dropping rapidly to capture the intended victim. While most populations in Arizona are non-migratory, it is believed that populations in northern Arizona are migratory. They are sensitive to high temperatures, which limits their daytime activities (AGFD 2001a).

Burrowing owls have significant declined in the western United States due to habitat degradation, loss, and fragmentation from human land development for agriculture and residential construction (NMDGF 2015). Declines have also been connected to the loss of many burrowing mammal populations. While the burrowing owl does responds positively to grazing, nest loss has been associated with human efforts to control squirrels and prairie dogs by poisoning (AGFD 2001a).

Existing Habitat

Potential range on Navajo Nation includes all low-elevation desert lands to elevations where juniper habitat is found (NNHP 2008).

Effects Analysis

The wide range of potential habitat for the burrowing owl indicates the potential for weed treatments to occur in areas occupied by the owl. However, populations on the Navajo Nation occur irregularly, with most in the San Juan Valley (NMDGF 2015). Due to their limited

populations, it is unlikely that weed treatments will have much impact on the species. Direct effects would be eliminated when conservation measures are implemented, particularly during breeding season. Indirect effects may come from herbicide overspray and smoke impacts during prescribed fires. None of the proposed herbicides cause secondary poisoning on predatory mammals (White 2007); therefore, herbicide overspray will not adversely affect burrowing owls. Implementing the conservation measures would eliminate the indirect effects from smoke from prescribed fire during breeding season.

Cumulative impacts may occur if abandoned mammalian burrows, that are potential habitat for burrowing owls, are proposed for agricultural or infrastructure development and mechanical clearing is proposed at the same site. If conservation measures are implemented, mechanical clearing would not occur during the breeding season. Outside of the breeding season, clearing would provide greater habitat for burrowing mammals by removing dense weeds. Many burrowing mammals, such as prairie dogs, ground squirrels, or foxes, would be temporarily displaced, but would likely recolonize areas after clearing ends. While development is irreversible, unless agricultural land becomes fallow, mechanical clearing would provide more habitat if adjacent to developed land. There would be no synergistic effects.

Belted Kingfisher *(Ceryle alcyon)*

Species Account

The belted kingfisher nests in burrows in earthen banks, usually near major water sources (streams, rivers, ponds, and lakes), with adequate prey of small fish and other aquatic animals. Important components of aquatic habitat for the species include clear water, riffles, and lack of overgrown vegetation. Small lakes, ponds, coves, and shallow bays of larger lakes are preferred lentic habitats. The kingfisher is generally solitary and prefers branches, stumps, snags, and powerlines near waterways for perches. Common predators include snakes, mammals, the peregrine falcon, and the sharp-skinned hawk. They can avoid raptors by diving below the water's surface.

The reasons for belted kingfisher population decline in the southwest are not well understood, though habitat loss and deterioration may be a factor. While kingfishers live near humans, they require relatively undisturbed areas near water for suitable hunting and nesting sites. Breeding habitat may be lost or compromised by river management activities, channelization, erosion, development, livestock grazing, and recreational land use. Kingfishers may avoid or vacate habitats that are frequented by human, especially when breeding (Hamas 1994, NMACP 2016).

Existing Habitat

On the Navajo Nation, the species is known from the Chuska Mountains (Tsaile and Asaayi Creeks), Morgan Lake, and the Little Colorado River. There is potential for the species to occur throughout the Navajo Nation where appropriate habitat exists (NNHP 2020).

Effects Analysis

The belted kingfisher would not receive direct impacts from noxious weed treatments due to the implementation of buffers listed in the conservation measures. Kingfishers may be impacted by chemical, mechanical and manual noxious weed treatments outside of the breeding season. Prescribed fire, mechanized ground and low and high aerial chemical spraying require a 1/8-mile (0.2 km) buffer from the active nest site from April 15- August 15. Chemical spot and manual treatments require 330 ft (0.1 km) buffer from the active nest.

Only herbicides registered for aquatic use are proposed for use in the riparian areas and all are practically non-toxic to small birds and their aquatic invertebrate prey (White 2007). No aquatic herbicide treatment would be conducted; therefore, water quality will not be affected. Kingfishers rely on clear streams to harvest prey. Trampling or habitat disturbance may occur to kingfisher habitat during mechanical or manual treatments. These actions may impact water quality; however, these impacts would be short in duration and minimal. Kingfishers would be displaced temporarily during treatments outside of the nesting season. Kingfishers would benefit from the long-term effects of noxious weed removal and native species planting as they create more habitat for dippers and improve water quality. No cumulative impacts or synergistic effects are anticipated.

Mountain Plover (*Charadrius montanus*)

Species Account

Mountain plover prefers dry shrublands, badlands, short grass prairie, and abandoned agricultural fields, including land disturbed by burrowing rodents such as prairie dogs (*Cynomys* spp.), native herbivores, or domestic livestock for foraging and nesting. Nests are usually located in flat (≤ 2-degree slope) to slightly rolling. Nests consist of a scrape in dirt, often next to a grass clump or old cow manure pile. Migration habitat is similar to breeding habitat. Suitable habitat ranges in elevation from 135 feet below sea level to 7,000 ft.

Existing Habitat

Known breeding areas on the Navajo Nation occur only in New Mexico (NNHP 2020). However, grasslands between the Chuska Mountains, Black Mesa, and southwest of Black Mesa to Little Colorado River are potential habitat (NNHP 2020).

Effects Analysis

Mountain plovers prefer dry shrublands, short grass prairie, and abandoned agricultural fields for foraging and nesting. They are rare migrating visitors to the Navajo Nation and only occur during breeding season. Therefore, no direct effects would occur for this species since conservation measures would be implemented. Indirect effects may occur from consuming herbicide contaminated prey. The majority of the herbicides are a slightly to moderately toxic eye irritants, and dichlobenil, metribuzin, paraquat, pendimethalin being slightly to moderately toxic. These chemicals require acute or chronic ingestion rates higher than would be used in the field to have observable effects on birds. The buffers established in the conservation measures

would reduce the risk of plovers encountering contaminated prey. Treated sites would be revegetated with native grass and forb species. This replacement vegetation would provide additional habitat for mountain plover.

Cumulative impacts may occur if the land is heavily grazed by livestock and treated for noxious weeds. Plovers prefer more open and disturbed habitat, so grazing provides habitat for the species; however heavy grazing poses a risk of nest trampling since the species nests on the ground. If a nest is trampled and plovers are seeking other areas for nesting, noxious weed treatments could impact these peripheral areas. Noxious weed treatments would provide more beneficial habitat to plovers in the short term by removing vegetation and long-term positive impacts from the recolonization of native grass and forb species. There are no synergistic effects anticipated for this action.

Dusky (or Blue) Grouse *(Dendragapus obscures)*

Species Account

The dusky grouse nests primarily in mixed-conifer stands with relatively open tree canopies, but possibly in nearly all montane forest habitats, especially those dominated by Douglas-fir with varying amounts of aspen, and possibly ponderosa pine. Winter habitat is nearly exclusively montane conifer forests composed of fir or spruce, and occasionally pinyon pine.

The grouse is primarily an herbivore, feeding on conifer needles and cones during the winter and preferring a variety of berries in the summer months. They also feed on insects, especially grasshoppers (James 2014). Common predators include mountain lions, bobcats, bears, badgers, and large raptors. Since the grouse can only fly in short bursts, camouflage is their best defense against predators (James 2014).

Forest management practices are known to affect dusky grouse populations. The species does poorly in even-aged silvicultural systems compared to old-growth forests. Overall, populations at the southern end of their range have been declining more than populations towards the northern end (Kaufman 2005). Declining populations are most impacted by deforestation and the loss of old growth forest habitat (Pekins et al. 1991) and the use of heavy grazing or overgrazing of habitats (Miyasaki 2003). Both actions remove important conifers that provide shelter and food for the grouse.

Existing Habitat

On the Navajo Nation, they are known only from the Chuska Mountains, with potential habitat occurring at all elevations, but the greatest potential is in high-elevation pine and fir forests, especially during winter (NNHP 2020).

Effects Analysis

The dusky grouse occur only in a very small area on the Navajo Nation, preferring forest habitats. The avoidance buffers in the conservation measures would avoid direct impacts to the dusky grouse. The grouse may be impacted by chemical and manual treatments when performed

outside of the breeding season. Trampling or habitat disturbance may occur in grouse habitat during manual treatments. Cultural treatments are not likely to impact dusky grouse as the most impactful treatment method, targeted grazing, would only be employed in community development areas and in existing and fenced agricultural fields and designated rangeland; areas that do not provide suitable habitat for the grouse. While prescribed burning may temporarily impact grouse populations, over time burning operations would improve habitat and encourage more multi-aged and old growth forest habitat structures. The chemical treatment best management practices would be implemented to prevent overspray to native habitats. Also, the proposed herbicides are slightly to moderately toxic to small birds (White 2007). Dusky grouse may encounter indirect effects from herbicide by consuming sprayed vegetation. The implementation of avoidance measures would minimize that risk and reduce the potential for grouse populations to encounter treated vegetation. Thus, weed treatments would not adversely affect dusky grouse populations.

Weed treatments within grouse foraging habitat would enhance the plant community and provide beneficial habitat valuable forage plants. This would be a long-term beneficial impact to grouse by improving forage availability and diversity.

Yellow Warbler *(Dendroica petechia)*

Species Account

The yellow warbler nests primarily in wet deciduous thickets, especially those dominated by willows, and in disturbed and early successional habitats. Migration habitats are mainly semi-open scrub or shrublands and second-growth forests, often associated with wetlands.

During breeding season, yellow warblers are extremely territorial, choosing to stay in nesting pairs, but will rejoin small flocks after breeding (Kadlec 2003). The species feeds primarily on insects but can supplement their diet with berries. Small insect larvae and caterpillars are preferred, and they are known to glean and hunt for adult insects and spiders. Major predators of the yellow warbler include small birds of prey, such as American kestrels and hawks and small predators, such as parasitic cowbirds or snakes. Some yellow warblers are known to not be fooled when cowbirds lay eggs in their nests, choosing instead to cover the cowbird eggs in another layer of nest material, sometimes burying their own (Kadlec 2003).

The species has been most impacted by the loss of riparian habitat in the southwest and by the expansion of the parasitic cowbird. Some populations may experience declines from the use of certain insecticides, which can affect available food sources for the species. Climate change is anticipated to further reduce suitable habitat for the species in the southwest (NMDGF 2014b).

Existing Habitat

There are no current yellow warbler breeding records for the Navajo Nation, but may occur where suitable habitat is present, especially areas of the San Juan River and its tributaries (NNHP 2020).

Effects Analysis

The project area contains suitable or potentially suitable habitat for migrating and nesting yellow warbler. The natural vegetation in these areas would be retained during treatments. The conservation measures would minimize any impacts from treatments that might disturb yellow warbler or damage their habitat. These measures include timing restrictions during the migrating and breeding seasons; 1/8 mile (0.2 km) buffers from active nests or habitat patches for mechanical and mechanized and low and high aerial chemical treatments. Manual treatments would be allowed up to the habitat patch boundary or suitable habitat, which may cause disturbance to the foraging warblers. However, manual treatments are low impact and short-lived. It is unlikely that yellow warblers would ingest herbicide contaminated insects, or come into direct contact with herbicides, because the buffers would prevent the likelihood of such contact. Yellow warblers will benefit from the treatments by the removal of lower-quality riparian habitat to the planting of native riparian species.

Cumulative impacts may occur in foraging habitats when weed control measures are implemented in fragmented or low-quality riparian habitat. The conservation measures would be implemented, and no treatments would occur in nesting areas as discussed above. While weed treatments would provide cumulative impacts to the habitat, there would be greater benefits from removing noxious weed species and replacing with native riparian vegetation. There are no anticipated synergistic effects.

Hammond's Flycatcher (*Empidonax hammondii*)

Species Account

Hammond's flycatcher breeds in nearly all high-elevation (2,000-3,000 m) forest types, including monotypic Douglas-fir, ponderosa pine, aspen, as well as mixed-conifer and aspen/conifer types; stands are typically dense old-growth with cool micro-climates. Migration habitat is less restrictive, but preferentially includes mid-elevation forests and riparian habitats. They primarily eat insects, varying their diets depending on seasonal and regional availability. They are primarily aerial foragers that may occasionally forage from nest surfaces and the ground (AGFD 2003b).

Hammond's flycatcher populations have been most impacted in the southwest by loss and fragmentation of mature old-growth coniferous woodlands. Logging and stand replacing fires that remove dense stands have negatively impacted the species. Aerial insecticide applications, stream dewatering, and deforestation are also known threats to the species (AGFD 2003b).

Existing Habitat

On the Navajo Nation, its only known nesting site occurs in the Chuska Mountains; however, there is potential on Black Mesa and Navajo Mountain (NNHP 2020).

Effects Analysis

Hammond's flycatcher is known to occur in a very small area on the Navajo Nation, preferring forest habitats. The conservation measures would minimize any impacts from treatments that might disturb Hammond's flycatcher or damage their habitat. These measures include timing restrictions during the migrating and breeding seasons; 1/8 mile (0.2 km) buffers from active nests or habitat patches for mechanical and mechanized and low and high aerial chemical treatments. Manual treatments would be allowed up to the habitat patch boundary or suitable habitat, which may disturb foraging flycatchers. However, manual treatments are low-impact and short-lived.

It is unlikely that the flycatcher would be directly impacted by chemical treatments because buffers and best management practices would be implemented to protect nests and foraging habitat and prevent overspray to native habitats. Hammond's flycatcher may encounter indirect effects from herbicides by consuming insects that either consumed sprayed vegetation or were directly sprayed. However, the proposed chemicals are slightly to moderately toxic to passerine birds through direct consumption (White 2007). While prescribed fires may temporarily impact flycatcher populations, over time burning operations would improve habitat and encourage more multi-aged and old growth forest habitat structures. The implementation of avoidance measures would minimize risks and reduce the potential for flycatcher populations to encounter treated vegetation. Thus, weed treatments would not adversely affect Hammond's flycatcher populations.

Weed treatments within flycatcher foraging habitat would enhance the plant community and provide beneficial habitat valuable forage plants. This would be a long-term beneficial impact to Hammond's flycatcher by improving forage availability and diversity.

Northern Pygmy Owl (*Glaucidium gnoma*)

Species Account

Northern pygmy owls hunt songbirds during the day by sitting quietly and surprising their prey. They nest in tree cavities, often near openings (e.g. meadows, lakes, and ponds), in a variety of montane forest habitats and possibly wooded canyons (NNHP 2020). Montane habitats include coniferous (spruce, fir, and ponderosa pine), mixed conifer-hardwood forests with oak and aspen, hardwood bottomlands, and occasionally aspen stands. Owls may migrate to lower elevations and use woodlands or prairie foothills as wintering habitat.

Existing Habitat

On the Navajo Nation, they occur in the Chuska Mountain Range and Tsegi Canyon; however, there is potential throughout forested areas and canyon lands on the Navajo Nation (NNHP 2020).

Effects Analysis

Direct impacts to Northern pygmy owls may occur from herbicide spraying in riparian and shrubland foraging habitats. If the species forages in these habitats during herbicide applications, there is a slight chance this species could be directly sprayed by herbicide since it is a diurnal predator. Treatment sites should be surveyed for this species prior to implementation so applicators know if the species uses the area for foraging and conservation measures can be applied. This would reduce the risk of direct impacts from herbicide spraying. It is also likely that noise disturbance from noxious weed treatments would deter the owls from temporarily using the site for foraging. Species conservation measures would be implemented to eliminate direct impacts from noxious weed treatments to nesting sites.

Indirect impacts from herbicide may occur to owls that consume prey directly sprayed or that have consumed sprayed vegetation. Best management practices would be implemented during noxious weed treatments to minimize herbicide drift. The herbicides proposed for use in riparian and shrubland habitats are practically non-toxic to small and predatory birds (White 2007). Mechanical and manual treatments may affect owls due to noise impacts. However, these impacts would be temporary, and owls would likely disperse from a site with disturbance. No mechanical treatments would be used in Northern pygmy owl nesting habitat.

Weed treatments within Northern pygmy owl winter habitat would enhance the plant community and provide beneficial habitat for prey species. This would be a long-term benefit to owls by increasing prey availability.

Flammulated Owl (*Otus flammeolus*)

Species Account

The flammulated owl nests in tree cavities in open conifer (usually ponderosa pine) or aspen forests, often with a brushy understory of dense saplings or oak shrubs; areas with old growth are preferred. They are neotropical migratory birds that winter in Central and South America and breed in forests in North America. Owls roost within dense stands with large-diameter trees or regeneration. Nest and roost habitats need a high abundance and diversity of nocturnal arthropods for prey. The species winters in lower elevation habitats, especially riparian areas.

Flammulated owls mainly eat nocturnal arthropods, especially owlet and geometrid moths, crickets, grasshoppers, and beetles. They locate their prey visually from a perch, judging distance by bobbing their heads vertically and horizontally, and deliver only one prey item at a time to their nests (Environment Canada 2013).

The most prominent threat to the species is from habitat loss and fragmentation related to timber harvesting and deforestation in its historic range. This is mostly due to the loss of snags and tree cavities used for nesting. Additionally, the use of some insecticides to control spruce budworm can lower the abundance of non-target insect species that serve as an important food source for the owls (NatureServe 2015b, Strawder 2003).

Existing Habitat

On the Navajo Nation, flammulated owls occur in the Chuska Mountain Range, Defiance Plateau, and Black Mesa. Potential exists throughout forested areas of the Navajo Nation (NNHP 2020).

Effects Analysis

There are only a few locations on the Navajo Nation where weed treatments may occur in areas used by flammulated owls. If owls do occur in proposed treatment areas, the species conservation measures should be employed to reduce direct impacts to the species, especially from chemical and mechanical methods. Manual and biological control methods are not anticipated to impact the flammulated owl directly or indirectly. There is potential for herbicide treatments to indirectly impact owls through overspray or drift into non-treatment areas. However, the conservation measures and best management practices would reduce the potential for impacts. These include restrictions on applying herbicide during windy or humid conditions or during periods with high temperatures. Additionally, the proposed herbicides are all listed as Class 1 or 0, which range in slightly toxic to non-toxic for small and predatory birds (White 2007). Thus, it is anticipated that management and control of noxious weed species will not adversely affect the flammulated owl.

Cumulative impacts may occur for populations impacted by timber harvesting or insecticide use to control forest insects. Such populations may be more sensitive to weed treatments. However, the species conservation measures, and best management practices would minimize such risks and the potential for synergistic effects. Overall, control of weed treatments, such as through mechanical removal or prescribed fire, can help restore forest habitat structure for the flammulated owl.

Band-tailed Pigeon (*Patagioenas fasciata*)

Species Account

The band-tailed pigeon nests primarily in montane conifer or mixed-species forests dominated by pines and oaks between 1,600-2,700 m in elevation (5,250-8,850 ft). The species prefers pine-Douglas-fir forests and spruce-fir with abundant berry-producing shrubs in Colorado, northern Arizona, and New Mexico. Migratory habitat is generally the same as that used for nesting. The species winters in central and southern California, and throughout its breeding range south of the U.S.-Mexico border.

Acorns serve as the staple food source year-round in the pigeon's range. Field grains, trees buds, cherries, blackberries, raspberries, and elderberries are the principal foods in the spring and summer months, while leaves and acorns are consumed during the late summer and fall (Ulev 2006). Mineral springs are also important to supplement mineral needs of their diet. The breeding season is prolonged, taking place from the beginning of March through fall in some areas and is largely a factor of food availability. Nests are built from a loose platform of twigs in

trees or shrubs under dense foliage but near openings or above a slope or precipice. Band-tailed pigeons have shown high fidelity to nesting sites and mineral springs (NatureServe 2015c).

Populations in North America have experienced significant declines since the early 1900s, with populations in the southwestern United States showing large declines between the 1960s through the 1990s (NatureServe 2015c). The causes for decline have not been adequately verified, but are suspected to be due to habitat loss, degradation, and/or fragmentation, inadequate recruitment, overharvesting from hunting, and/or disease (Ulev 2006). Hunting is still largely permitted in many parts of Arizona, Colorado, New Mexico, and Utah, as it remains unclear how hunting pressure may affect long-term populations.

Existing Habitat

Band-tailed pigeon occurs in the Chuska Mountains on the Navajo Nation; however, there is potential for the species on the Defiance Plateau and possibly Black Mesa and Navajo Mountain (NNHP 2020).

Effects Analysis

While the band-tailed pigeon may occur in areas identified for weed treatments, it is not likely that treatments will directly impact the species. Effects from noise, habitat alternation from the removal of noxious weed species, and smoke or disturbance from prescribed fire may result in some pigeons temporarily leaving treated sites, but such impacts are not likely to result in permanent abandonment of these locations. The species conservation measures would allow work crews to avoid more sensitive nesting sites while implementing treatments. Herbicide treatment may indirectly impact some populations by exposing them to overspray or drift or by consuming contaminated food. The best management practices and above-mentioned species conservation measures would reduce the potential for such impacts by creating wide buffers around sensitive nest sites and restricting the use of herbicides during certain weather conditions. Such measures would reduce or eliminate the potential for pigeons to encounter or consume herbicides. Additionally, all proposed herbicides are not considered to be highly toxic to small or foraging bird species, such as the band-tailed pigeon (White 2007). These factors indicate that the integrated weed management plan would not likely adversely affect the band-tailed pigeon.

Cumulative impacts may be present for populations stressed from low birth rates, hunting, and/or habitat degradation. Such populations may be more sensitive to impacts from weed treatments. However, the species conservation measures and best management practices would reduce the potential for such impacts and the risk of synergistic effects. Overall, the removal of noxious weed species would improve foraging habitat and incorporate many of the forest management strategies suggested for conserving the band-tailed pigeon. As such, treatment and management of noxious weed species within band-tailed pigeon habitat would benefit the long-term survival of the species on the Navajo Nation.

American Three-toed Woodpecker (*Picoides dorsalis*)

Species Account

The American three-toed woodpecker is a resident bird to western North America. They feed on beetles found in decaying and dead trees within their range, often occurring in low densities. Populations may increase significantly in areas where fires have recently burned, or where other natural disturbances cause widespread die-off in conifer stands, leading to bark beetle. Such occurrences often lead woodpeckers to remain in affected areas for up to three years (Wiggins 2004). Breeding season for the species is estimated from March through late July, with birds preferring the use of snags or stubs found in a mature, unlogged, conifer forests that have undergone some form of disturbance (Wiggins 2004).

The American three-toed woodpecker nests and winters primarily in spruce, fir, aspen, or mixed-conifer forests (and possibly adjacent ponderosa pine habitats) above 2,400 m (8,000 feet) in elevation; ideal conditions have mature or old-growth stands, fire-killed trees, 42-52 snags per 40 ha (100 acres), and/or large numbers of bark-boring beetles. Nests are placed 1½-15 m high in a stump or dead/dying conifer or aspen.

Declines in the species have been largely attributed to forest management practices that affect old-growth forest habitat structure and natural disturbance regimes. Even-aged stand structures, short logging rotations, invasive species, and suppression of forest fires have largely contributed to the decline of the American three-toed woodpecker (Wiggins 2004).

Existing Habitat

On the Navajo Nation, the species is only known from the Chuska Mountains and has low potential to exist within habitats on Black Mesa and Navajo Mountain (NNHP 2020).

Effects Analysis

The American three-toed woodpecker is found in some areas on the Navajo Nation where noxious weed treatments may occur. Some treatments, such as mechanical removal, prescribed fire, and chemical applications may impact or disturb populations in treatment sites. The species conservation measures would require work crews to avoid or minimize disturbance to sensitive nesting birds and minimize encounters with birds while applying treatments. Herbicide applications have the potential to indirectly impact birds from overspray or drift, which may result in herbicides coming directly into contact with birds or their prey. Such impacts are most likely from broadcast aerial applications in treatment areas. However, the recommended buffers for these application methods, along with restrictions on herbicide use during weather conditions that can facilitate herbicide drift or volatilization, would reduce the potential for broadcast herbicide treatments to adversely impact woodpecker populations.

Cumulative impacts may occur for populations near timber harvesting operations in the Chuska Mountains. These populations may be more sensitive to weed treatments, which may be implemented as part of a forest management prescription. However, use of buffer zones and the

best management practices outlined for each weed treatment method would minimize or avoid potential impacts to woodpecker populations. Noxious weeds, such as cheatgrass and Russian thistle, can increase the frequency and severity of fires within forests. While the woodpecker relies on such disturbance events for increased beetle activity, such fires increase the risk of severe fires that leave few live remaining trees, instead of the mixed severity fires the woodpeckers prefer (Kotliar et al 2008). While the continued spread of noxious weed species may provide a short-term benefit to the woodpecker by facilitating disturbance in its native habitat, increased fire severity would reduce the occurrence of preferred moderately burned forest patches and could negatively impact old-growth forest habitats that the woodpeckers rely on. Thus, the management of noxious weeds would contribute to creating more pre-historic disturbance regimes that would benefit the woodpecker over the long-term.

Sora (*Porzana carolina*)

Species Account

The sora nests in wetlands with shallow to intermediate-depth water and fine-leaved emergent vegetation (typically cattails, sedges, bur-reeds, and bulrushes); floating and submerged vegetation increases habitat quality. Wetlands with heavy snow, ice, or high water until early May are unusable for nesting. Migration habitat is typically wetlands with tall dense vegetation and shorter seed-producing plants, but occasionally may include upland habitats (e.g. fields and pastures).

Their diet consists mostly of seeds, insects, and snails. Seeds are primarily from common wetlands species and snails and insects are foraged from the ground surface. During mating season, which occurs from April to July, sora weave shallow basket nests from dead emergent wetland vegetation either directly over or adjacent to the water.

Many populations within the central United States have showed significant declines with losses attributed to wetland loss from drought or habitat loss (Stavne 2002). Heavy grazing has also negatively impacted sora habitat (Meyer 2006). However, the species is still widely abundant throughout much of its historic range.

Existing Habitat

The species winters in the extreme southern US, Mexico, and Central America. It is known from various ponds and lakes on the Navajo Nation, including several in the Chuska Mountains, Morgan Lake, and near Tuba City. The species may also exist in suitable wetlands throughout the Navajo Nation (NNHP 2020).

Effects Analysis

Because the sora occurs within wetland habitats, which are closely associated with riparian habitats, there is the potential for weed treatments to occur where sora are present. Biological control methods are not likely to impact the sora, beyond temporarily flushing the species while placing species. Targeted livestock grazing is not likely to occur within sora habitat as these

treatments are only proposed for Community Development Areas and agricultural or grazing areas, which will be fenced. While the sora may occasionally forage in these areas, they are considered of little value for the species. Other cultural treatments, such as restoration of native vegetation, would benefit the sora, by creating more diverse plant communities and improving wetland habitat. The species conservation measures, described above, would reduce or eliminate the risk of mechanical, manual, and chemical treatments directly impacting the sora at treatment sites. Such measures would reduce impacts around more sensitive nesting areas and wetlands habitats by creating avoidance buffers. While the temporary loss of vegetation from treated sites may prevent the sora from utilizing treated habitats, birds are known to return to degraded sites once native wetland plants re-establish.

Herbicides may pose concern for the sora. Because sora are found in wetland habitats, only aquatic-approved herbicides would be used to treat potential habitat for the sora outside of the breeding season. Additionally, chemical treatments would not be permitted within 330 ft of an active nest. However, glyphosate does present a concern as it does have an aquatic formulation that may be applied near wetland habitats. In one study, sora abundance was less in wetland areas treated with glyphosate (Zimmerman et al. 2002). However, the abundance may have also been from a lack of living vegetation in the treated areas than from direct impacts from the herbicide. The species conservation measures and the best management practices for chemical treatments would minimize the risk of herbicide impacts to the sora. These include avoidance of nesting habitats and restrictions on herbicide applications near open water. Herbicides would also not be applied during high humidity, high winds, and high temperatures to reduce the risk of herbicide drift in non-treatment areas and to allow herbicides to work more effectively. The weed management plan, based on these measures, would not likely adversely affecting the sora.

Cumulative impacts may exist for sora populations impacted by changes in water availability, grazing, or loss of native plant communities. These populations may be more sensitive to impacts from the removal or control of noxious weed populations. The best management practices and species conservation measures would prevent or minimize potential synergistic impacts from noxious weed management. Additionally, the noxious weed removal from sora habitat would benefit the species, by replacing noxious weeds (which do not provide suitable habitat for the species), with preferred native plant communities and species. Thus, the integrated weed management plan would benefit the sora over the long-term.

Tree Swallow (*Tachycineta bicolor*)

Species Account

Tree swallows are small neotropical migratory birds that live in open areas near open water sources. They primarily eat flying insects along with some plant material. They forage while in flight and sometimes in flocks when insects are abundant, gleaning insects from the water or vertical surfaces from dusk until dawn. When weather conditions are bad, their diets become more herbivorous, feeding on bulrushes, bayberries, and other plant seeds (Roof and Harris

2001). When breeding, males and females engage in a complex courtship flight coinciding with more abundant food availability. Males select tree cavities for nesting prior to female arrival, and the females then select a nest site with an occupying male. Once paired, the females will construct a nest of grass to lay 4-7 eggs and incubate for about two weeks (Kaufman 2001).

Tree swallows breed in the existing cavities of a variety of tree species (coniferous and deciduous), and often use snags in open fields near water, especially marshes and wooded ponds. The Tree Swallows' breeding range includes most of central and northern North America but is a local breeder in Arizona and New Mexico.

Climate change models indicate that trees swallow wintering habitat will shift further north and inland, with a 56% loss of current winter range in the next 70-80 years (Langham et al. 2015). The movement of tree swallows north would require an increase in nest sites either through standing dead trees or human-supplied bird boxes. Herbicides, such as PCBs (polychlorinated biphenyl) and DDE (dichlorodipheynldicholorethylene, a biproduct of DDT), may affect some populations as studies have found high levels in adults, eggs, and nestlings, which may affect long-term recruitment of the species (Roof and Harris 2001). The use of some insecticides, such as imidacloprid, may also affect the health of insectivorous birds, such as the tree swallow (NMDGF 2013c). Lastly, the loss of dead standing trees could impact breeding success as the tree swallow uses the tree cavities for nesting habitat (Roof and Harris 2001).

Existing Habitat

On the Navajo Nation, the tree swallow occurs in the Chuska Mountains; but may be found throughout forested areas of Navajo Nation (NNHP 2020).

Effects Analysis

Tree swallow habitat on the Navajo Nation may occur in areas requiring noxious weed treatments. The conservation measures would avoid direct impacts to the tree swallow. The swallow may be impacted by chemical and manual treatments when performed outside of the breeding season. Cultural treatments, such as native plant restoration and mulching, are not likely to impact tree swallow. Targeted grazing would not occur in tree swallow habitat, as it would only be permitted in Community Development Areas and in fenced-in designated agriculture and rangeland areas. While prescribed fire may temporarily impact swallow populations, over time burning operations would improve habitat and encourage more multi-aged and old growth forest habitat structure. Many of the proposed chemicals are slightly to moderately toxic or non-toxic to small birds (White 2007). Potential negative effects from chemical treatments would be minimized or reduced by implementing the species conservation measures and following the best management practices. Such measures include restrictions on herbicide applications during periods of high humidity, high temperatures, or windy conditions to prevent overspray and drift. Tree swallows may encounter indirect herbicide impacts by consuming insects that either consumed sprayed vegetation or were sprayed during operations. The conservation measures would minimize such risks and reduce the potential for the consuming sprayed plants and

insects, also reducing the risk of adverse impacts. Thus, weed treatments would not adversely affect swallow populations.

Cumulative impacts may exist for populations impacted by climate change. The shift in suitable habitat may affect species migration, tree cavity availability for nesting, and food resources. These populations may be more sensitive to impacts from weed treatments. The species conservation measures and best management practices for weed treatments would reduce or avoid the risk of synergistic impacts on more sensitive tree swallow populations.

Gray Vireo (*Vireo vicinior*)

Species Account

During the breeding season, the Gray Vireo is insectivorous, feeding on a wide variety of flying insects. During the winter, the species is frugivorous, instead preferring fruits from many desert plants. The Gray Vireo will stalk their prey after a short flight, preferring to forage in thickets (NMDGF 2007). During breeding season, males arrive first to the breeding grounds and begin calling for females. Once paired, they will search for a suitable nest site, which are built from woven grasses, bark, plant fiber, spider webs, and cocoons and are located primarily in juniper trees. Eggs are laid one per day until the clutch is complete and then the male and female take turns incubating them for 12 to 14 days (NMDGF 2007).

The gray vireo prefers habitat with mixed pinyon-juniper, juniper-sagebrush associations, and possibly in dry brushland and oak scrub woodlands. Continuous shrub cover, 0.5 – 2 m in height, is an important component of breeding habitat in California and Texas, and possibly on the Navajo Nation. Nests studied in Colorado were typically 2 m above the ground in 3 m tall junipers. The species is known to nest in pinyon pine, sagebrush, sumac, mountain mahogany, and oak species. The species' breeding range includes mostly montane regions and adjacent scrubland in the southwestern U.S.

The primary threat to the Gray Vireo is habitat alteration from juniper control, firewood collection, and energy production. These changes make sites unsuitable for the species, who will not use areas lacking trees. Brood parasites, such as the cowbird, have also impacted the species. It may also be impacted from increased soil erosion in some juniper woodlands, where a loss of native grasses may result in a lack of prey for the vireo (NMDGF 2007).

Existing Habitat

The species winters mostly in south-central Arizona; Sonora, Mexico; the Baja Peninsula; and also, in southwestern Texas. The species distribution on the Navajo Nation is relatively unknown; however, it may occur throughout the pinyon-juniper woodlands on the Navajo Nation (NNHP 2020).

Effects Analysis

It is unknown whether the gray vireo currently occurs on the Navajo Nation, but potential habitat may exist in areas requiring noxious weed treatment. The species conservation measures would minimize and avoid direct impacts to the species from chemical, manual, and mechanical treatment methods. Biological control methods are not likely to impact the species. Herbicide treatments may indirectly impact the species by spraying prey or plant food used by the gray vireo. The buffer distances described in the species conservation measures and the best management practices for chemical methods would minimize the potential for overspray, reducing the risk of exposure for the gray vireo. There are also restrictions on the herbicide applications when there is high humidity, high windspeed, and high temperatures, which would minimize drift and overspray when applied. The integrated weed management plan, based on these mitigation measures, would likely not adversely affect gray vireos that may occur on the Navajo Nation.

There is the potential for cumulative impacts for populations affected by the removal of juniper trees or the loss of native grasses. These populations may be more sensitive to impacts from weed treatments. Removal of some noxious weeds, especially large trees or shrubs, from invaded areas, may reduce the suitability of certain habitats for the gray vireo. However, such impacts would likely be short-lived, as the regeneration of native plant communities may provide better forage habitat for prey. Overall, the treatment of noxious weeds may improve habitat for the gray vireo over the long-term, by improving soil retention and providing more diverse plant communities for valuable prey species.

5.3.3 Invertebrates

Great Basin silverspot *(Speyeria nokomis)*

Species Account

The Great Basin silverspot inhabits perennially wet meadows associated with seeps, springs, and streams, which vary in size from 0.1 ha to >1.2 ha. Habitat must be relatively open, dominated by grasses, and with few shrubs. Violets (*Viola nephrophylla*), found in wet soils in shady areas beneath shrubs or in stream banks, are a necessary habitat component and serve as the host plant for larvae. There is potential for the silverspot to occur on rangeland and farmland where violets, thistles, and other nectar producing plants grow, which are an important food source for adults and can include both native and introduced thistle species (NatureServe 2016). For populations to persist, continuous riparian habitat is needed for dispersal for reproduction and development (Wild Earth Guardians 2013).

The Great Basin silverspot is threatened by habitat loss and fragmentation, altered hydrology, overgrazing, climate change, and the use of pesticides. Expansion of noxious weeds are also a great concern, as the spread of rangeland species like Canadian thistle and leafy spurge, can replace diverse plant communities preferred by the silverspot with dense monocultures (Selby 2007). Noxious weeds can also contribute to habitat loss and fragmentation in riparian corridors.

Overgrazing can negatively impact the silverspot as heavy grazing can reduce nectar availability, alter vegetation cover, and spread noxious grass species (Wild Earth Guardians 2013). However, light to moderate grazing can provide a competitive advantage to violet plants (NatureServe 2016). On the Navajo Nation, heavy grazing and unmanaged grazing have largely reduced ground cover and led to reduced native plant diversity in many areas where the silverspot occurs. The pesticide use can also negatively impact the silverspot. Broadcast spraying can indiscriminately eliminate valuable food sources for larval and adult butterflies. However, the use of selective pesticide applications and non-persistent herbicides (i.e., glyphosate) can reduce negative impacts on non-target vegetation. Such applications, though, can be difficult to apply safely in areas with high water tables, which are also preferred by the Great Basin silverspot (Selby 2007).

Existing Habitat

On the Navajo Nation, the silverspot is known from <10 populations in the Chuska Mountains and Defiance Plateau: Tsaile, Wheatfields, Whiskey Creeks, and two springs near Washington Pass. However, potential exists throughout the Chuska Mountains and the Defiance Plateau where appropriate habitat is present (NNHP 2020). There are 12-13 breeding populations on the Navajo Nation, with each colony requiring 1-2 acres of habitat. These populations are considered stable but may be impacted by grazing and altered hydrology from water use and drought (Wild Earth Guardians 2013).

Effects Analysis

The occurrence of the Great Basin silverspot in riparian areas and rangelands means there is the possibility of weed treatments occurring in their known habitat and range. The greatest concern would be impacts that may harm violets and thistles that are important food sources for the silverspot. Surveys for species occurrence and the host plant would allow field crews to establish appropriate avoidance buffers to prevent and reduce the potential for weed treatments to negatively affect the species. Additionally, the use of targeted grazing would not be permitted in areas where host plants occur and during mating season. This would prevent grazing of required host plants and nectar sources within silverspot habitat.

For the control of many thistle species, the use of biological control agents is proposed. There is concern that some of the proposed biological agents may impact some native thistle species. However, none of the APHIS-approved biological agents proposed would treat thistle commonly used as food sources by the silverspot, including *Cirsium, Carduus, or Onopordum* species. Additionally, while thistles are a nectar source for the Great Basin silverspot, they also use a variety of other species, including horsemint (*Monarda* sp.), and joe pye weed (*Eutrochium* sp.). The silverspot needs diverse nectar sources throughout its adult flight to increase fecundity (Selby 2007). Control of individual weed species in the western seep fritillary may not result in negative impacts as long as other diverse native nectar sources are available. Introducing biological control agents in this species' habitat would eliminate potential deleterious effects from using other treatment methods, including erosion from mechanical methods and herbicide

overspray that could impact its host plant and other native nectar sources. Native flowering plants could be planted on site to provide nectar sources for this species.

Herbicide use may impact silverspot populations, especially for broadcast applications herbicides. Because Great Basin silverspot populations are found in riparian areas near water sources, the use of non-aquatic herbicides would be prohibited per the plan mitigation measures. The use of aquatic approved herbicides in these areas, which are less persistent, would reduce their impacts on preferred food sources. Selective applications of pesticides in silverspot habitat would further reduce the risk of negative impacts on non-target plant species. The implementation of buffer zones and restrictions on herbicide applications during high humidity, precipitation events, and high temperatures would also reduce potential drift or overspray and potential risks to non-target plants.

There is potential for cumulative impacts on Great Basin silverspot populations already impacted by grazing, habitat fragmentation and loss, and altered hydrology. The conservation measures would reduce the risk of synergistic effects from weed treatments in areas where the Great Basin silverspot and its food sources occur. By setting up buffers around known populations identified by a qualified biologist and educating field crews, there is a better chance of reducing adverse impacts to the silverspot. Climate change is also considered a threat to the Great Basin silverspot, as changes in temperature and water availability may alter habitat suitability for the silverspot's host plant and a variety of food sources. The species conservation measures would reduce potential synergistic impacts related to climate change on the species.

Further, the treatment and control of noxious weed species in the silverspot's habitat would benefit the species. Noxious weed monoculture reduction would increase plant diversity and nectar sources. Avoidance of host plants would reduce negative impacts on populations while providing a competitive advantage for native vegetation. Overall, the mitigation measures, including buffers for each treatment method, and best management practices would reduce potential risks to the Great Basin silverspot and allow weed treatments to not adversely affect the species.

Rocky Mountainsnail (*Oreohelix strigosa*)

Species Account

The Rocky Mountainsnail occurs in leaf-litter or within/near rocks and rock outcrops within steep-sloped, northern-aspect coniferous forests. Steep-walled canyons and areas that maintain moist soils are also potential habitat (NatureServe 2015j). Within most of the species' U.S. range, it is restricted to limestone outcrops or under vegetation on limestone slopes where the presence of limestone is critical; sandstone seems to provide adequate substrate, especially on the Navajo Nation (NNHP 2020). Plant community composition is of little importance in determining potential habitat; however, a cool, moist microclimate and leaf mold are critical. This species may be threatened by timber harvesting and high intensity fires that could disturb soil habitat, increase soil temperature, and decrease humidity.

Existing Habitat

On the Navajo Nation, the Rocky Mountainsnail occurs in the southern half of its U.S. range. There is one historic record from the south slope of Navajo Mountain, but presently the species is known from only a few locations in the Chuska Mountains (NNHP 2020). The species may occur throughout forested areas and possibly canyon lands on the Navajo Nation (NNHP 2020).

Effects Analysis

The Rocky Mountainsnail has a limited distribution on the Navajo Nation. None of the herbicides proposed for this project have required buffers for land snails. Also, these snails are typically under leaf litter during the day when herbicide applications would occur so it is unlikely this species would be affected by herbicide overspray. This species may be directly affected by trampling from mechanical or manual treatments in their habitat. Rocky Mountainsnails may be threatened by high intensity fires, which would differ in intensity and severity from prescribed fire. Prescribed fires would be implemented to control surface noxious weeds and material and would not burn hot enough to affect soils. Also, the species conservation measures would reduce this effect on the snails by limiting more impactful treatments in areas where snails occur. Indirect effects may occur from foot traffic trampling when applying treatments. Indirect effects would be reduced by the species conservation measures. Biological controls and cultural treatments would not affect this species.

Cumulative impacts may occur as climate change reduces soil moisture causing additional stress to snails already stressed by weed treatments. Also, development of roads or infrastructure may make snails more susceptible to impacts from weed treatments. The species conservation measures can reduce or eliminate the overall impact of any cumulative effects by establishing buffers that would further protect the species.

Yavapai Mountainsnail (*Oreohelix yavapai*)

Species Account

The Yavapai mountainsnail's only known extant populations on the Navajo Nation occur on steep-sloped, northern-aspect coniferous forest with dense mossy groundcover over an exposed rock/boulder substrate (NNHP 2020). Cool and moist microclimate and dense moss are likely key habitat components. Potential habitats include steep forested slopes with leaf-litter and/or exposed rocks and rock outcrops, steep-walled canyons, and other areas with a cool microclimate and moist soils. Snails take shelter under plants. These snails will not breed in dry conditions, because they are subject to desiccation. This can hurt the population during dry winters (AZGFD 2003c). The snails are active in March – April and October – November, but inactive for the rest of the year (AZGFD 2003c). This species is threatened by habitat degradation from grazing pressure. It cannot traverse grazed areas, so it becomes restricted to suitable habitat (AZGFD 2003c).

Existing Habitat

Historic records indicate the presence of two subspecies on the Navajo Nation (*O.y.clutei* and *O.y.cummingsi*) from Navajo Mountain, but presently the species is only known from one location in Canyon de Chelly National Monument (subspecies unknown) (NNHP 2020). There is potential for the species to exist in forested areas and possibly canyon lands on the Navajo Nation (NNHP 2020).

Effects Analysis

Yavapai Mountainsnail has a limited distribution on the Navajo Nation. None of the herbicides proposed for this project have required buffers for land snails. These snails are active primarily during short periods of the year, in March – April and October – November, so they could be exposed to direct impacts from herbicide spray during this time. Their habitat includes dense moss and rock outcrops so it is unlikely that weeds would be a problem in these areas. This species' habitat is threatened by grazing, and it will not use heavily grazed areas. Cultural control techniques such as target grazing are not proposed in their habitat. These snails may be directly affected by trampling from mechanical or manual treatments in their habitat. The species conservation measure would reduce these effects on the snails. Indirect effects may occur from foot traffic trampling when applying treatments. Indirect effects would be reduced by the species conservation measures. Biological controls would not affect this species.

Cumulative impacts may occur if climate change reduces moisture levels, reducing reproduction and population growth, which could further stress populations impacted by weed treatments. Also, populations stressed by heavily grazing would be further stressed by weed treatments. The species conservation measures can reduce or eliminate the overall impact of these cumulative effects by establishing buffers that would further protect the species.

5.3.4 Fish

Bluehead Sucker (*Catostomus discobolus*)

Species Account

This species was determined as a genetically separate species from the federally listed Zuni bluehead sucker (*C. d. yarrowi*) found in Kinlichee Creek watershed of the Defiance Plateau. Bluehead suckers can occupy a range of water temperatures (16-26°C) and stream volumes (<1 to several hundred m^3/second) (NNHP 2020). They feed primarily on algae scraped off cobbles, boulders, or bedrock (Selby 2020). Adults tend to stay in deep pools and eddies during the day and move to shallow water to feed during the night. Small juveniles occupy shallow, slower stream edges and backwaters. Spawning occurs during spring and summer. One or two males accompany a female into flowing water over gravel substrates and fertilize the eggs as they are expressed by the female (AZGFD 2017).

Threats to bluehead suckers are dams, water diversions, land use practices, drought, climate change, habitat loss, and competition with non-native species. On the Navajo Nation, the

bluehead sucker is also threatened by soil erosion, lack of plant cover, and high nutrient loads from domestic livestock grazing (Selby 2020). Logging and fire increase soil erosion and pollution. Finally, building and road construction increase sediment deposition into streams, decreased water quality, and pollution that can impact spawning areas for native fish (Selby 2020).

Existing Habitat

Bluehead suckers occur on the San Juan River and its major tributaries, Little Colorado River and confluence with Colorado River and Crystal, Tsaile, Wheatfield Creek, and Whiskey Creeks in the Chuska Mountains.

Effects Analysis

No direct impacts would occur to bluehead sucker because no aquatic weed treatments are proposed under this plan. Bluehead suckers are sensitive to increased sedimentation in their habitat and could receive indirect impacts from mechanical or prescribed fire treatments. Conservation measures and best management practices are required to minimize ground disturbance during noxious weed treatments. These impacts would be minimal and temporary. Pile burning and prescribed fire would require a site-specific burn plan and would be conducted 300 ft outside of the floodplain. The mitigation measures in riparian areas require erosion control measures to stabilize and limit erosion along bank lines. Also, long term measures include planting native vegetation to stabilize soils and prevent noxious weed re-growth after weed treatments. Target grazing is not proposed for areas where bluehead suckers occur, as overgrazing has shown to destabilize bank lines and increase erosion.

Another indirect effect may occur from herbicide overspray. Only herbicides determined to be practically non-toxic to fish species would be used within the riparian zone. Aquatic formulations of 2,4-D, glyphosate, triclopyr and imazapyr would be used exclusively within 25 ft of the daily high-water mark. Herbicides that are practically non-toxic to fish and mollusks (White 2007) require a 25 ft (8 m) buffer from the daily high-water mark, including: aminopyralid, chlorsulfuron methyl, clopyralid, diflufenzopyr, imazapic, and thifensulfuron-methyl. Chlorsulfuron, imazapic, imazapyr, and herbicides have shown no risk to fish even if there is an accidental direct spray or spill to aquatic habitats (BLM 2007). No aerial spraying will occur in habitats with bluehead sucker. All herbicide applications would follow required protection measures. These measures would minimize herbicide exposure to such small levels that the effects would be immeasurable to the species or its habitat. The long-term benefits to habitat and critical habitat floodplain areas and its riparian vegetation include improved function, reduced erosion, and an improved invertebrate foodbase due to the return of the native riparian vegetation.

There are no proposed aquatic weed treatments under this plan, and, therefore, no synergistic effects or cumulative impacts are anticipated by the proposed treatments. Cumulative impacts may occur if there is an indirect effect from increased sedimentation from mechanical treatments

in areas where overgrazing has destabilized bank lines. Destabilized bank lines increase erosion particularly during high water events. Conservation measures would be implemented to prevent increased erosion during treatments and would be maintained until native vegetation re-grows. Noxious weed treatments would temporarily decrease vegetation at a site but would stabilize bank lines in the long-term from planting activities.

5.3.5 Amphibians and Reptiles

Northern Leopard Frog (*Lithobates pipiens*)

Species Account

The northern leopard frog requires a mosaic of habitats to meet its life stage requirements. It breeds in a variety of aquatic habitats that include slow-moving or still water along streams and rivers, wetlands, permanent or temporary pools, beaver ponds, and human-constructed habitats such as earthen stock tanks and borrow pits (USFWS 2011f).

The northern leopard frog is threatened by habitat loss, disease, non-native species, pollution, and climate change that individually and cumulatively result in population declines, local extinctions, and disappearance from vast areas of its historical range in the western U.S. and Canada.

Existing Habitat

On the Navajo Nation, historic records include the Chuska Mountains; Little Colorado, Colorado, and San Juan Rivers; Navajo and Chinle Creeks; Canyon de Chelly; and near Tuba City, Cameron, Thoreau, and Newcomb. However, most of these populations are now extirpated (NNHP 2020). This species may occur where habitat occurs across the Navajo Nation.

Effects Analysis

No aquatic weed treatment will be conducted; therefore, no direct impacts are anticipated. Northern leopard frogs may be indirectly impacted by herbicide overspray, trampling during noxious weed treatments, and mechanical clearing. The conservation measures would eliminate the indirect effects of these treatments. Riparian noxious weeds would be treated with aquatic approved herbicides, which are practically non-toxic for aquatic amphibians (White 2007). Trampling of northern leopard frog habitat may occur if treatments take place in these areas. Also, weed treatments would be temporary and short term, and northern leopard frogs would benefit over the long-term from the removal of noxious weeds that encroach their habitat.

In the unlikely event of herbicide over-spray, cumulative impacts may occur. While adult and larval amphibians are not necessarily more sensitive to chemicals than other terrestrial or aquatic vertebrates, they may experience sublethal effects including increased susceptibility to disease, increased predation, altered growth rates, or disrupted development (Carey and Bryant 1995). Endocrine-disrupting toxicants can affect tissues well below detectable levels. Atrazine and the surfactant polyethoxylated tallow amine (POEA) used with glyphosate-based herbicides can

have endocrine disrupting effects on amphibians. The use of POEA is not proposed under this action and atrazine would require a 300 ft (90 m) buffer from potential habitat.

Milk Snake (*Lampropeltis triangulum*)

Species Account

The milk snake is a secretive species that uses rocks, logs, stumps, boards, and other surface objects as cover in a variety of habitats including river valleys, desert scrub, grasslands, pinyon-juniper, and coniferous forests (NNHP 2020). They are shy and mostly nocturnal, especially during the summer, spending most of their time underground. Breeding occurs in spring and early summer (April through June). The snakes feed primarily on lizards, small snakes, and rodents, but will feed on eggs and insects. They may constrict their prey, but usually only hold them long enough to swallow them whole (AGFD 2012a). Common predators include raccoons, foxes, skunks, and coyotes.

While the milk snake is widespread and abundant in most of its range, many are killed by humans who mistake them for venomous snakes (Isberg 2002). Collecting snakes as pets may also affect local populations, especially populations near roads. Milk snakes may also be threatened by intense agricultural development and urbanization, which can alter habitat and result in local declines (NatureServe 2015k).

Existing Habitat

Currently no records exist on the Navajo Nation, but the species has been found in bordering areas (Farmington, Cameron, Bluff, Wupatki National Monument, and Petrified Forest National Park), and could occur at all elevations and habitats on the Navajo Nation (NNHP 2020).

Effects Analysis

If milksnakes do occur in weed treatment areas, there is potential for some treatment methods to directly impact the milksnake. Chemical, biological, manual, and cultural treatment methods are unlikely to impact existing snakes directly or indirectly since this species is nocturnal. However, some mechanical treatments, such as those that remove plant parts below the surface or those that cause soil compaction may impact milksnake dens, especially when hibernating. The species conservation measures would restrict the use of mechanical treatments in occupied habitats, avoiding the risk of indirect or direct impacts to the snake. Thus, the integrated weed management plan is not likely to adversely affect the milksnake.

No known cumulative impacts have been identified that would contribute toward synergistic effects on the milksnake.

Chuckwalla (*Sauromalus ater)*

Species Account

Chuckwalla habitat consists of low desert lands (especially with volcanic alluvia and lava flows or desert hardpan) and rocky canyons (especially with large boulders). Chuckwallas also use the

margins of grass-oak woodlands in southern Utah. They are primarily herbivores, browsing on leaves, buds, flowers, and fruit, and may occasionally eat insects. They bask on rocks during the day and remain inactive during cold weather and extreme heat. Chuckwallas use rock crevices for their homes. When frightened, a chuckwalla will retreat into a crevice and wedge itself in sideways while inflating its body (AGFD 2009). Males are territorial, tolerating females and juveniles, but fighting off other adult males (AGFD 2009).

Local populations are most threatened by collectors and habitat degradation. Collectors often damage habitat to extract the animals by using tools to move or break rock and exfoliants to expose reptiles (NMDGF 1997). Populations in Arizona have been exploited based on unique color patterns that are highly desired by pet traders. Historic populations in the Glen Canyon portion of Utah have also been reduced or eliminated by the damming of the Colorado River (AGFD 2009).

Existing Habitat

Chuckwalla's known range on the Navajo Nation is not well understood, but likely includes deep canyons and adjacent desert lands of the Little Colorado River, the Marble Canyon area (including Echo Cliffs) of the Colorado River, and the San Juan River in Utah (NNHP 2020).

Effects Analysis

Because chuckwallas may occur near riparian areas and canyons on the Navajo Nation, this species may live in areas planned for weed treatments. Biological, cultural, or manual treatments would not likely impact the chuckwalla. The treatment method that poses the most risk of impacting the chuckwalla are mechanical treatments, specifically those that move or dig up large quantities of earth while removing vegetation. Because the chuckwalla is sensitive to habitat degradation, especially near the rock crevices it uses as its home, the species conservation measures would avoid potential negative effects to the species.

Use of herbicides may pose some risk to the chuckwalla, as it uses a wide variety of vegetation for its main diet. The proposed herbicides are all rated as being either slightly to moderately toxic to reptile species or non-toxic (White 2007). The best management practices for chemical treatment methods would reduce the risk of the chuckwalla unintentionally consuming enough contaminated vegetation to result in adverse effects. These measures include use of only aquatic approved herbicide near open water, restrictions on the application of herbicides during adverse weather conditions, restrictions on where herbicides can be mixed and stored, and adherence to the herbicide label, which includes restrictions on how much herbicide used for each application method. These restrictions would limit the amount of herbicide an animal would be exposed to and limit the risk of drift in non-target areas. Thus, the integrated weed management plan would likely not adversely affect the chuckwalla on the Navajo Nation.

No cumulative impacts have been identified that would contribute to synergistic impacts to the species. Overall, removal and treatment of noxious weeds in occupied habitats would benefit the chuckwalla by providing more diverse native plant communities for forage and browsing.

5.3.6 Plants

Cutler's Milk-vetch (*Astragalus cutleri*)

Species Account

Cutler's milk-vetch is endemic to San Juan County, Utah and isolated to the San Juan section of Lake Powell. Its habitat consists of warm desert shrub communities on sandy, seleniferous soils with level to moderate slopes on the Shinarump and Chinle Formations at 3800 ft. in elevation. This species grows in very remote areas of the Navajo Nation and is threatened by trampling from feral burros in the area, especially along the San Juan River from Chinle Wash to Paiute Canyon (Roth 2009). Non-native annual species such as common Mediterranean grass (*Schismus barbatus)*, red brome (*Bromus rubens*), and red stork's bill (*Erodium cicutarium*) occur within Cutler's milkvetch habitat and compete with this rare species.

Existing Environment

There are three known populations of Cutler's milk-vetch: at Copper Canyon, Nokai Canyon, and Castle Creek, all of which occur at Lake Powell. Populations at Copper and Nokai Canyons are on the Navajo Nation. The Copper Canyon and Nokai Canyon populations are the largest known populations, likely containing close to 90% of the extant population (Roth 2009).

In 2005, the Utah and the Navajo Nation set up two monitoring plots at known population sites to better understand population dynamics of Cutler's milk-vetch. After a wet 2004-2005 winter, surveys conducted in May found a total of 501 plants spread between the Copper Canyon, Nokai Canyon, and Castle Creek sites. In 2018, a total of 48 plants were detected at the same site and by 2019 no plants were detected. Early surveys found that Culter's milk-vetch seeds could survive for extended periods of time in the seed bank until ideal conditions are present for germination and flowering (Roth 2009). This can lead to years where no plants are visible or present in an area, followed by thousands flowering in a single year, which may account for the varying populations numbers observed over sampling years.

Effects Analysis

As a G2 tribally listed species, the Navajo Nation requires surveys for Cutler's milk-vetch in areas with potential habitat. All identified populations would be flagged and designated buffers would be established. Therefore, it is unlikely that weed treatments will have direct impacts on Cutler's milk-vetch individuals and habitat. This species may be indirectly impacted from trampling, mechanical equipment, and herbicide overspray from adjacent habitats. These effects would be reduced or eliminated by the species conservation measures and best management practices. Flagging or fencing the species in the treatment area would prevent mechanical or

human foot traffic from trampling the species. Herbicides would not be sprayed during high wind or humid conditions to prevent overspray.

The conservation measures would also eliminate synergistic effects. The largest threats to this species are grazing and trampling from feral burros in their known habitat. Trampling from burros in combination with herbicide overspray may cause a synergistic effect to the species. However, the introduction and spread of noxious weeds such as red brome and common Mediterranean grass may more seriously impact the milk-vetch as these species compete for nutrients, water, and sunlight in the shallow soils where these plants grow. The conservation measures would reduce the risk of impacts from herbicide overspray, mechanical equipment, and trampling.

It is unknown how climate change may impact the milkvetch, but changes to other plant species in the area may have indirect impacts on Cutler's milkvetch. Shifts in species composition and the continued spread of many non-native noxious plant species could affect conditions needed for the milkvetch to germinate and grow. As the climate warms and drought continues, this species will be impacted by reduced water availability in its habitat and the frequency between wet and dry periods. Climate change with the combination of herbicide overspray, mechanical impacts, or trampling may cause cumulative impacts to the population. The conservation measures would reduce the risk of impacts from herbicide overspray, mechanical equipment, and trampling.

Goodding's Onion (*Allium gooddingii*)

Species Account

Gooding's onion habitat consists of spruce-fir forests and mixed conifer forests in the Chuska Mountains and under Gambel oak thickets interspersed with aspen, dogwood, and Douglas fir (NNHP 2020). It is often found in moist, shady canyon bottoms and north-facing slopes, often along streams, from 6,400 – 9,400 ft (2,286 to 3,429 m) in elevation (NNHP 2020). Soils that support this species are comprised of loamy alluvium with high organic content (USFWS 2001). This species reproduces from seed and vegetatively from bulbils from the division of its rhizomes. Seeds germinate readily, but a stem may not grow from every bulb every year. It may be locally abundant at certain sites and dominate the herbaceous understory. It usually does not occur where other perennial herbaceous species exceed 50% ground cover (AGFD 1999). Known pollinators include hymenopterans, dipterans, and lepidopterans (AGFD 1999).

Threats include livestock grazing, timber harvesting, habitat destruction, and wildfire. This species is unable to maintain its populations after high intensity fires that result in canopy removal but may survive direct impacts from localized fires (NMRPTC 1999a).

Existing Environment

On the Navajo Nation, Goodding's onion is found in Canyon de Chelly, the Chuska Mountains in Apache County, Arizona and McKinley County and San Juan Counties in New Mexico (USFS

and USFWS 1997a). The species may occur throughout the Chuska Mountains and the Defiance Plateau (NNHP 2020). This species was extirpated from Canyon del Muerto on the Navajo Nation. It is locally abundant when it occurs, and its current population appears to be stable (NatureServe 2015f).

Effects Analysis

Goodding's onion is associated with native mixed conifer stands, Gambel oak thickets, and other native tree species at high elevation. Noxious weeds are not known as a threat to this species. As a G3 tribally listed species, the Navajo Nation requires surveys for Goodding's onion in areas with potential habitat. All identified populations would be flagged and designated buffers would be established. Therefore, it is unlikely that weed treatments will have direct impacts on Cutler's milk-vetch individuals and habitat. The conservation measures would prevent direct impacts to the species from weed control activities. If treatments occur near this species' habitat, indirect effects may occur from trampling during treatments and herbicide overspray. These effects would be reduced or eliminated by the species conservation measures and best management practices. Herbicides would not be sprayed during high wind or humid conditions to prevent overspray. Other methods such as mechanical, including prescribed fire, and cultural treatments require a 200 ft. buffer from fleabane populations. All vehicles used to access sites will follow established roadways and would be parked in previously disturbed sites. There are no anticipated effects from the proposed biological controls as none of the control agents target onion species. Cultural controls are not proposed within its habitat.

The largest threats to Goodding's onion include logging, grazing, road construction, wildfire, and recreation. The Navajo Nation is considered open range, and livestock may use the habitat occupied by this species. This species appears to be less vigorous after several years of consistent grazing, which may eliminate sexual reproduction within an impacted population (AGFD 1999). Grazing and other threats combined with herbicide overspray or trampling may cause cumulative impacts on the population. If Goodding's onion populations are compromised by these outside pressures, herbicide overspray may further impact susceptible populations. The mitigation measures would reduce the potential impacts from herbicide overspray, mechanical treatments, and trampling.

Marble Canyon Milk-vetch (*Astragalus cremnophylax* var. *hevronii*)

Species Account

Marble Canyon milk-vetch habitat consists of crevices and depressions with shallow soils on Kaibab Limestone and on rimrock benches at the edge of Marble Canyon. The plants are associated with Great Basin Desert scrub communities found at 5000 ft. in elevation. It grows in clusters where cracks form in the limestone with a few centimeters of soil have formed. This species of milkvetch prefers areas with dry, exposed white rock with full sun and brisk dry winds.

Surveys of Marble Canyon milk-vetch indicate the species has a high rate of establishment, which has helped some populations recover quickly following extended periods of drought (Hazelton 2011b, Roth 2007). This is also evidenced by its higher seed to ovule seed ratio for survey populations in relation to other closely related milk-vetch species (Allphin et al. 2005, Roth 2007).

It is considered endemic to the rim of Marble Canyon and is threatened on the Navajo Nation by the rarity of its occurrence and the rarity of suitable habitat for the species (Hazelton 2011b). While the species has some level of protection due to the remoteness of known populations, its proximity to the Grand Canyon still presents a threat to its long-term survival. Major threats for the species include trampling and damage from visitors and livestock, illegal collection, long-term drought from climate change, and natural erosional processes (Roth 2007).

Existing Environment

Marble Canyon milk-vetch is known from 8 populations found along the rim of Marble Canyon; seven of which are located on the Navajo Nation. These populations are found along the east rim of Marble Canyon between Sheep Springs Wash and Shimuno Wash. Potential habitat for the species has been identified between Little Colorado River Gorge and Navajo Bridge along the Little Colorado River (NNHP 2020). Monitoring and survey efforts by the Navajo Natural Heritage Program have determined that the total range for Marble Canyon milk-vetch extends less than 10 miles along the eastern rim of Marble Canyon. Most populations are small with few plants. Surveys in 2007 estimated less than 1,000 plants total (Roth 2007).

Of these populations, the Redwall population is considered the most stable. In 1997, the Navajo Natural Heritage Program installed four permanent transects to monitor the Redwall population to assess changes in reproductive output, age class distribution, and survivorship (Hazelton 2011b, **Table 18**). The monitoring program determined that this population has remained relatively stable, even demonstrating population recovery during a prolonged regional drought between 2001 and 2002 (Roth 2007).

Table 18. Demographic data collected for the Redwall population of Marble Canyon milk-vetch during four monitoring years (Hazelton 2011).

Monitoring Year	No. of Individual Plants
1997	169
2007	164
2008	171
2011	166

It is currently unknown how existing populations respond to drought, while closely related species in the area experienced significant population declines. However, the limited range and number of plants on the Navajo Nation, the Marble Canyon milk-vetch is listed as threatened by the Navajo Nation Department of Fish and Wildlife.

Effects Analysis

The biggest threat to the Marble Canyon milk-vetch is trampling from humans and livestock and potential habitat destruction from development along Marble Canyon. Known populations of the milk-vetch occur in remote areas often infrequently visited by people. These factors make it unlikely that weed treatments will directly affect the Marble Canyon milk-vetch. However, indirect impacts from trampling, mechanical equipment use on site, and herbicide overspray from adjacent habitat may affect some populations. These effects, however, would be reduced or eliminated by the species conservation measures and best management practices for weed treatments. As a G3 species, the Navajo Nation requires surveys for Marble Canyon milk-vetch in areas with potential habitat. These measures include flagging or installing fencing at buffer zones around existing populations to avoid impacts from trampling or crushing of plants by workers or equipment. Also, herbicides would not be sprayed during periods of high winds or precipitation events to prevent overspray or drift into untreated areas.

Recent monitoring of known populations suggests the milk-vetch has a higher reproductive rate than other closely related milk-vetches in the area, allowing it to recover more quickly following drought events (Hazelton 2011). This suggests that the Marble Canyon milk-vetch may be better adapted to climate variability, but additional evidence on seed reproduction and plant establishment is still needed. However, how the plants respond to multiple stressors and how that may affect its ability to reproduce is unknown. The species conservation measures would minimize and eliminate known impacts (i.e., trampling and herbicide overspray) and would reduce the risk of cumulative impacts related to climate change.

Cronquist Milk-vetch (*Astragalus cronquistii*)

Species Account

Suitable habitat for the Cronquist milk-vetch consists of salt desert shrub and blackbrush communities on sandy or gravelly soils derived from the Cutler and Morrison Formations or Mancos Shale, ranging in elevation from 4750 to 5800 ft. in elevation (NNHP 2020). It is considered endemic to the Colorado Plateau in San Juan County, Utah, and Montezuma County, Colorado.

The Cronquist milk-vetch is threatened by habitat loss and trampling from oil and gas exploration and road construction (CNPS 1997).

Existing Environment

On the Navajo Nation, it is reported from south of Bluff, Aneth, and near the Utah border with Colorado, with known populations in the Comb Wash region near the San Juan River (CNPS 1997). Potential habitat is located throughout southeastern Utah (NNHP 2020). Estimates for the Cronquist milk-vetch put the total population at around 1500 individual plants distributed between 6-20 populations (NatureServe 2015b).

Effects Analysis

The Cronquist milk-vetch is considered rare in its suitable habitat. It has been heavily impacted by oil and gas exploration, and road construction in southern Utah. Trampling from humans and livestock may also affect populations. Its rarity in this portion of the Navajo Nation makes it unlikely that weed treatments directly impact existing populations. This species may be indirectly impacted by trampling, mechanical equipment, and herbicide overspray from adjacent habitats. This is a G3 tribally listed species and surveys are required by the Navajo Nation in areas with potential habitat. All identified populations would be flagged, and designated buffers would be established. Therefore, it is unlikely that weed treatments will have direct impacts on Cutler's milk-vetch individuals and habitat. These effects would be reduced or eliminated by the species conservation measures and best management practices. Flagging or fencing the species in the treatment area would prevent mechanical or human foot traffic from trampling the species. Herbicides would not be sprayed during high wind or humid conditions to prevent the potential for overspray.

The conservation measures would also eliminate synergistic effects. The largest threat to this species is from off- road recreational vehicles and livestock grazing. Trampling from off-road vehicle use and livestock in combination with herbicide overspray may cause synergistic effects. OHV and livestock trampling may reduce the population and weed treatments may further stress and reduce existing populations. The conservation measures would reduce the risk of impacts from herbicide overspray, mechanical treatments, and trampling.

It is unknown how climate change will impact Cronquist milk-vetch. As the climate warms and drought continues, this species may be impacted by reduced water availability in its habitat. However, the Cronquist milk-vetch is adapted to persist underground and avoid flowering except during periods with adequate rainfall (CNPS 1997). Such adaptations can reduce stress on the plants during periods of extended drought. However, if weed treatments are conducted during periods of drought, it may make it harder to identify potential populations in treatment sites, resulting in unintended impacts during weed treatments. The conservation measures would reduce the risk of impacts from herbicide overspray, mechanical equipment, and trampling.

Naturita Milk-vetch (*Astragalus naturitensis*)

Species Account

Habitat consists of sand filled pockets on sandstone slickrock and rimrock pavement along canyons in the pinyon-juniper zone. Known populations occur between 5000—7000 ft. in elevation. The Naturita milk-vetch is a low-growing perennial with seed pods from late April through May. Plants growing in shady areas tend to have smaller overall diameters and are sparsely leaved and can be larger in sunny areas, especially after wet winters (Schneider 2015).

While the Naturita milk-vetch occurs in areas with active energy and housing development without much effect, land conversions in the area have restricted its current habitat (NatureServe 2015c).

Existing Environment

On the Navajo Nation, the species has been reported from the Hogback in San Juan County to the Pinetree Canyon area in McKinley County in New Mexico. Suitable habitat for the species occurs north of I-40 in McKinley County to the Hogback in San Juan County (NNHP 2020). Known populations occur in McKinley and San Juan Counties in New Mexico and in southwestern Colorado to San Juan County in Utah.

Effects Analysis

The Naturita milk-vetch is not likely to be directly impacted by noxious weed treatments as it is not highly impacted by disturbance and impacts related to trampling or construction. The Naturita milk-vetch is not heavily impacted by trampling in its native habitat, and thus impacts from mechanical equipment and manual removal are not likely to affect known plants. The milk-vetch may be indirectly impacted by herbicide overspray from adjacent habitat and vegetation removal from areas where it occurs. However, the species conservation measures and best management practices would reduce or eliminate these impacts on the species. As a G3 species, treatment areas would be surveyed for existing populations, which would be flagged or fenced to help field workers avoid plants. Herbicide would also not be applied during periods of high winds or high humidity to prevent overspray into adjacent areas.

Little is known about how climate change may affect the Naturita milk-vetch, which is not impacted by disturbance and climatic variability. Thus, it is unlikely that the Naturita milk-vetch would be impacted by cumulative impacts associated with weed treatments and current land use in the area. Species conservation measures and best management practices would reduce the impacts of unknown synergistic impacts on the Naturita milk-vetch.

Acoma Fleabane (*Erigeron acomanus*)

Species Account

The perennial plant sprouts in mat-forming clones from a rhizomatous taproot. The species produces white ray flowers (light pink when budding) and a yellow disk corolla, which flower between late May and July (Roth 2012). While the species is rare and endemic in its suitable habitat, it does have relatively high genetic diversity, which is attributed to its ability to spread through clonal asexual reproduction, obligatory outcrossing, and its ability to spread through wind dispersal and generalist pollinators (Roth 2012).

Suitable habitat consists of sandy slopes beneath sandstone cliffs of the Entrada Sandstone Formation in pinyon-juniper woodland communities, with some populations in areas overlain with Todilto Limestone (NNHP 2020, Roth 2012). Populations occur around 7000 ft. in elevation.

The rarity and the isolation of known populations make it susceptible to extinction events related to human and naturally caused disturbance. One population declined from trampling and

equipment use at a nearby mining site. Other populations occur in areas where grazing occurs, but no evidence of damage from trampling or herbivory have been observed (Roth 2012).

Existing Environment

The species is currently known from four populations which have been divided between two distinct sub-populations in McKinley and Cibola counties in New Mexico, with one of the McKinley populations located on the Navajo Nation (Roth 2012). On the Navajo Reservation it is documented north of Thoreau and north of Prewitt; however, the species may exist north of I-40 in McKinley County (NNHP 2020). Surveys of the species estimates between 2,000 to 3,000 individual plants divided between the four known populations. The population on the Navajo Nation is estimated between 200-300 individual plants (Roth 2012).

Effects Analysis

The Acoma fleabane is a rare and endemic plant on the Navajo Nation, just north of the town of Thoreau. The rarity and isolation of the species makes it highly susceptible to extinction. Surveys and observations suggest its most direct threats could be related to trampling and disturbance (Roth 2012). Due to the rarity of the species in the project area, it is unlikely that weed treatments would directly affect the Acoma fleabane. However, weed treatments may take place near some populations and have the potential to indirectly affect individual plants through trampling, the use of mechanical equipment, and herbicide overspray. As a G3 tribally listed species, the Navajo Nation requires surveys for this species in areas with potential habitat. The species conservation measures would reduce or eliminate these impacts by identifying known plants so field crews could avoid them during treatments. Measures such as installing flagging and fencing at buffer perimeters around identified plants during mechanical and manual treatments to avoid disturbing the plants. Herbicides would also not be administered during high wind and humid conditions to prevent overspray to areas adjacent to treatment sites.

In terms of cumulative impacts, additional trampling from grazing, land use, and recreational activities near populations may have synergistic effects when coupled with weed treatments. The additional stress on the plants when activities happen within relatively short periods of time may contribute to the decline of the species at its known locations. Additionally, impacts from climate change, specifically extended periods of drought, may also contribute to the species' decline by stressing existing populations, making plants more susceptible to impacts from weed treatments. The species conservation measures can reduce or eliminate the overall impact of these cumulative effects by helping field crews avoid known populations and utilizing treatment methods that protect the species.

Round Dunebroom (*Errazurizia rotundata*)

Species Account

Round dunebroom grows as a low, woody shrub, reaching up to 30 cm in height, which spreads clonally. The plant also has several spikes emanating from the main branches with short flowers and an axis not over 2 cm long in fruit (NNHP 2020). This species can occur on several types of

outcrops, ranging from sandy soils in sandstone, gravelly soils in calcareous outcrops, to deep, alluvial cinders in sandstone breaks. Generally, this plant is found in exposed habitats in semi-arid environments of the Great Basin Desert scrub.

The species is well adapted to wind erosion and has been used to reduce erosion in sandy areas and to protect annuals by the microclimate created by its branches (Phillips et al. 1981). While the species is naturally rare, it is most impacted by habitat loss, heavy grazing, and off-road vehicle use.

Existing Environment

On the Navajo Nation, populations are known from sandy pockets between outcroppings of Moenave Sandstone, between 4600 and 5200 ft. in elevation. This species has been found between Moenave and Willow Springs; however, suitable habitat exists between Gap, Arizona and Petrified Forest National Monument (NNHP 2020). It is considered endemic to the Little Colorado River drainage, particularly the Painted Desert, Echo Cliffs, Wupatki Basin, middle Little Colorado River drainage, and northwest of Winslow, Arizona (AGFD 2005a)

Effects Analysis

Round dunebroom is found in sandy areas along the Little Colorado River drainage and has been noted in several grazing areas, which are near areas some areas prioritized for weed treatment. However, the rarity of its occurrence and its suitable habitat make it unlikely that weed treatments would directly impact the species. These isolated populations may be indirectly impacted by trampling, mechanical equipment use, or from herbicide overspray in adjacent areas. As a G3 tribally listed species, the Navajo Nation requires surveys for round dunebroom in areas with potential habitat. The species conservation measures, however, would likely reduce or eliminate the negative impacts related to such activities. These measures include identification of populations in and near the treatment site, flagging or fencing of populations to establish avoidance buffers, and training crews to identify and avoid known populations. These measures would minimize trampling or crushing plants while field crews work in areas with round dunebroom. Herbicides would also not be sprayed during windy or humid conditions to prevent overspray or drift to areas adjacent to treatment sites.

Livestock are considered a threat to round dunebroome from grazing and trampling. Livestock threats are primarily the result of unmanaged grazing. While targeted grazing may be a cultural treatment method used in some range management areas, if round dunebroom is present, flagging and fencing would be placed around populations to ensure a 200 ft avoidance buffer.

Herbicide overspray may provide a cumulative impact with the known threats in round dunebroom habitat, including livestock grazing and trampling and water development for livestock. If round dunebroom populations are compromised by these outside pressures, herbicide overspray may further impact susceptible populations. The effect of grazing and trampling on round dunebroom may fluctuate from year to year, depending on how livestock are

managed, which may also result in varying impacts to different populations. Such variations could be due to project location, the treatments used, the frequency of retreatments, and the size and intensity of grazing that occurs at the site.

By removing noxious weeds from areas adjacent to round dunebroom populations, these measures would protect these populations from the habitat loss from noxious species. The mitigation measures, including buffers for each treatment method, and best management practices would eliminate the risk to round dunebroom and allow weed treatments to not likely adversely affect the species.

Navajo Bladderpod (*Physaria navajoensis*)

Species Account

Suitable habitat primarily consists of windward, windswept mesa rims and nearby habitat with little vegetative cover and high insolation. It is also found at the base and slopes of small hills of the Chinle Formation. Typically, this plant is only found in a combination of Todilto Limestone overlaying Entrada Sandstone or Chinle outcrops in pinyon-juniper communities. Todilto limestone outcrops are heavily mined in this region for road material. Many populations also occur near areas near roads or are slated for road construction. These two land uses have largely restricted suitable habitat and led to population loss through trampling and crushing of plants (AGFD 2005b).

Existing Environment

On the Navajo Nation, Navajo bladderpod is found in New Mexico on mesa rims northwest of Thoreau and the Continental Divide and in the Chuska Mountains at Todilto Park; in Arizona it occurs from the Red Valley area to Wheatfields Lake. There is potential for the species to occur anywhere there are Todilto and Chinle outcroppings northeast and northwest of Thoreau and in the Chuska Mountains within McKinley and San Juan Counties in New Mexico. It is possible the species occurs in the Chuska and Carrizo Mountains in Apache County, Arizona as well (NNHP 2020). Currently, the species is known from about 20 populations, 10 of which occur on the Navajo Nation (NatureServe 2015d).

Effects Analysis

Trampling and crushing of plants are the biggest threats to the long-term survival of the plant, most of which is associated with mining in its habitat. Since the bladderpod occurs in areas with Todilto limestone, these areas are limited to a few small sites on the Navajo Nation, making it unlikely that noxious weed treatments will directly impact the species. However, indirect impacts from trampling, mechanical equipment use on site, and herbicide overspray from adjacent habitats may potentially affect some populations. As a G3 tribally listed species, the Navajo Nation requires surveys for this species in areas with potential habitat. These effects, however, would be reduced or eliminated by the species conservation measures and best management practices for weed treatments. These measures include flagging or installing fencing at buffer zones around existing populations to avoid impacts from trampling or crushing of plants by

workers or equipment. Herbicides would also not be sprayed during periods of high winds or precipitation events to prevent overspray or drift into untreated areas.

Little is known about how climate change may affect the Navajo bladderpod. The species is currently threatened more by land use changes than by shifts in habitat suitability. However, the species conservation measures and best management practices would reduce the impacts of unknown synergistic impacts on the Navajo bladderpod.

Navajo Mountain Penstemon (*Penstemon navajoa*)

Species Account

Habitat consists of rocky, open places in ponderosa pine, aspen, and Douglas-fir communities ranging from 7,000 to 10,300 ft. in elevation. Plants are best identified during the flowering period between July and August.

Because the penstemon is only known to occur on Navajo Mountain, fire and fire-fighting activities are one of the largest threats to known populations. Other threats include road improvements and grazing in the region (NatureServe 2016).

Existing Environment

This plant is known from roughly 5 populations which occur on the upper slopes of Navajo Mountain and upper Dark Canyon in San Juan County, Utah (NatureServe 2016). The species may occur on the upper slopes of Navajo Mountain and, potentially, at upper elevations of Skeleton Mesa (NNHP 2020).

Effects Analysis

The Navajo Mountain penstemon is restricted to the mountains and plateaus in the Utah portion of the Navajo Nation. Additionally, its rarity makes it unlikely that weed treatments would occur in areas where the penstemon is found. As a G3 tribally listed species, the Navajo Nation requires surveys for this species in areas with potential habitat. All identified populations would be flagged and designated buffers would be established. The conservation measures would further minimize or eliminate the risk of weed treatments directly or indirectly impacting the penstemon in its known habitat. Indirect impacts may include those related to trampling, mechanical equipment use nearby, damage from prescribed burning, and herbicide overspray into non-treated areas, which could cause damage to plants. Surveys for populations in potential habitat areas would identify known populations in and around the proposed treatment site. Such identification would allow field crews to implement buffer zones and avoidance measures to prevent and/or reduce the impacts of weed treatment on plants. Herbicides would also not be utilized when windy conditions or precipitation are forecast for the area, which can prevent and reduce herbicide drift to non-treatment sites.

In terms of cumulative impacts, many climate models indicate that the southwest could experience an increase in the frequency and severity of wildfires in the southwest, which is a significant threat to the Navajo Mountain penstemon. These changes in wildfires would result in

additional stress to existing plants, which may further exacerbate impacts related to trampling or herbicide drift. Grazing and road improvements in the area may also present a cumulative impact, as these impacts can create pressure on existing populations, making them more susceptible to impacts from trampling by field crews or mechanical equipment use and contact with some herbicides.

Alcove Rock Daisy (*Perityle specuicola*)

Species Account

The alcove rock daisy is a perennial herb which is endemic to hanging gardens found on the Colorado Plateau between 3690 and 4000 ft. in elevation. Habitat consists of dry sites in alcoves, cliff bases, and narrow, protected canyons in Navajo Sandstone, Wingate, and Cedar Mesa sandstone formations, and in Permian limestone. However, it is not considered substrate specific (BLM 2008). They are often associated with pinyon-juniper, desert shrub and hanging garden plant communities (Welsh 2008). The alcove rocky daisy blooms between July and September. Due to the isolated and limited range of the plant, the alcove rock daisy is mostly threatened by water development and trampling from recreation in the area (NatureServe 2016).

Existing Environment

There are only 10 known populations composed of approximately 660 individual plants found along canyons on the Colorado and San Juan Rivers in Utah (NatureServe 2016a). On the Navajo Nation, it is only known from one site on the San Juan River downstream from Goosenecks State Park; however, there is potential for the species to occur anywhere there are hanging gardens in the San Juan River drainages (NNHP 2020).

Effects Analysis

There will be no direct effects to alcove rock daisy since weed treatments are not proposed in hanging garden sites. Since this is a G3 species, surveys for the rock daisy are required to identify species in the project area and install 200 ft buffers around populations found within treatment sites. Indirect effects include herbicide drift from chemical treatments. The likelihood of herbicide drift would be reduced by implementing a 200 ft buffer around existing plants during chemical treatments. Also, herbicides would not be applied when wind speeds exceed 10 miles per hour, temperatures are greater than 80° F (26.7° C), and humidity is high. Finally, many hanging gardens with alcove rock daisy are located in remote and inaccessible areas where it is unlikely weed treatments will occur, and, if they do occur, wind drift herbicide would likely not reach these populations. Other methods such as mechanical, including prescribed fire, and cultural treatments require a 200 ft buffer from alcove rock daisy populations. Due to the remote nature of hanging gardens, it is unlikely heavy machinery would impact such areas. Chainsaws may be used for cut-stump treatments, but would focus on woody trees, which could easily avoid damage to herbaceous plants in nearby areas.

Herbicide overspray on the alcove rock daisy may provide a cumulative impact with other known threats to alcove rock daisy habitat, including trampling and water development for

livestock. If rock daisy populations are compromised due to these outside pressures, herbicide overspray may further impact susceptible populations. The effects of trampling, climate change, and water development on hanging gardens with alcove rock daisies annually, which may also result in variations in the severity of impacts on known populations. The mitigation measures, including buffers identified for each treatment, and best management practices would eliminate risks to alcove rock daisy and make weed treatments not likely to adversely affect the species.

Alcove Bog-orchid (*Platanthera zothecina*)

Species Account

Suitable habitat consists of seeps, hanging gardens, and moist stream areas in desert shrub, pinyon-juniper, and ponderosa pine/mixed conifer communities (NNHP 2020). Pollination is required for seed production and seed establishment is required for recruitment of new individuals (Hudson 2001). Herbivory of spikes and flowers from small mammals can be detrimental to the species, which may cause the plant to revert back to a vegetative state or even cause mortality (Hudson 2001). Alcove bog orchid populations are widely scattered with low numbers; however, colonies appear stable with plants still present in areas where they were reported over 60 years ago (AZGFD 2004).

Existing Environment

Known populations of this species are confined to the upper Colorado River watershed in southeastern Utah, northeastern Arizona, and extreme western Colorado between 4000 and 7200 ft. (1300 – 2700 m) in elevation (Hudson 2001). On the Navajo Nation, it occurs at the headwaters of Oljeto Wash, Tsegi Canyon Watershed, and hanging gardens surrounding Navajo Mountain, Chinle Wash drainages, and drainages within and around Carrizo Mountains (NNDFW 2020). There are fewer than 30 sites known, and these are small, scattered, and with few individuals (AZGFD 2004a).

Effects Analysis

Prior to weed treatments, surveys by a trained biologist would be conducted to identify the locations of alcove bog orchid within potential habitat in the project area. A 200 ft buffer from identified orchid populations would be marked with flagging to prevent field crews from entering the buffer zone.

There would be no direct effects to alcove bog orchids due to the species conservation measures. Indirect effects include herbicide drift from chemical treatments. The likelihood of herbicide drift would be reduced by the 200 ft buffer required for chemical treatments. Also, herbicides would not be applied when wind speeds exceed 10 miles per hour, temperatures are greater than 80° F (26.7° C), and humidity is high. Finally, many hanging gardens and seeps with alcove bog orchid habitat are in remote and inaccessible areas where it is unlikely weed treatments will occur, and, if they do occur, wind drift herbicide would likely snot reach these populations. Other methods such as mechanical, including prescribed fire, and cultural treatments require a 200 ft buffer from alcove bog orchid populations.

Livestock grazing and trampling may be a threat to alcove bog orchid, which would decrease plant vigor. Livestock threats are primarily the result of unmanaged grazing, and differs from targeted grazing, which is proposed as a cultural treatment. Targeted grazing is restricted is proposed for Community Development Areas and agricultural fields. If alcove bog orchid is present in these locations, a fence would be established around the species to ensure that the 200 ft buffer is enforced.

Herbicide overspray to alcove bog orchid habitat may provide a cumulative impact with the known threats to its habitat, including livestock grazing and trampling and water development for livestock. If alcove bog orchid populations are compromised due to these outside pressures, herbicide overspray may further impact these susceptible populations. Climate change is a concern for species dependent on small seeps, including hanging gardens. Many of the species occurring in these rare habitats, including the alcove bog-orchid, rely on moisture for their existence. As the climate changes, this species may be synergistically impacted by herbicide overspray and trampling.

Removing noxious weeds species from areas adjacent to alcove bog-orchid populations would protect these populations from the potential threat of noxious weed invasion. The species conservation measures, including buffers identified for each treatment, and best management practices would eliminate the risk to alcove bog-orchid and allow weed treatments to not likely adversely affect the species.

Alcove Death Camas (*Anticlea vaginatus*)

Species Account

Alcove death camas is a stout perennial that sprouts from rhizomes. This species flowers from mid-July through August. Its habitat consists of hanging gardens, seeps, and alcoves, primarily on Navajo Sandstone, between 3,700 and 6,200 ft (1100 – 1900 m) in elevation. It is found in the backwall habitat and colluvial-detritus habitat in hanging gardens (Palmquist 2011). Populations are sporadic in distribution. The primary threat to this species is the potential impact of climate change and grazing and trampling by livestock.

Existing Environment

It is endemic to the Colorado Plateau in southern Utah and northern Arizona. On the Navajo Nation, it occurs hanging gardens in sandstone canyons surrounding Navajo Mountain in Coconino County, Arizona and San Juan County, Utah. There is a disjunct population in Canyon de Chelly National Monument (NNHP 2020). Potential habitat exists in the surrounding drainages into Lake Powell and Chinle Wash south of Canyon de Chelly (NNHP 2020).

Effects Analysis

Alcove death camas may have positive direct effects from a change in grazing management. A 5-year deferment period followed by adjustments to herd size based on carrying capacity, seasonal deferment, and rotational grazing would reduce the impacts of livestock on the alcove death

camas habitat. This would lessen the impacts of trampling and grazing. Fencing springs where alcove death camas occurs would further protect the species over the long-term from trampling.

As a G3 tribally listed species, the Navajo Nation requires surveys for this species in areas with potential habitat. All identified populations would be flagged and designated buffers would be established. Therefore, it is unlikely that weed treatments will have direct impacts on alcove death camas individuals and habitat. Additionally, weed treatments are not proposed in hanging garden sites. Indirect effects include herbicide drift from chemical treatments. The species conservation measures and best management practices would reduce the indirect effect of herbicide drift from chemical treatments. Also, much of the habitat where alcove death camas may occur, including hanging gardens and seeps, are in remote and inaccessible areas where it is unlikely weed treatments would occur, and, if they do occur, wind drift herbicide would not reach the populations. It is unlikely these species would be impacted by mechanical treatments or trampling during manual treatments. However, the buffers outlined in the species conservation measures would be implemented and eliminate the effects of these treatments on this species.

The construction of stream stabilization structures would likely have no negative effect on alcove death camas. These structures are proposed for areas with severe streambank erosion issues and do not to occur in this species habitat. These structures would slow water and retain sediment on site, which may increase potential habitat for this species.

Climate change is a concern for species dependent on small seeps, including hanging gardens. Many of the species in these rare habitats, including the alcove death camas, rely on moisture for their existence. The proposed action for this project may mitigate some of the cumulative impacts that may occur from the current grazing management system, the threat of noxious weed invasion, and climate change. Addressing overgrazing, restoring riparian habitats, and fencing sensitive spring habitats would protect the alcove death camas from noxious weed competition and grazing and trampling.

By removing noxious weeds species from areas adjacent to alcove death camas populations would protect these populations from the potential threat of noxious weed invasion. The implementation of species conservation measures, including buffers identified for each treatment, and best management practices would eliminate the risks to alcove death camas and allow weed treatments to not likely adversely affect the species.

Aztec Gilia (*Aliciella formosa*)

Species Account

Aztec gilia is endemic to clay/sand soils of the Nacimiento Formation in salt-desert scrub communities ranging from 5,000 6,400 ft. in elevation. Vegetation cover in the badland habitats is sparse, but may consist of pinyon, Utah juniper, bitterbrush, Utah serviceberry, mountain mahogany, rabbitbrush, Mormon tea, Bailey's yucca, brown spine prickly pear, and Clover's hardwall cactus (Roth and Sivinski 2018). Due to its limited habitat range, it is found almost

exclusively in San Juan County in New Mexico, although some have reported populations as far south as Sonora, Mexico (NatureServe 2016).

The Aztec gilia is most threatened by oil and gas development in the area, which occurs on the Nacimiento Formation, on the San Juan Basin. Such development has resulted in habitat loss and trampling or crushing of plants within the development areas. Plants have also been threatened by damage from recreational activities, such as off-road vehicles use (Heil and Herring 1999).

Existing Environment

On the Navajo Nation, it has been recorded in Kutz Canyon south of Bloomfield, New Mexico. The species may also exist south of Farmington and Bloomfield where the Nacimiento Formation occurs (NNHP 2020). In 2017, 107 out of 140 previously documented Aztec gilia populations were detected with a total of 13,674 plants documented on BLM lands (Roth and Sivinski 2018). This recent survey indicates that Aztec gilia populations are declining from original counts in 1992. The reason for these population declines is uncertain; however, oil and gas development, OHV use, and cattle grazing were uses detected in this species range.

Effects Analysis

Due to the limited range of the Aztec gilia on the Navajo Nation, it is likely that very few weed treatment projects would encounter or impact the plant. Additionally, any treatment sites in potential habitat for the Aztec gilia would require surveys conducted by a qualified biologist. Any identified populations would be flagged so field crews could follow the necessary buffers. These buffers and avoidance measures would minimize or eliminate any direct impacts on known gilia populations. In terms of indirect impacts, some plants may be impacted by trampling, mechanical equipment use, or herbicide drift from neighboring treatment areas. Damage or crushing of plants would be reduced or eliminated through the treatment buffers. Herbicides would also not be sprayed during high wind or humid conditions to prevent the risk of overspray.

In terms of cumulative impacts, continued development for oil and gas extraction and recreation in the area would continue to pose a threat to populations. If Aztec gilia populations are compromised from such activities, herbicide drift may further harm or impact these susceptible populations. Further stress on populations related to climate change, such as limited water availability and significant changes in seasonal temperatures, could also further exacerbate the effects of weed treatments to plant populations located in treatment sites.

The treatment of noxious weeds, however, would benefit the Aztec gilia, as treatments remove and control weed species that may outcompete the gilia in its known habitat. The species conservation measures, including buffers identified for each treatment, and best management practices would eliminate the risk to Aztec gilia and allow weed treatments to not likely adversely affect the species.

San Juan Milkweed (*Asclepias sanjuanensis*)

Species Account

Habitat for the San Juan milkweed consists of primarily sandy or sandy loam soils in pinyon-juniper woodlands and Great Basin grassland communities. Known populations occur from 5,000 to 6,200 ft. in elevation, often in disturbed sites. During dry years this species may not bloom.

Listed threats to the San Juan milkweed include land development and conversion of land to irrigated agriculture. While grazing occurs in its known habitat, no direct effects have been indicated (NMRTPC 1999).

Existing Environment

It primarily occurs in San Juan County in New Mexico, with potential for it to occur in southeastern Utah and northeastern Arizona. On the Navajo Reservation it is recorded from east of Highway 491 south of the San Juan River, and just south of the San Juan County line (NNHP 2020). The species may occur on the Navajo Nation within suitable habitat throughout San Juan and McKinley Counties in New Mexico.

Effects Analysis

The San Juan milkweed occurs in areas identified for treatment under the proposed action. The area indicated where known populations of the milkweed are present on the Navajo Nation is also area where the Navajo Agricultural Products Industry (NAPI) is located and where several Range Management Units (RMUs) and designated farmlands are managed by local land users. These areas have been prioritized for weed management under this action. As a G4 species, it is recommended that prior to weed treatment projects, biological surveys be conducted in proposed treatment areas to help identify, flag, and install buffers around populations so work crews can avoid damaging plants. The buffers in the species conservation measures would reduce and eliminate any direct impacts to milkweed populations found in treatment sites. Plants located outside of treatment sites may also be susceptible to indirect impacts, such as trampling from crews performing weed treatments, mechanical equipment use, and herbicide overspray to areas adjacent to the main treatment site. Educating field crew members to identify the San Juan milkweed, along with the proposed conservation measures would minimize and avoid damage to plants located directly outside of the treatment site.

While grazing does occur in the known habitat for the San Juan milkweed, it has not been shown to directly impact the species. Such grazing is largely due to unmanaged grazing of livestock and not from the use of targeted grazing as a cultural control method as described under this action. The use of cultural control (i.e. targeted grazing) would be restricted to Community Development Areas and agricultural fields, as long as fields are fenced. If the San Juan milkweed occurs in agricultural fields proposed for treatment, plants would be flagged and a fence would be installed around the plants to ensure a 200 ft buffer is enforced.

The San Juan milkweed is most impacted by agricultural land use and community development in its known habitat. Populations impacted by these factors may be more susceptible to impacts related to weed treatments, such as herbicide overspray or trampling. The avoidance measures previously described would help crews avoid plants and reduce or eliminate impacts associated with such treatments. By removing noxious weed species from areas adjacent to San Juan milkweed populations, these populations would be further protected from the potential threat that noxious weeds could have on the long-term conservation of this species. The proposed mitigation measures, including the buffers identified for each treatment method, and the best management practices would eliminate the risks to San Juan milkweed and allow weed treatments to not likely adversely affect the species.

Heil's Milk-vetch (*Astragalus heilii*)

Species Account

Heil's milk-vetch habitat consists of rocky ledges of the Mesa Verde Group in pinyon-juniper communities around 7,200 ft (NNHP 2020). It is currently only found in McKinley County in New Mexico (NMRPTC 1999b).

Existing Environment

On the Navajo Nation, it is only documented from its habitat near Borrego Pass, which currently is its only known location (NNHP 2020). More surveys are needed to understand this species abundance and distribution.

Effects Analysis

Heil's milk-vetch is currently only known from one population found on rocky ledges of the Mesa Verde geological formation near Borrego Pass on the Navajo Nation. Little is known about the factors that affect the species, making it hard to determine what impacts could potentially adversely affect the species. Currently the Heil's milk-vetch does not occur in any of the priority treatment areas. However, if noxious weed treatments are proposed in potential habitat for the Heil's milk-vetch, biological surveys of the area are recommended to identify any potential populations. These populations would be flagged, and buffers would be installed based on the proposed treatment methods. These measures would prevent trampling or damage to plants while treatments are implemented. Best management practices proposed for the use of herbicides, and avoidance buffers include restrictions during windy conditions, periods of high humidity, or when temperatures are greater than 80° F (26.7° C). Such measures would minimize or avoid adverse effects on the Heil's milk-vetch during chemical treatments.

Populations of Heil's milk-vetch may be located outside of the main weed treatment sites, and may be impacted indirectly through trampling, mechanical equipment use or transportation, or herbicide overspray. Educating field crews to identify and avoid plants found outside of the main treatment area would reduce these impacts. Avoidance measures, best management practices, and treatment buffers would also minimize damage to or avoid plants that could be indirectly

impacted. Herbicides would also not be sprayed during periods of high winds or precipitation events to prevent overspray or drift into untreated areas.

Because little is known about the current threats that affect Heil's milk-vetch, it is hard to determine what impacts would contribute cumulatively to weed treatment and management. It is advised that the proposed species conservation measures and best management practices for the proposed weed treatment methods would reduce the potential for cumulative impacts to populations potentially impacted by additional environmental or land use stressors.

Treatment of noxious weed populations may likely benefit the milk-vetch. Noxious weed populations can impact native plant species by outcompeting plants for resources or by altering habitat conditions. By removing noxious weed species from areas adjacent to Heil's milk-vetch populations, these populations would be protected from the potential threat noxious weeds could have on the long-term conservation of this species. The proposed mitigation measures, including the buffers identified for each treatment method, and the best management practices would reduce or eliminate the risks to Heil's milk-vetch and allow weed treatments to not likely adversely affect the species.

Navajo Saltbush (*Atriplex garrettii* var. *navajoensis*)

Species Account

Navajo saltbush is a deciduous shrub growing up to 1.5 m in height. The species is found west of Marble Canyon near Navajo Bridge in Coconino County, Arizona. The species' habitat consists of salt desert shrub communities between 3000 – 4000ft. in elevation (NNHP 2020). It grows on Moenkopi Shale, often overlain with a Kaibab Limestone.

Navajo saltbush is considered narrowly endemic to the Navajo Bridge section of the Colorado River (Stutz 1978). The species is known to hybridize with the similar *A. occidentalis*, which affects its reproductive success (Sanderson and Stutz 2001). Recreation is also a potential impact in the area, as its habitat is near Grand Canyon National Park, Lee's Ferry, and Navajo Bridge. Because of its limited range, little is known about other potential threats affecting this species.

Existing Environment

On the Navajo Nation it is located on the east side of Marble Canyon from Lee's Backbone to Jackass Canyon; however, the species may exist on the east side of Marble Canyon and Glen Canyon from Glen Canyon Dam south and west to the Echo Cliffs and along tributary canyons of the Colorado River, south to Shinumo Wash (NNHP 2020).

Effects Analysis

Navajo saltbush is currently only known from a few populations found near Navajo Bridge and Marble Canyon on the Navajo Nation. Little is known about the factors that affect the species, making it hard to determine what impacts could adversely affect it. If noxious weed treatments are proposed in potential habitat for the Navajo saltbush, biological surveys of the area are recommended to identify any populations. If surveys are completed, identified populations

would be flagged, and buffers would be installed based on the proposed treatment methods. These measures would prevent trampling or damage to plants while treatments are implemented. Best management practices proposed for herbicides, along with avoidance buffers, include restrictions during windy conditions, periods of high humidity, or when temperatures are greater than 80° F (26.7° C). Such measures would minimize or avoid adverse effects on the Navajo saltbush during any of the proposed noxious weed treatment methods.

Populations of Navajo saltbush located outside the main weed treatment sites, may be impacted indirectly through trampling, mechanical equipment use or transport, or herbicide overspray. The avoidance measures, best management practices, and treatment buffers would be implemented to avoid and minimize damage to plants as described above.

Because little is known about the current threats or factors that impact Navajo saltbush, determining cumulative impacts from weed treatment and management is difficult. It is advised that the proposed species conservation measures and best management practices for the proposed weed treatment methods would reduce the risk of cumulative impacts to populations already impacted by additional environmental or land use stressors.

Noxious weed treatment may benefit this species of saltbush. Noxious weed populations can impact native plant species by outcompeting other plants for resources or by altering habitats. By removing noxious weed species, Navajo saltbush populations would be protected from the potential threat noxious weeds may have on the long-term conservation of this species. The proposed mitigation measures would allow weed treatments to not likely adversely affect the species.

Atwood's Camissonia (*Camissonia atwoodii*)

Species Account

Atwood's camissonia is a winter annual herb that sprouts from a taproot. The plants proliferate following wet periods, making them hard to find during periods of drought. The species is endemic to a narrow portion of eastern Kane County, Utah near Last Chance Drainage. The species' habitat consists of salt desert shrub communities growing on clay soils of the Tropic Shale and Carmel Formations. Known populations occur between 4,060 and 5,000 ft. in elevation (NNHP 2020).

Threats to the camissonia include mining development and road construction in its known habitat (UNPS 2009). Because plants only tend to appear following years with sufficient rainfall, the overall trend of the population is unknown. Surveys conducted in the 1990s identified at least four distinct populations within the species' known habitat. While additional populations have been noted during subsequent surveys, no data on the size of these populations is known (NatureServe 2016d).

Existing Environment

Atwood's camissonia has not been reported on the Navajo Nation; however, there is potential habitat along shores and drainages of Lake Powell (NNHP 2020).

Effects Analysis

The Atwood's camissonia does not occur on the Navajo Nation, however, potential habitat does exist along the Navajo Nation side of Lake Powell. The species conservation measures would reduce or eliminate direct effects to populations that may occur in the main treatment areas. Some populations may be indirectly impacted by herbicide overspray or damage to plants from trampling or mechanical equipment transport and use in neighboring areas. As a G4 species it is recommended that surveys for plants and installation of fencing and flagging to mark treatment-specific avoidance buffers be implemented. Restrictions on the use of herbicides during periods of precipitation, high humidity, and high temperatures would reduce or eliminate indirect impacts to plants found within treatment sites. The removal of noxious weeds from camissonia habitat would benefit the species, by reducing competition and improving habitat quality. Therefore, it is determined that the proposed action would not result in adverse impacts to the Atwood's camissonia.

Cumulative impacts may occur to plants that are located near roads or mining sites. Road construction and mine development have been identified as major threats to this species of camissonia. Such impacts may make plants more susceptible to damage from herbicides or trampling. The conservation measures would help crews avoid additional impacts that may further stress or harm existing plants. Avoidance buffers would prevent treatments from damaging existing plants. Herbicide mitigation measures would reduce the risks of overspray and drift. These measures would reduce the potential for synergistic effects on the Atwood's camissonia.

Rydberg's Thistle (*Cirsium rydbergii*)

Species Account

Rydberg's thistle is considered an endemic to the hanging gardens of the Colorado Plateau, occurring in southeastern Utah and northern Arizona. Suitable habitat consists of hanging gardens, seeps, and sometimes stream banks below hanging gardens, between 3,300-6,500 ft. The species' restricted habitat makes it vulnerable to changes in groundwater availability that may be due to water diversion projects, groundwater pumping, and drought. Grazing and recreation near hanging garden habitats may also impact the species (May et al 2013).

Existing Environment

On the Navajo Nation, the species occurs in southern San Juan County, Utah and in Coconino and Apache Counties in Arizona (NNHP 2020).

Effects Analysis

Rydberg's thistle is an important indicator species for many hanging gardens in the Colorado Plateau. As a G4 tribally listed species, the Navajo Nation recommends surveys for this species in areas with potential habitat and identified populations flagged and designated buffers established. Therefore, it is unlikely that weed treatments will have direct impacts on Cutler's milk-vetch individuals and habitat. Buffers would be marked with flagging around identified populations to prevent weed treatment field crews from entering the buffer zone. There will be no direct effects to Rydberg's thistle since weed treatments are not proposed in hanging garden sites. Indirect effects include herbicide drift from chemical treatments. The likelihood of herbicide drift would be reduced by a 200 ft buffer for chemical treatments. Also, herbicides would not be applied when wind speeds exceed 10 miles per hour, temperatures are greater than 80° (26.7°), and humidity is high. Finally, many hanging gardens with Rydberg's thistles are in remote and inaccessible areas where it is unlikely weed treatments would occur, and, if they do occur, wind drift herbicide would not reach the populations. Other methods, such as mechanical, including prescribed fire, and cultural treatments, require a 200 ft buffer around identified populations. Due to the remote nature of hanging gardens, it is unlikely that heavy machinery would be used to treat weeds. Chainsaws may be used for cut stump treatments, but this technique is focused on trees and woody plants.

Livestock can also be a threat to Rydberg's thistle habitat due to grazing and trampling damage. Such impacts are primarily a result of unmanaged grazing, which differs from targeted grazing used as a cultural control method under this action. Targeted grazing is also restricted to Community Development Areas and agricultural fields, which require fencing around the treatment site.

No biological control agents for musk thistle, Canada thistle, and bull thistle are permitted under the plan due to their close relation to Rydberg's thistle. Three other thistles (spotted knapweed, yellow starthistle, and diffuse knapweed) also have biological control agents to control their populations. These agents are specific to the *Centaurea* family and have not been indicated for control of species outside of this family of thistles. Specificity testing is required of all biological control agents to further rule out the risk of these species negatively impacting other plant species in related genera. Many of the species proposed have already been released in the continental United States, some in states in or near the Navajo Nation (**Table 19**). As a result, the proposed agents have been permitted for by APHIS for some time and have not shown impacts on any of the native thistle populations. Because of these factors, it is not likely that biological control agents would adversely affect the Rydberg thistle under the proposed action.

Table 19. Biological control agents proposed for the management of thistles as proposed by the BIA Navajo Region Integrated Weed Management Plan. Date of release is based on information from the APHIS Technical Advisory Group for Biological Control Agents for Weeds (2013).

Proposed Agent	Type	Target Weed Species	Year released in the U.S.	States Released
Bangasternus fausti	Seed head feeding weevil	Spotted knapweed Diffuse knapweed	1990	CA, CO, ID, MO, MT, NE, OR, SD, UT, WA, WY[1]
Bangasternus orientalis	Seed head feeding weevil	Spotted knapweed Diffuse knapweed Yellow starthistle	1985	CA, ID, OR, UT, WA[2]
Chaetorellia australis	Starthistle peacock fly	Yellow starthistle	1988	CA, ID, OR, WA[2]
Cyphocleonus achates	Root feeding weevil	Spotted knapweed Diffuse knapweed	1988	CO, MT, NE, OR, UT, WA, WY[1]
Eustenopus villosus	Starthistle hairy weevil	Yellow starthistle	1990	AZ, CA, ID, OR, UT, WA[2]
Jaapiella ivannikovi	Diptera: Cecidomyiidae	Russian knapweed	2009	CO, MT, WY, OR[2]
Larinus minutus	Seed head feeding weevil	Spotted knapweed Diffuse knapweed	1991	CA, CO, MN, MT, NE, NV, OR, SD, UT, WA, WY[1]
Larinus obtusus	Seed head feeding weevil	Spotted knapweed	1993	CO, ID, MN, MT, NE, OR, SD, WA, WY[1]

[1] Cornell University, College of Agriculture and Life Sciences. 2009. Biological Control: A Guide to natural enemies of North America. Available online at: http://www.biocontrol.entomology.cornell.edu/weedfeedTOC.php. Last visited on Jan 21, 2016.

[2] Whitehall High School and Montana Weed Control Association. Montana War on Weeds: Biological Control Agents Website. Available online at: http://mtwow.org/Bio-Control-main.htm. Last visited Jan 21, 2016.

Herbicide overspray to populations of Rydberg's thistle may provide a cumulative impact with the known threats to its habitat, including livestock grazing, trampling, and water development. If Rydberg's thistle populations are comprised by these outside pressures, herbicide overspray may further affect these susceptible populations. The effect of grazing, trampling, climate change, and water development on hanging gardens fluctuates from year to year, meaning that the risk of synergistic impacts would vary as well.

Removal of noxious weed species from areas adjacent to Rydberg's thistle populations would protect the species from impacts related to noxious weed invasions. The mitigation measures, including buffers identified for each treatment method, and best management practices would eliminate the risk to Rydberg's thistle and allow weed treatments to not adversely affect the species.

Utah Bladder-fern (*Cystopteris utahensis*)

Species Account

The Utah bladderfern is found in hanging gardens in the southwest. Habitat consists of seeps, cracks, and ledges on cliffs formed from calcareous substrates including sandstone, limestone, and dacite, commonly those of the Weber formation (AGFD 2005d). Populations are known

from 4,200 to 8,800 ft. in elevation. The bladderfern is listed as a sensitive species due to its limited range and its association with hanging gardens in the southwestern United States.

Existing Environment

It was formally thought to only occur on the Navajo Nation at Canyon de Chelly, but additional populations have been found in Coconino and Yavapai Counties in Arizona and in southern Utah (AGFD 2005d, NNHP 2020).

Effects Analysis

Prior to weed treatments, surveys by trained biologists are recommended to identify populations of Utah bladderfern in potential habitat identified at treatment sites. As a G4 tribally listed species it is recommended that buffers be marked with flagging based on the proposed treatment methods around identified populations to prevent field crews from entering the buffer zone.

There will be no direct effects to Utah bladder since weed treatments are not proposed in hanging garden sites. Indirect effects include herbicide drift from chemical treatments. The likelihood of herbicide drift would be reduced by a 200 ft buffer for chemical treatments. Also, herbicides would not be applied when wind speeds exceed 10 miles per hour, temperatures are greater than 80° (26.7°), and humidity is high. Finally, many hanging gardens with Utah bladderferns are in remote and inaccessible areas where it is unlikely weed treatments would occur, and, if they do occur, wind drift herbicide would not reach the populations. Other methods, such as mechanical, including prescribed fire, and cultural treatments, require a 200 ft buffer from identified populations. Due to the remote nature of hanging gardens, it is unlikely that heavy machinery would be used to treat weeds. Chainsaws may be used for cut stump treatments, but this technique is focused on trees and woody plants, which may occur in hanging gardens.

Livestock can be a threat to Utah bladderfern habitat due to grazing and trampling damage. Such impacts are primarily a result of unmanaged grazing, which differs from targeted grazing used as a cultural control method under this action. If Utah bladderfern populations are present where targeted grazing is implemented, a fence would be established around the hanging garden to ensure a 200 ft buffer is enforced.

Herbicide overspray to populations of Utah bladderfern may provide a cumulative impact with known threats to its habitat, including livestock grazing, trampling, and water development. If Utah bladderfern populations are compromised due to these outside pressures, herbicide overspray may further impact susceptible populations. The effect of grazing, trampling, climate change, and water development on hanging gardens fluctuates from year to year, meaning that the risk of synergistic impacts would vary as well.

Removal of noxious weed species from areas adjacent to Utah bladderfern populations would protect the species from impacts related to noxious weed invasions. The mitigation measures, including buffers identified for each treatment method, and best management practices would

eliminate the risk to Utah bladderfern and allow weed treatments to not adversely affect the species.

Sivinski's Fleabane (*Erigeron sivinskii*)

Species Account

Sivinski's fleabane habitat consists of steep, barren, shale slopes of the Chinle Formation where it can be locally abundant, in pinyon-juniper woodland and Great Basin Desert scrub communities. Known populations from 6,100 to 7,400 ft (NNHP 2020) in elevation. The species occurs in McKinley County in New Mexico and Apache County in Arizona (AGFD 2005). This species is a sensitive due to its narrowly endemic status in its range, although it can withstand some disturbance (NatureServe 2016e).

Existing Environment

On the Navajo Nation, the plant is found on east and west facing slopes of the Carrizo and Chuska Mountains, the Cove area, the Round Rock area, and north of Navajo in San Juan County, New Mexico and Apache County, Arizona. Elsewhere on the Navajo Nation, the species may exist north of I-40 in New Mexico and in the Chuska Mountains (NNHP 2020).

Effects Analysis

Due to the rarity of the species in the project area and barren slope habitat, it is unlikely that weed treatments would directly affect Sivinski's fleabane. However, weed treatments may take place near populations and have the potential to indirectly affect individual plants through trampling, mechanical equipment, and herbicide overspray. As a G4 tribally listed species, the Navajo Nation recommends surveys and conservation measures for Sivinski's fleabane in areas with potential habitat. The recommended species conservation measures would likely reduce or eliminate such impacts by identifying known plants so field crews can avoid them during weed treatments. Measures such as installing flagging and fencing at buffer perimeters around identified plants would reduce or eliminate disturbance from mechanical and manual treatments. Herbicides would also not be administered during high wind and humid conditions to prevent overspray to areas adjacent to treatment sites.

In terms of cumulative impacts, additional trampling from grazing, land use, and recreational activities near populations may have synergistic effects when coupled with weed treatments. The additional stress on the plants from such activities happening within relatively short periods of time from each other may contribute to the decline of the species from its known locations. Additionally, impacts from climate change, specifically extended periods of drought, may also contribute to the species' decline by stressing existing populations, making plants more susceptible to impacts from weed treatments. The species conservation measures can reduce or eliminate the overall impact of such cumulative effects by helping field crews avoid known populations and utilize treatment methods that would further protect the species.

Sarah's Buckwheat (*Eriogonum lachnogynum var. sarahiae*)

Species Account

Sarah's Buckwheat suitable habitat consists of windswept mesa tops in pinyon – juniper communities between 5,900- 7,500 ft. in elevation (NNHP 2020). This species is endemic to the Owl Rock Member of the Chinle Formation, topped by Todilto limestone. The species occurs in very small, widely scatter populations that may be impacted by mining operations and road building projects in its habitat. Because it is considered unpalatable by livestock, grazing does not pose much of a threat to its conservation (NMRPTC 1999).

Existing Environment

Sarah's Buckwheat occurs in McKinley County in New Mexico, the Chuska Mountains, and Apache and Navajo Counties in Arizona (NMRPTC 1999). Only a few plants have been recorded on the Navajo Nation in the vicinity of Red Valley, north of Red Lake. The species may exist in the Chuska Mountains between Lupton, Arizona and Prewitt, New Mexico (NNHP 2020).

Effects Analysis

Sarah's buckwheat is most threatened by activities that alter habitat suitability or that directly damage existing plant populations. Surveys are for Sarah's buckwheat plants are recommended in the treatment area to identify, flag, and install the appropriate treatment buffers to avoid and minimize direct impacts to plants during noxious weed treatments, either through trampling, mechanical equipment use, or herbicide spraying. Some populations may occur outside the treatment area and may be at risk for indirect impacts from workers traveling to and from treatment areas, moving equipment, or from herbicide overspray or drift. Herbicides would not be applied when windy or humid conditions are anticipated, or if outside temperatures rise above 80°F (26.7°C) to avoid overspray and drift. These measures would prevent noxious weed treatments from adversely impacting Sarah's buckwheat.

Populations of Sarah's buckwheat impacted by mining operations, development, or road construction, may experience additional stress that would result in a cumulative impact in areas also treated for noxious weeds. These additional stressors may make populations more susceptible to damage from weed treatments. The removal of noxious weed species, however, would also benefit Sarah's buckwheat by reducing competition and habitat alteration caused by many of the target weed species. The mitigation measures, such as enforcement of avoidance buffers and limitations on herbicide use, would reduce the impacts associated with noxious weed management to limit such synergistic impacts.

Bluff Phacelia (*Phacelia indecora*)

Species Account

The bluff phacelia is a localized endemic, occurring in hanging gardens of salt desert communities between 3,600 ft. and 4,500 ft. in elevation in San Juan County in Utah (NNHP

2020). This species' range consists of<40-100 square miles (<100-250 square km) (NatureServe 2021).

Because bluff phacelia's habitat is composed of hanging gardens, which are endemic in this portion of the southwest, threats such as water development, grazing, and damage from recreation are believed to also impact this species.

Existing Environment

This species has not been documented on the Navajo Nation; however, it may occur in the San Juan River drainage on the Navajo Nation (NNHP 2020).

Effects Analysis

The bluff phacelia is endemic to hanging gardens on the Colorado Plateau. If this species occurs at the project site, buffers marked with flagging are recommended based on the proposed treatment methods around identified populations to prevent field crews from entering the buffer zone. This is a G4 tribally listed species and surveys and conservation measures are recommended.

There will be no direct effects to bluff phacelia since weed treatments are not proposed in hanging garden sites. Indirect effects include herbicide drift from chemical treatments. The likelihood of herbicide drift would be reduced by a 200 ft buffer for chemical treatments. Also, herbicides would not be applied when wind speeds exceed 10 miles per hour, temperatures are greater than 80° (26.7°), and humidity is high. Finally, many hanging gardens with bluff phacelia are in remote and inaccessible areas where it is unlikely weed treatments would occur, and, if they do occur, wind drift herbicide would not reach the populations. Other methods, such as mechanical, including prescribed fire, and cultural treatments, require a 200 ft buffer from identified populations. Due to the remote nature of hanging gardens, it is unlikely that heavy machinery would be used to treat weeds. Chainsaws may be used for cut stump treatments, but this technique is focused on trees and woody plants.

Livestock can also be a threat to bluff phacelia habitat due to grazing and trampling damage. Such impacts are the result of unmanaged grazing, which differs from targeted grazing used as a cultural control method under this action. Targeted grazing is also restricted to Community Development areas and agricultural use areas. If bluff phacelia is present in these locations, a fence would be established around the hanging garden to ensure a 200 ft buffer is enforced.

Herbicide overspray to populations of bluff phacelia may provide a cumulative impact with the known threats to its habitat, including livestock grazing, trampling, and water development. If bluff phacelia populations are comprised due to these outside pressures, herbicide overspray may further impact these susceptible populations. The effect of grazing, trampling, climate change, and water development on hanging gardens fluctuates from year to year, meaning that the risk of synergistic impacts would vary as well.

Removal of noxious weed species from areas adjacent to bluff phacelia populations would protect the species from impacts related to noxious weed invasions. The mitigation measures, including buffers for each treatment method, and best management practices would eliminate the risk to bluff phacelia and allow weed treatments to not adversely affect the species.

Cave Primrose (*Primula specuicola*)

Species Account

Cave primrose is endemic to the canyons found along the Colorado River in northern Arizona and southern Utah (AGFD 2004a). Suitable habitat consists of hanging gardens and occasionally stream sides in Entrada and Navajo Sandstone Formations between 3,500 and 7,200 ft. in elevation (NNHP 2020). In the Grand Canyon it occurs in seeps in Kaibab and Redwall limestone. Threats to the species are unknown due to the remoteness of its habitat, but recreation may impact the species (AGFD 2004a).

Existing Environment

On the Navajo Nation, it occurs in the Chinle Wash area and in canyons surrounding Navajo Mountain. The species may occur in any of the hanging gardens in the Chinle Wash drainage and in canyons north and south of Navajo Mountain (NNHP 2020).

Effects Analysis

The cave primrose is endemic to hanging gardens on the Colorado Plateau. If this species occurs at a project site, buffers marked with flagging around identified populations are recommended based on the treatment methods to prevent field crews from entering the buffer zone.

There will be no direct effects to cave primrose since weed treatments are not proposed in hanging garden sites. Indirect effects include herbicide drift from chemical treatments. The likelihood of herbicide drift is reduced by a 200 ft buffer for chemical treatments. Also, herbicides would not be applied when wind speeds exceed 10 miles per hour, temperatures are greater than 80° (26.7°), and humidity is high. Finally, many hanging gardens with cave primrose are in remote and inaccessible areas where it is unlikely weed treatments would occur, and, if they do occur, wind drift herbicide would not reach the populations. Other methods, such as mechanical, including prescribed fire, and cultural treatments, require a 200 ft buffer from identified populations. Due to the remote nature of hanging gardens, it is unlikely that heavy machinery would be used to treat weeds. Chainsaws may be used for cut stump treatments, but this technique is focused on trees and woody plants.

Herbicide overspray on populations of cave primrose may provide a cumulative impact with the known threats to its habitat, such as trampling from recreational users. If cave primrose populations are comprised by these outside pressures, herbicide overspray may further impact these susceptible populations. Removal of noxious weed species from areas adjacent to cave primrose populations would protect the species from noxious weed impacts. The mitigation

measures, including buffers for each treatment method, and best management practices would eliminate the risk to cave primrose and allow weed treatments to not adversely affect the species.

Marble Canyon Dalea (*Psorothamnus arborescens var. pubescens*)

Species Account

The Marble Canyon dalea is found in drainages of the Colorado River in Marble Canyon and the Grand Canyon in southern Utah and northern Arizona (NatureServe 2016f). Suitable habitat consists of mixed desert shrub communities growing on soils derived from the Moenkopi Formation between 3,400 and 4,900 ft. (NNHP 2020). While grazing is common in the dalea's native habitat, little is known about any specific threats or impacts on the species.

Existing Environment

On the Navajo Nation, the dalea has been recorded in the Navajo Springs area south of Navajo Bridge. The species may occur from Lee's Backbone to Bitter Springs (NNHP 2020).

Effects Analysis

The Marble Canyon dalea is considered narrowly endemic to the sandstone cliffs found at Marble Canyon and the Grand Canyon. Little is currently known about factors that threaten the Marble Canyon dalea, although populations are limited with relative few individuals (NatureServe 2016). The recommended conservation measures would minimize or eliminate the risk of weed treatments to directly or indirectly impact the dalea in its known habitat. Indirect impacts may include those related to trampling, mechanical equipment use nearby, damage from prescribed burning, and herbicide overspray into non-treated areas. Herbicides would not be used when windy conditions, high temperatures, high humidity, or precipitation are forecast for the area, which can prevent and reduce herbicide drift to non-treatment sites.

Grazing in the area may present a cumulative impact, as unmanaged grazing can create pressure on existing populations, making them more susceptible to impacts from trampling from field crews or mechanical equipment use and contact with some herbicides. However, the species conservation measures, would minimize, or avoid impacts from weed treatments, reducing potential synergistic impacts. Removal of noxious weed species from areas adjacent to Marble Canyon dalea populations would protect the species from noxious weed impacts. The mitigation measures, including buffers identified for each treatment method, and best management practices would eliminate the risk to Marble Canyon dalea and allow weed treatments to not adversely affect the species.

Parish's Alkaligrass (*Puccinella parishii*)

Species Account

Parish's alkaligrass suitable habitat includes alkali seeps, springs, and seasonally wet areas such as washes where soils are wet or moist throughout the year. It occurs in alkaline clay soils. It does not occur in dense vegetation or where water is not present at the surface for part of the year (Greene and Sanders 2006). Populations occur between 800 to 2,200 m (2,600 to 7200 ft.)

(NNHP 2020). This species is threatened by reduction of water, trampling from livestock, and noxious weed invasion.

Existing Environment

On the Navajo Nation, this species occurs in Utah in San Juan County northeast of Beclabito and in the vicinity of Two Grey Hills (NNHP 2020). The species may exist anywhere on the Navajo Nation in alkali seeps, springs, or seasonally wet areas (NNHP 2020). This species does occur within Coconino Co, AZ, near Tuba City; in Navajo Co, AZ, near Shonto; Apache Co, AZ, near Tees Nos Pos, Monument Valley and south of Red Valley, and San Juan Co, NM, east of Beclabito and in the vicinity of Two Grey Hills.

Effects Analysis

Since Parish's alkali grass does not grow in dense vegetation, it is unlikely that weed treatments would occur directly in this species habitat. The species conservation measures would eliminate direct effects to this species from noxious weed treatments. Noxious weed invasion is a threat to this species, so weed treatments in adjacent habitats would prevent the spread of noxious weeds. There may be indirect effects to this species from herbicide drift from chemical treatments or trampling and destruction of habitat from manual or mechanical treatments during site access. As a G4 tribally listed species, it is recommended that surveys are conducted and species conservation measures are implemented. The best management practices would reduce the indirect effects of herbicide drift from chemical treatments and unintentional trampling.

Climate change is a concern for Parish's alkali grass since it depends on moist soils. Cumulative impacts may occur as the climate changes and this species' habitat is reduced. Herbicide overspray and trampling may further impact the vigor and density of this species. However, implementing noxious weed removal would reduce competition of noxious weeds and may increase moisture levels.

Arizona Rose Sage (*Salvia pachyphylla ssp. eremopictus*)

Species Account

Arizona rose sage habitat consists of barren desert shrub lands and pinyon-juniper communities on basalt or soils derived from the Chinle Formation, between 5,500 and 6,500 ft. (Taylor and Ayers 2006, NNHP 2020). While this subspecies is rare, its population appears stable (AZGFD 2014c).

Existing Environment

This species is found in California, Nevada, and Arizona, but the subspecies is endemic to northeast Arizona (AZGFD 2014c). This subspecies occurs from Meteor Crater to Petrified Forest National Park and north to Hopi Buttes area (AZGFD 2014c). On the Navajo Nation, it is often found along the base of volcanic plugs, mesa tops, and slopes (NNHP 2020). It has been found north of Dilkon in Navajo County. The species may occur along the southern boundary of

the Navajo-Hopi Reservation to the southern boundary of the Navajo Nation, between just north of Winslow and Petrified Forest National Park (NNHP 2020).

Effects Analysis

Arizona rose sage has a limited range; however, it can be abundant where it occurs. Also, this species occurs on barren slopes, where noxious weeds are unlikely. Therefore, it is unlikely that noxious weed treatments would occur in this species' habitat and no direct impacts are anticipated. Weed treatments may indirectly affect individual plants through trampling, the use of mechanical equipment, and herbicide overspray. The species conservation measures are recommended and would likely reduce or eliminate such impacts by identifying known plants so field crews can avoid them during weed treatments. Measures, such as installing flagging and fencing at buffer perimeters around identified plants, will reduce or eliminate disturbance from mechanical and manual treatments. Herbicides would also not be administered during high wind and humid conditions to prevent overspray to areas adjacent to treatment sites.

Cumulative impacts may occur from the additive, indirect effects of weed treatments on the current disturbances from trampling due to grazing, land use, and recreational activities. The additional stress on the plants from these activities in relatively short periods of time may contribute to the decline of the species from its known locations. Additionally, impacts from climate change, specifically extended periods of drought, can also contribute to the species' decline by stressing existing populations, making plants more susceptible to impacts from weed treatments. The species conservation measures can reduce or eliminate the overall impact of such cumulative effects by helping field crews avoid known populations and utilize treatment methods that would protect the species.

Brack's Hardwall Cactus (*Sclerocactus cloveriae* ssp. *brackii*)

Species Account

The Brack's hardwall cactus is found in northwest portion of New Mexico, in San Juan, Sandoval, and Rio Arriba Counties (NMRPTC 1999). Suitable habitat consists of desert scrub and scattered juniper communities growing on sandy, clay hills of the Nacimiento Formation. This cactus prefers eroding sandy-loam to sandy-clay substrates within valleys. The total range of this species is about 150 miles north to south and about 60 miles wide (Muldavin et al. 2016). Populations occur between 5,000 and 6,000 ft. in elevation. This species was determined to have no genetic differences with Clover's cactus (*Sclerocactus cloverae* spp. *cloverae*) and will be referred to as *Sclerocactus cloverae* in subsequent publications (NNHP 2020). Despite the lumping of these species, the species range is still limited.

The Brack's hardwall cactus is threatened by intense energy development and off-road vehicle use in its habitat. Its small size can make it difficult to see plants in its habitat (NMRPTC 1999).

Existing Environment

On the Navajo Nation, potential habitat exists in San Juan County south of the San Juan River (NNHP 2008). Surveys conducted on the Nacimiento formation in 2015 found 2,571 live cactus plants (including both sub-species) with the highest densities in sparse grama-galleta grasslands and open sagebrush shrublands with scattered grass understories along valleys and dry washes (Muldavin et al. 2016).

Effects Analysis

Due to its small size and limited population size, Brack's hardwall cactus is susceptible to impacts in its known habitat. Any projects that occur in its potential habitat are recommended to conduct surveys by a qualified biologist to identify and flag cacti. The recommended treatment-based buffers would prevent workers from accidently crushing or damaging plants in the treatment area. Buffers and restrictions on the use of herbicides during periods of high humidity, high temperatures, and within 24 hours of a precipitation event would reduce or eliminate direct impacts to the cactus.

However, indirect impacts from trampling, mechanical equipment use on site, and overspray of herbicide in adjacent habitat may potentially affect some populations. These effects, however, would be reduced or eliminated by the species conservation measures and best management practices for weed treatments.

Populations of Brack's hardwall cacti that occur in areas where energy development or off-road use is common may experience stress from these land uses, making them more susceptible to damage from weed treatments. The avoidance measures would prevent damage and impacts to such populations and minimize the risk of synergistic impacts. Further, management and control of noxious weed species in the range of the cactus would be beneficial as it would reduce competition and habitat alteration from many target weed species. Overall, the proposed noxious weed treatment management plan, with the proposed species conservation measures, would not adversely affect this species.

Welsh's American-aster (*Symphyotrichum welshii*)

Species Account

Welsh's American-aster suitable habitat consists of wet meadows, seeps, springs, and hanging gardens between 4,300 and 8,000 ft. where they are locally abundant (NNHP 2020). They occur primarily on wet sandstone and limestone habitats (NatureServe 2021).

On the Navajo Nation, known populations occur within grazing habitat, although no direct impacts have been observed. Other threats include drying up of hanging gardens due to climate change (NatureServe 2021a). The species is considered protected by the remote nature of the hanging gardens where they occur (NatureServe 2016g).

Existing Environment

On the Navajo Nation, it is only known from one population in the Tsegi watershed in northern Navajo County. However, it may occur in northern Coconino and Navajo Counties (NNHP 2020). This species is currently known from 3 occurrences on the Navajo Nation in Arizona, however more occurrences may be present where hanging gardens occur (NatureServe 2021a).

Effects Analysis

To prevent field crews from trampling the aster in treatment sites, buffers marked with flagging are recommended based on the proposed treatment methods. There will be no direct effects to Welsh's American-aster since weed treatments are not proposed to hanging garden sites, although populations in other wetland habitats may require weed treatments. Indirect effects include herbicide drift from chemical treatments. The likelihood of herbicide drift would be reduced by a 200 ft buffer for chemical treatments. Also, herbicides would not be applied when wind speeds exceed 10 miles per hour, temperatures are greater than 80° (26.7°), and humidity is high. Finally, many hanging gardens with Welsh's American-aster are located in remote and inaccessible areas where it is unlikely weed treatments will occur, and, if they do occur, wind drift herbicide would not reach these populations. Other methods, such as mechanical, including prescribed fire, and cultural treatments, require a 200 ft buffer from identified populations. Due to the remote nature of hanging gardens, it is unlikely that heavy machinery would be used to treat weeds. Chainsaws may be used for cut stump treatments, but this technique is focused on trees and woody plants.

Livestock can also be a threat to Welsh's American-aster habitat due to grazing and trampling damage. Such impacts are primarily a result of unmanaged grazing, which differs from targeted grazing used as a cultural control method under this action. Targeted grazing is restricted to Community Development areas and agricultural areas. If Welsh's American-aster populations are present in targeted grazed locations, a fence would be established around the hanging garden to ensure a 200 ft buffer is enforced.

Herbicide overspray to populations of Welsh's American-aster may provide a cumulative impact with the known threats to its habitat, including livestock grazing, trampling, and water development. If Welsh's American-aster populations are compromised due to these outside pressures, herbicide overspray may further impact these susceptible populations. The effect of grazing, trampling, climate change, and water development on hanging gardens fluctuates from year to year, meaning that the risk of synergistic impacts would vary as well.

Removal of noxious weed species from areas adjacent to Welsh's American-aster populations would protect the species from impacts related to noxious weed. The mitigation measures, including buffers identified for each treatment method, and best management practices would eliminate the risk to Welsh's American-aster and allow weed treatments to not adversely affect the species.

6. Determination

The species listed above do occur in the action area for this project. Project-specific actions tiering off this document would require further biological evaluation by submitting a Data Request Form for the project to NNDFW NNHP. The Data Request Form requires the specific weed treatment methods proposed and maps of the project area. The project sponsor is required to obtain a Biological Resource Compliance Form (BRCF) to initiate the project. The BRCF will determine if potential habitat for Federal or Navajo Listed Endangered, Threatened, Sensitive, or Proposed species or migratory birds exists at the site. If potential habitat occurs at the site, the project sponsor will have to complete species or habitat assessments by a qualified and permitted biologist, implement species conservation measures, and/or have a qualified biologist on site during project implementation.

To conduct species surveys, a Native Endangered Species Recovery Permit will be obtained from the USFWS (if it is a species listed on the federal Endangered Species Act) and a Biological Investigations Permit from the Navajo Nation Department of Fish and Wildlife. Surveys will be conducted according to protocols approved by the USFWS and NNDFW. If a listed species is found, the appropriate species-based protection measures would be implemented, or the species will be avoided. If the species is not present after species surveys are conducted, no buffers need to be employed. It is anticipated there will be long-term beneficial effects to the listed species above by the removal of noxious weeds. By the species conservation measures listed above, the Integrated Weed Management Plan **will not affect** or **may affect, but is not likely to adversely affect** the species listed above.

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Appendix A. Navajo Nation Integrated Weed Management Plan

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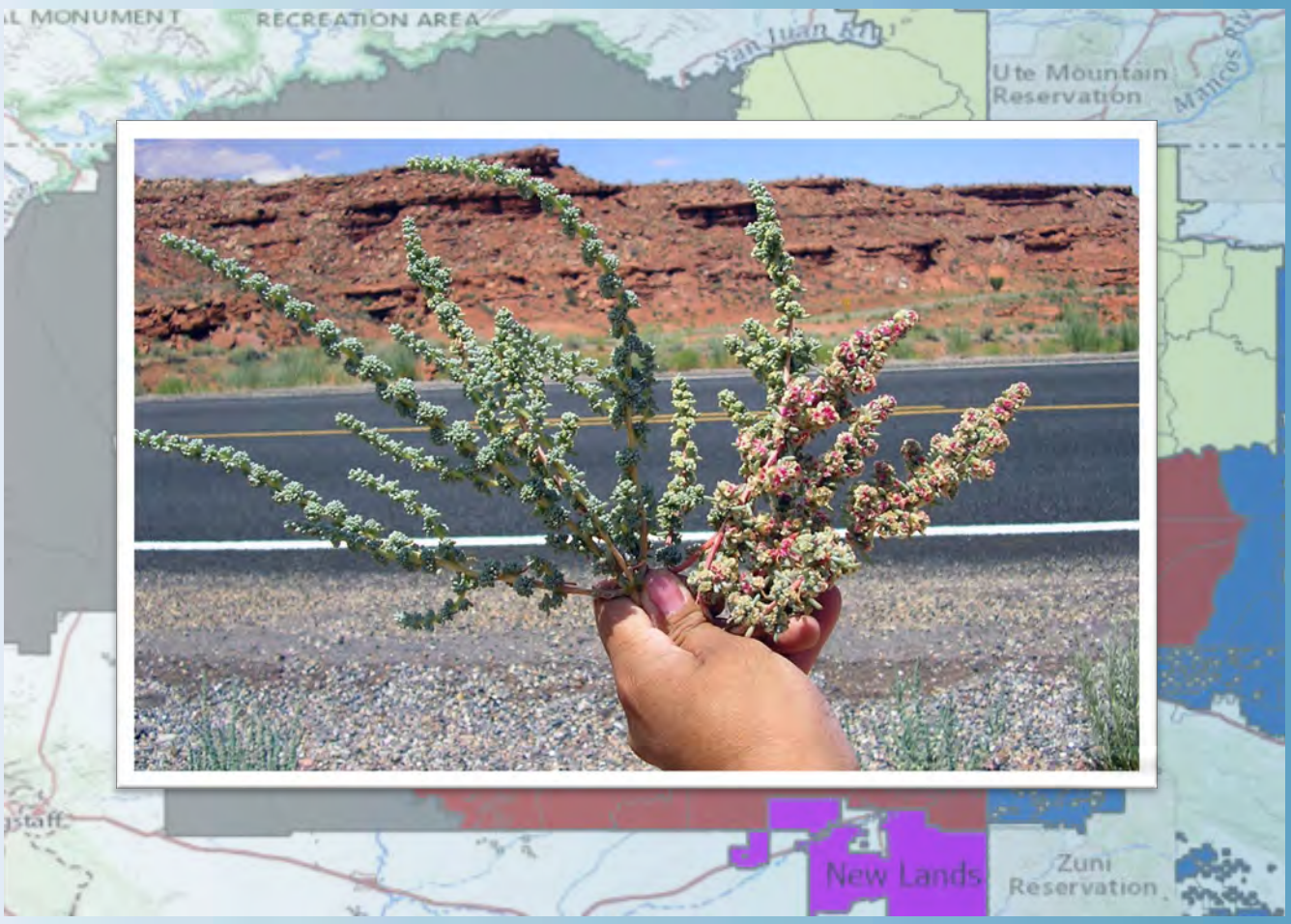

Navajo Nation Integrated Weed Management Plan

DRAFT

July 2021

ON BEHALF OF:
THE NAVAJO NATION

UNITED STATE DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS NAVAJO REGION

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NAVAJO NATION INTEGRATED WEED MANAGEMENT PLAN

July 2021

U.S. Department of Interior
Bureau of Indian Affairs
Navajo Region

Prepared by:
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Cover photo by Renee Benally, Bureau of Indian Affairs Western Navajo Agency Natural Resource Specialist of a halogeton sample collected along Highway 163.

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1.0 Introduction

Controlling noxious/invasive weeds, or more appropriately, undesirable non-native vegetation, has long been a serious concern for land users. According to the Federal Noxious Weed Act of 1974 (P.L. 93-629), noxious or invasive weed species are plants "classified as undesirable, noxious, harmful, exotic, injurious, or poisonous" and does "not include plants indigenous to an area where control measures are to be taken." Noxious weeds have little value and often have negative impacts on desired native plants and wildlife. Noxious weeds occupy space across the landscape, absorb sunlight, and utilize soil moisture that would otherwise be available for native plants. Many noxious weeds can directly change a site, making it difficult to re-establish desired native plants. In addition, noxious weeds can harm livestock, wildlife, and humans; thereby, resulting in economic, cultural, and social impacts.

On the Navajo Nation, the number and cover of noxious weed species has increased in recent years. Noxious plants were introduced through various activities, including:

- Road construction & maintenance,
- Use of non-weed-free hay and feed,
- Transportation of weed seeds by livestock and wildlife to remote locations,
- Infrastructure development (i.e., waterline, gas lines, and powerlines),
- Flowing streams, wildlife and the wind which contribute to seed dispersal, and
- A lack of grazing limits, which can put additional pressure on native vegetation, allowing noxious weeds to outcompete native plants.

Disturbed habitats facilitate the establishment of noxious weeds. Disturbance can introduce weeds along roads and rights-of-way from vehicles that carry seeds and plant materials, construction material, or garbage. These linear corridors provide a thoroughfare for rapid weed expansion to adjacent wild, agricultural or range lands. Rights-of-way also provide access points for weeds to spread to riparian corridors from runoff or road crossings.

The expansion of noxious weeds on the Navajo Nation contributes to the decline of forage production, native grassland community quality, wildlife habitat quality, and overall ecological health of the region. Noxious weeds impact every habitat on the Navajo Nation, which affects the economic, historic, and cultural livelihood of the Navajo people. Control of these weeds will improve rangeland and agricultural land quality by improving growth of native forbs and grasses that benefit subsistence ranching and farming, increase native plant diversity in riparian corridors, protect water resources and water quality, prevent the spread of additional weeds to unaffected land and property, and maintain and improve wildlife habitat.

1.1 Background

The Bureau of Indian Affairs (BIA) Noxious Weed program was initiated in December 1988 in response to Congressional directives to improve management on Indian lands. A task force and 10-Year Management Plan were developed and included in 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. This policy directed on-the-ground work and allocated funds directly for weed control projects. Program standards and oversight are provided by BIA Branch of Agriculture and Rangeland Development based on input from BIA Regional Noxious Weed Coordinators.

The BIA Navajo Region has initiated various projects to control specific target noxious weeds on the Navajo Nation using various methods. The target noxious weeds treated to date on the Navajo Nation include:

- Tamarisk (*Tamarix* spp.)
- Russian olive (*Elaeagnus angustifolia*)
- Russian knapweed (*Acroptilon repens*)
- Camelthorn (*Alhagi camelorum*)
- Halogeton (*Halogeton glomeratus*)
- Musk thistle (*Carduus nutans*)

While these efforts support the goals of the Noxious Weed Control Program, the Navajo Regional Office (NRO) determined the need for an integrated and coordinated management plan which used methodical, science-based strategies to actively monitor and control noxious weeds. In conjunction with developing a weed management plan, NRO determined that compliance with the National Environmental Policy Act (NEPA) was necessary to facilitate discussions with the public regarding potential impacts of a weed management plan. By completing one wholesale environmental compliance effort for integrated weed control, the BIA can streamline planning and compliance processes and encourage large-scale cooperative projects.

To address the need for a more balanced approach to weed management, NRO initiated development of a weed management plan. This Integrated Weed Management Plan (IWMP) identifies weed species of concern; details weed removal strategies; and consolidates the best management practices available for weed control. Best management practices that were limited in the past are now an integral component of the Region's weed management efforts, such as early detection and eradication, prevention, and education. This plan will encompass a 10-year period but will be reviewed after five years. Repeated treatments will be necessary until the desired control objective is reach for most species as seeds can be viable for 10 or more years.

1.2 Project Goals

1. Develop the best control techniques described for the target weed species in a planned, coordinated, and economically feasible program to limit the impact and spread of noxious weeds.
2. Use adaptive management strategies to incorporate successful projects from completed weed projects when developing new initiatives.
3. Identify and prevent the expansion of existing target weed species, and quickly prevent the spread of new high priority weed species.
4. Coordinate weed removal efforts with adjacent landowners, land managers, and/or federal agencies to prevent the further spread of weeds.
5. Provide and promote economic opportunities for the Navajo people to improve rangeland and farmland productivity and to remove noxious weeds.
6. Develop a public education program focused on weed identification, prevention, and removal techniques for local communities and non-profit organizations.

2.0 Project Area

The Navajo Nation covers approximately 16.3 million acres across northeastern Arizona, southeastern Utah, and northwestern New Mexico and (**Figure 2-1**). The BIA Navajo Region is divided into five BIA agencies including (acres indicate total size of areas managed by each agency):

- Western Navajo Agency (Tuba City, Arizona, 5.2 million acres)
- Eastern Navajo Agency (Crownpoint, New Mexico, 2.3 million acres)
- Fort Defiance Agency (3.3 million acres)
- Shiprock / Northern Navajo Agency (2.7 million acres)
- Chinle / Central Navajo Agency (1.4 million acres)

The Navajo Partitioned Lands (Pinon, Arizona, 910,000 acres) and the New Lands Area (310,000 acres) contain an additional 1.2 million acres. At the date of this writing, New Lands is managed by the Office of Hopi and Navajo Indian Relocation but may come under the BIA in the foreseeable future. Thus, the New Lands Area is included in the project area. Additionally, there are approximately a million acres of land that may be in transition to allotment or trust lands on the Navajo Nation as part of land buy backs. For this document, the project area refers to the entire Navajo Nation as defined above with project sites referring to individual weed project locations.

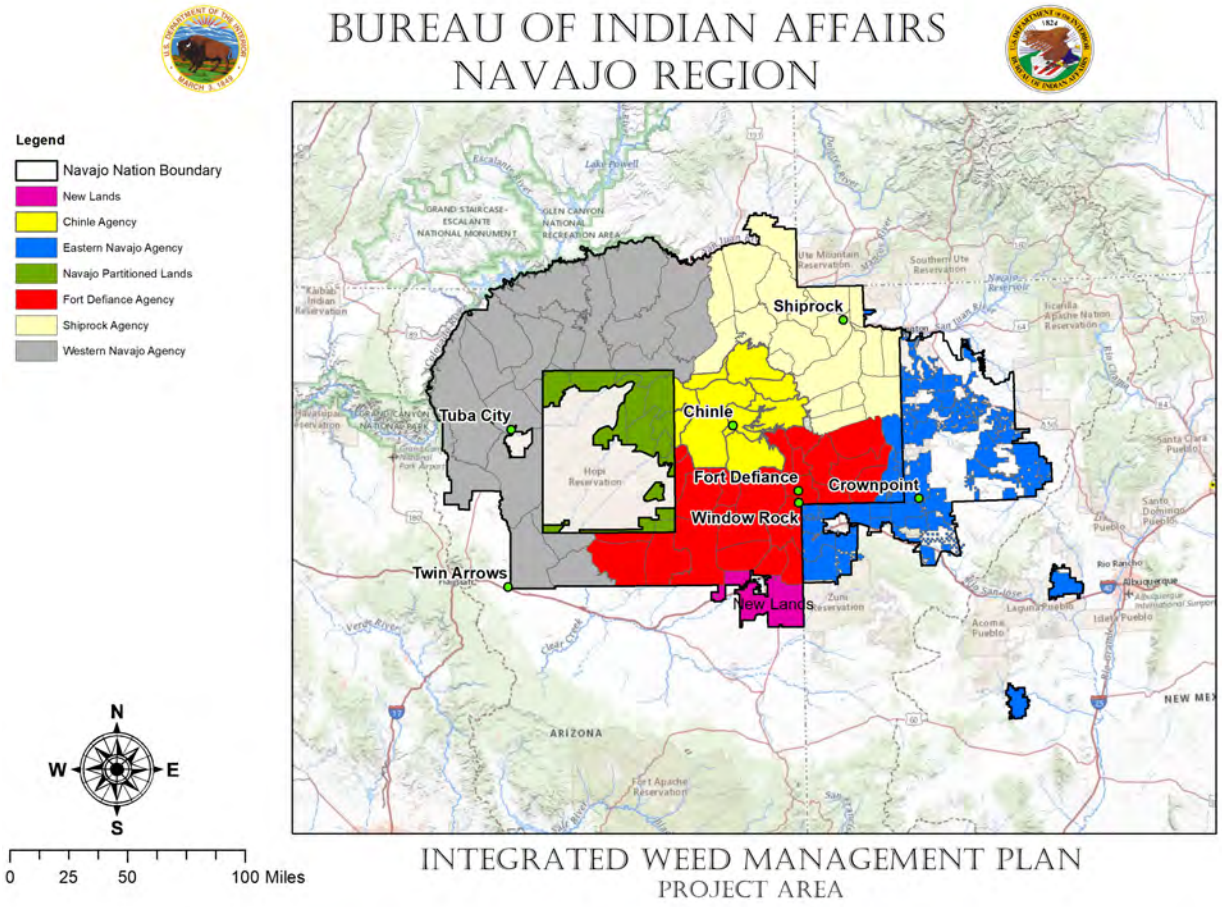

Figure 2-1. Project area of the Navajo Nation divided by BIA Navajo Regional Agencies.

This plan addresses lands under the direct administration of the NRO, which includes all Navajo Indian Allotments and Navajo trust land. Priority areas were identified to direct weed treatments where noxious weeds cause significant issues for land users and land managers (Appendix B). These areas were selected based on general land use types where a majority of weed management projects have been planned or coordinated. Priority areas include:

- Navajo Nation, BIA, federal, state, and county roads
- Riparian areas
- Navajo Nation-designated Community Development Areas
- Rights-of-way
- Designated rangeland
- Designated farmlands
- Navajo Agricultural Products Industry (NAPI) lands

All weed treatment projects shall be conducted in close coordination with local communities, Chapter Houses, and the Navajo Nation.

Roads are a primary contributor of noxious weed populations on the Navajo Nation and are a priority area for weed treatment. In 2018, the Navajo Nation DOT assumed full responsibility for the administration and management of the Tribal Transportation Program (TTP), including the BIA Navajo Region Branch of Transportation (NRBOT) Force Account Program. There are numerous paved and unpaved public roads managed under the TTP. For roads managed by state transportation agencies, vegetation is treated approximately 300 ft from the center of the road for interstates and between 50-100 ft from the center of the road or to the right-of-way fence on state highways. Agencies responsible for management of public roads include Navajo Nation Department of Transportation (Navajo DOT, 5,174 miles); Bureau of Indian Affairs Branch of Transportation (6,086 miles); County Roads (1,512 miles); and state and federal routes managed by Arizona Department of Transportation (ADOT), Utah Department of Transportation (UDOT) and New Mexico Department of Transportation (NMDOT). Treatments may also occur along tribal forest roads, which will require coordination with Navajo Forestry Department and the BIA Branch of Forestry.

Riparian areas are distinct ecosystems surrounding perennial and intermittent surface water bodies, such as lakes, rivers, and streams. These areas are hotspots of biodiversity in the region and cover approximately 1.3 million acres on the Navajo Nation. Water bodies are classified based on the major watershed basin they are located in. Five sub-regional watershed basins occur on the Navajo Nation and include the Rio Grande (710,367 acres), Upper Colorado (980,449 acres), San Juan (8.54 million acres), Lower Colorado (723,528 acres), and Little Colorado (6.67 million acres). These major watersheds are divided into 32 drainage basins on the Navajo Nation. Noxious weeds have been identified in all drainage basins on the Navajo Nation. Riparian habitats in these watersheds have been most impacted by noxious trees, such as Russian olive (*Elaeagnus angustifolia*) and tamarisk (*Tamarix spp.*). Weed populations in these habitats often serve as seed sources to downstream habitats and degrade valuable habitat for wildlife populations, including federally and tribally listed species.

Community Development Areas (CDAs) are defined by the Navajo Nation Department of Fish and Wildlife as "areas in and around towns with few or no restrictions on development." Planning for these areas is done through the Navajo Nation Department of Community Development with local Navajo Chapters. These areas are deemed unsupportive for Navajo species of concern with few restrictions on development. CDAs can be hotspots for weeds as construction, road work, and development activities spread seeds and plant parts to neighboring communities and natural areas. Weed treatments can occur in Biological Preserves and other Sensitive Conservation Areas only on a project-by-project basis in close coordination with the U.S. Fish and Wildlife Service (USFWS) and Navajo Nation Department of Fish and Wildlife (NNDFW) Natural Heritage Program.

Rights-of-way (ROWs) occur along all utility transmission lines, homesite leases, and roads on the Navajo Nation. Utility ROWs on the Navajo Nation are Indian Trust Land and maintained by utility companies who manage the lines. These include transmission lines for electricity, water,

sewage, internet, phone, and natural gas. Most lines are managed by the NTUA, who provide utility service to residents on the Navajo Nation. BIA Realty currently estimates over 14,000 acres of approved rights-of-way across the Navajo Nation.[1] In addition to NTUA and a few local service providers, Arizona Public Service, Public Service Company of New Mexico, and the Salt River Project also maintain transmission lines on the Navajo Nation but may not provide direct service to trust lands. Federal law requires grantees to control and prevent weeds as part of their right-of-way (25 CFR §169.5). Land disturbance from installation or repair of utility lines can encourage the growth and introduction of many of noxious weed species.

Designated rangeland are areas managed for livestock grazing. These areas are administered by the Navajo Nation either through the Department of Agriculture (NNDA) or the BIA. There are currently around 11,000 active grazing permits on the Navajo Nation. All range permits and range units are managed by the BIA, while NNDA manages enforcement and oversight. These lands encompass roughly 2.6 million acres. The highly disturbed nature of designated rangelands has promoted the growth of many noxious weeds.

Designated farmlands are set-aside either through land lease agreements or permits by the Navajo Nation (3 N.N.C. 1) and the BIA (25 CFR § 162 and 167). Designated farmlands comprise approximately 57,900 acres of the Navajo Nation under an estimated 5,000 customary land use permits. Farmlands are categorized as either dryland farms or irrigated farms. Irrigated farms are located near open water used to irrigate fields. Dryland farms are located further away from open water and receive water through irrigation, pumping, and seasonal precipitation.

Commercial farmlands cover areas managed by the Navajo Agricultural Products, Inc. (NAPI) and the Navajo Indian Irrigation Project (NIIP), which provide irrigation and agricultural products for the Navajo Nation. The BIA is responsible for NAPI and NIIP project oversight and ensures they remain in compliance with environmental concerns. The Navajo Nation is responsible for overall management and operations. NAPI lands comprise approximately 110,000 acres along the border between Shiprock / Northern Navajo Agency and Eastern Navajo Agency east of Farmington, New Mexico. In 2019, 66,490 acres were in active production, and 7,000 acres were inactive or fallow. The remaining 36,510 acres are inactive due to delays in the construction of the NIIP irrigation delivery system to the site.

Although the BIA will focus on weed treatments in these priority areas, weed treatments may occur in non-priority areas based on ecological and economic impacts and need. If a site matches the site prioritization criteria outlined in Section 5.0, and serious concern exists for the ecological and economic impacts of existing weed populations, efforts should be made to treat and manage weeds in those areas.

[1] Based on BIA TAMS data compiled on January 15, 2021 recently transferred and requires additional clean up and categorization to determine road vs. right of way data. Estimate is likely higher due to undigitized records.

Weed inventory and mapping will be conducted concurrently as part of this plan to identify weed populations in the project area and to prioritize control efforts. Recent efforts in the past 5 years have documented over 70,000 acres of noxious weeds. All areas with identified weed infestations should be ranked and prioritized based on criteria outlined in Section 4.0

3.0 Priority Weed Species

Forty-five noxious weed species are prioritized for control in this plan. The priority weed species were identified through previous weed mapping efforts by the BIA and the Southwest Exotic Plant Information Clearinghouse (SWEPIC) managed by the U.S. Geological Survey (USGS) Colorado Plateau Research Station (**Table 3-1**). These weeds were selected and ranked based on variety of factors, such as weed occurrence data and priority status in nearby states. The BIA also proposes implementing a weed mapping program as part of the Plan to assess and monitor weeds cover and impacts on the Navajo Nation. Weed inventory and mapping is discussed further in Section 6.0.

These 45 weed species were categorizing into Category A, B, or C with help from the San Francisco Peaks Weed Management Area Working Group (**Table 3-1**). Category A noxious weeds are not currently present or have limited distribution on the Navajo Nation but may occur in neighboring areas. The management goal for Category A weeds is to prevent new and eradicate existing infestations. For Category A species, the BIA will emphasize eradication, prevention, education, awareness, identification, monitoring, and treatment. Category B noxious weeds are limited in range across the Navajo Nation and the management goal is to contain existing infestations and stop further spread. For Category B species, the BIA will emphasize immediate control, prevention of seed spread, and eradication. Category C noxious weeds are wide-spread and well established on the Navajo Nation, and the management goal is to locally contain infestations and monitor populations. Management of Category C species is determined at the local level and is based on the feasibility of control and level of infestation. For Category C species, the BIA will emphasize management, education, awareness, and identification/monitoring.

Under this plan:

- **Prevention** means minimizing introductions of a weed species in the project area and is usually combined with eradication to allow the elimination of small populations as they arise.
- **Eradication** means to eliminate a species from the project area.
- **Contain** means preventing seed production in a target patch and reducing the area covered by a species.

Long-term eradication means an attempt to eliminate a species from the project area over several years. The "contain" and "long-term eradication" strategies are combined as different sized populations may be found in different areas. Some populations may be controlled in a manner to eventually achieve eradication within the project area.

- **Local contain** means local weed management teams will identify the species to contain in localized sites and implement monitoring.
- **Monitoring** means making observations to detect changes in a population using qualitative or quantitative techniques. Monitoring can help prioritize noxious weed removal activities by identifying increases in existing populations, presence of new infestations, and invasion from new noxious weed species.
    - Qualitative techniques involve monitoring methods that do not include measurements or statistics (i.e. photo monitoring and general ocular observations).
    - Quantitative techniques involve using a systematic empirical investigation of plant community characteristics via statistical, mathematical, or computational methods.

Table 3-1. Noxious weeds of concern and proposed management strategy objectives.

CATEGORY A - HIGH		
COMMON NAME	**SPECIES**	**MANAGEMENT GOAL**
Leafy spurge	*Euphorbia esula*	Prevent
African rue	*Peganum harmala*	Prevent
Tree of Heaven	*Ailantus altissima*	Prevent
Fountaingrass	*Pennisetum setaceum*	Prevent
Squarrose knapweed	*Centaurea virgata*	Prevent
Blue mustard	*Chorispora tenella* (Pall.) DC.	Eradicate
Ravenna grass	*Saccharum ravennae*	Eradicate
Yellow starthistle	*Centaurea solstitialis*	Eradicate
Bull thistle	*Cirsium vulgare*	Eradicate
Canada thistle	*Cirsium arvense*	Eradicate
Dalmatian toadflax	*Linaria dalmatica*	Eradicate
Musk thistle	*Carduus nutans*	Eradicate
Perennial pepperweed	*Lepidum latifolium*	Eradicate
Scotch thistle	*Onopordum acanthium*	Eradicate
Spotted knapweed	*Centaurea maculosa, C. stoebe*	Eradicate
Tall Whitetop	*Cardaria draba*	Eradicate
Sahara mustard	*Brassica tournefortii*	Eradicate
Uruguyan pampas grass	*Cortaderia sellonana*	Eradicate
Yellow nutsedge	*Cyperus esculentus*	Eradicate
Sulphur cinquefoil	*Potentilla rect L.*	Eradicate
Common Mediterranean grass	*Schismus barbatus*	Eradicate
Tamarisk (other species)[2]	*Tamarix* spp., including hybrids	Eradicate
CATEGORY B - MEDIUM		
COMMON NAME	**SPECIES**	**MANAGEMENT GOAL**
Camelthorn	*Alhagi camelorum*	Eradicate
Halogeton	*Halogeton glomeratus*	Contain & Long term eradicate
Siberian elm	*Ulmus pumila*	Contain & Long term eradicate
Tamarisk, Saltcedar	*Tamarix ramosissima*	Contain & Long term eradicate
Diffuse knapweed	*Centaurea diffusa*	Contain & Long term eradicate
Russian knapweed	*Acroptilon repens*	Contain & Long term eradicate
Russian Olive	*Elaeagnus angustifolia*	Contain & Long term eradicate
Johnsongrass	*Sorghum halepense*	Contain & Long term eradicate
CATEGORY C - LOW		
COMMON NAME	**SPECIES**	**MANAGEMENT GOAL**
Cheatgrass	*Bromus tectorum*	Local Contain & Monitor
Field bindweed	*Convolvulus arvensis*	Local Contain & Monitor
Jointed goatgrass	*Aegilops cylindrica*	Local Contain & Monitor
Puncturevine	*Tribulus terrestris*	Local Contain & Monitor
Rescuegrass	*Bromus catharticus*	Local Contain & Monitor
Ripgut brome	*Bromus diandrus*	Local Contain & Monitor
Smooth brome	*Bromus inermis*	Local Contain & Monitor
Bald brome	*Bromus racemosus*	Local Contain & Monitor
Red brome	*Bromus rubens*	Local Contain & Monitor
Spreading wallflower	*Erysimum repandum*	Local Contain & Monitor
Horehound	*Marrubium vulgare*	Local Contain & Monitor
California burclover	*Medicago polymorpha*	Local Contain & Monitor

[2] Saltcedar is a Category B species due to its high density and cover, making it a target for management. All other tamarisk species are considered Category B species due to the limited distribution on the Navajo Nation

COMMON NAME	SPECIES	MANAGEMENT GOAL
Russian thistle	*Salsola kali, S. collina, S. paulsenii, S. tragus*	Local Contain & Monitor
Field brome	*Bromus arvensis*	Local Contain & Monitor
Kochia	*Bassia scoparia*	Local Contain & Monitor

4.0 Implementation Strategy

The BIA proposes completing up to 50,000 acres of weed treatments across the Navajo Nation annually. Noxious weed treatments will be prioritized for the priority areas described above including roads; riparian areas; Navajo Nation Designated Community Development Areas; utility rights-of-way; designated rangeland; designated farmlands; and Navajo Agricultural Products Industry (NAPI) lands. BIA has identified priority Demonstration Projects in these areas (see Section 12.0) based on completed weed mapping efforts and on-going projects, which will be initiated upon approval of this plan. To assist BIA in selecting and ranking new noxious weed projects, the following implementation prioritization strategy was developed. Since funding is limited, the number of projects and acres treated per year will likely vary.

The tasks outlined below provide the essential steps for implementing successful weed removal projects. For the long-term sustainability of weed removal efforts, a Weed-Free Policy should be developed and enforced by the Navajo Nation and BIA to prevent the further spread of noxious weeds. The Weed-Free Policy should require use of certified-weed free hay, seed, ballast, and road material on the Navajo Nation to prevent further spread and establishment of noxious weed species. A checklist is provided in Appendix C, which outlines all steps necessary for weed projects.

Task 1. Initiate demonstration projects near communities. These projects are shovel ready projects that will provide public outreach and educational opportunities, obtain public support for the broader goals of the Plan, and engage the local community in weed removal efforts. The demonstration projects provide information about the distribution of noxious weeds, effective removal methods, project costs, and effective monitoring and maintenance. Proposed demonstration projects are listed in Section 12.0.

Task 2. Meet with local communities and nearby federal agencies. Engagement with the public should determine potential concerns or issues that may affect local communities, such as public health concerns, treatment preferences, or treatment conflicts. Meeting with local residents, community leaders, and agencies will determine the scope of the weed treatment project, identify concerns and challenges, and inform each project's goals and objectives.

Task 3. Map and inventory noxious weeds. A regular workshop will be conducted with the BIA Weed Coordinators to establish a standardized approach to consolidate and coordinate mapping efforts. Mapping provides information on the species present, the size of the infestation, and location.

Task 4. **Apply the site and species approaches.** Actions are prioritized using the site and species approaches to select the best sites to initiate weed management (see below). This applies to all new weed management projects.

Task 5. Develop a site-specific plan to implement weed removal efforts for projects. The plan will provide information on weed species present; a map of the treatment area; the removal efforts selected, including detailed information on equipment; native plant restoration; and proposed project costs. If the treatment is located within forestlands a silvicultural prescription may be required.

Task 6. Obtain required permits, clearances, and funding. Acquire permits and support from the tribe, BIA, develop landowner access agreements, obtain funding, and build capacity. Required permits and clearances may include but are not limited to: Forest product harvest permit or contract, burn permit, consent of the majority Indian interest of the beneficial Indian owner(s), Biological Resource Compliance Form from NNDFW, the Cultural Resource Compliance Form from Navajo Nation Historic Preservation Department (NNHPD), and a tribal resolution from the local Chapter House(s) and/or Grazing Committee(s) affected by the project. Finally, all projects should complete a project-specific EA based on the analysis provided in the Programmatic EIS prepared for this plan. See Appendix C for more details on these processes.

5.0 Approach for Prioritizing Actions and Sites

To successfully work toward the Plan's goals, an organized approach is essential to prioritize weed removal actions and sites. While the Navajo Nation is a large land base, focused weed removal efforts in targeted areas will help prevent the spread of noxious weeds. A two-pronged approach was developed to prioritize noxious weed removal actions: 1. Site Approach (**Table 5-1**) and 2. Species Approach (**Figure 5-1**).

The Site and Species Approaches are tools used to first prioritize sites and then prioritize the species for removal within a given site. In some cases, all noxious weeds occurring at a site could be removed. This should be determined on a case-by-case basis.

There are five fundamental requirements that dictate the feasibility of a successful weed removal project at any given site. The characteristics listed below must be met for weed removal to proceed:

1. Funding is available to complete the project, including for monitoring and maintenance.
2. The land user/manager is interested and willing. Commitment, cooperation, and common goals with the land user or land manager are required to complete weed removal actions and goals, monitoring and long-term maintenance.

3. Permits are obtained. Noxious weed removal work cannot start without all required permits and environmental clearances. Any projects implemented under this plan will require compliance with the National Environmental Policy Act (NEPA), Section 106 of the National Historic Preservation Act (NHPA), and Section 7 of the Endangered Species Act (ESA) coverage. Additional permits and clearance may be necessary to comply with Navajo Nation regulations as managed by the Navajo Nation Environmental Protection Agency (NNEPA), Navajo Forestry Department, and the U.S. Army Corps of Engineers, as well as coordination with local communities, Navajo Nation Programs, and neighboring land management agencies. Permits and additional compliance are explained further in Section 7.0.

4. There is capacity to conduct work at project sites. A trained work force and a logistic plan are necessary to implement a successful and timely noxious weed removal project.

5. The site is accessible. Site accessibility will affect the cost of the noxious weed removal efforts. Difficulty employing certain removal techniques, monitoring, and long-term maintenance should be considered based on the accessibility of the site.

5.1 Site Approach

The site prioritization criteria listed in **Table 5-1** is used to select sites where weed treatments will be most effective at preventing the spread of noxious weed infestations.

Table 5-1. Criteria for site prioritization

Criteria	Criteria Objective
A. Sites upwind of prevailing wind direction or higher in elevation	Prevent seed or vegetative source from infesting sites downwind of the prevailing wind direction.
B. Sites upstream in the watershed	Prevent seed or vegetative source from infesting downstream sites.
C. Sites with high economic value	Removal efforts can be focused in areas of economic value (i.e. range and farmland) if noxious weed species compromise their functionality.
D. Sites with potential for high mobility (i.e. roads, rights-of-way)	Prevent the spread of noxious weeds along roads or other developed linear corridors that have high mobility potential.
E. Presence of Category A species	These species occupy minimal habitat and are feasible to remove. These species should be prevented from further spread.
F. Coordinated project efforts	Removal efforts can be focused in areas where adjacent land management agencies (e.g., Bureau of Land Management, Forest Service, Hopi Tribe, National Park Service, etc.) have similar noxious weed removal projects.

Criteria	Criteria Objective
G. Greater than 10% total canopy cover of woody invasive plants	Maintain woody noxious weed cover below 10 percent.
H. Greater than 20% total canopy cover of herbaceous and grass invasive species	Maintain herbaceous and grass noxious weed cover below 20 percent.
I. Presence of isolated small populations of Class A or B species	Isolated populations of Class A or B weeds are feasible to remove to prevent further infestation. Priority Class A or B weeds should be identified using the Species Prioritization Flow Chart (Figure 5-1).
J. Potential for wildfire	Reduce wildfire risk for damage to property, human safety and wildlife habitat.
K. Herbaceous weed control where plants interfere with passive or active revegetation	Control noxious herbaceous species if they have the potential to serve as secondary weeds when woody noxious weed species have been removed.
L. Sites with high wildlife value	Removal efforts can be focused in areas with high wildlife value if noxious weeds are compromising their habitat.

5.2 Species Approach

The species prioritization approach is adapted from the U.S. Forest Service (USFS) Region 3 Invasive Weed Classification System and the Coconino National Forest (**Figure 5-1**). A species prioritization approach provides a plan for treating and managing different target weed species on a site based by species category, infestation size, risk, or potential of spread, and available resources.

5.2.1 Risk Assessment

An essential consideration when prioritizing species is to determine factors that may facilitate the spread of noxious weeds to other areas, such as the species' mechanism of establishment or colonization (seed, vegetatively, spread via flood events, wind, water, etc.), its location at a site, and site characteristics. Weeds classified as Category A (**Table 3-1**) are highly aggressive but may be a lower priority than a Category B species because the site factors are not conducive to spread, whereas the Category B species may have the appropriate site conditions to spread. For example, a patch of saltcedar (A) located on flat or isolated area off the river corridor may be less of a priority than camelthorn (B) located on the riverbank. While saltcedar is a highly aggressive species, the camelthorn may have a higher risk of spreading through flood events. Risk assessments should be conducted in the field by qualified professionals.

5.2.2 Pre-Field Review

The species prioritization process should begin with a review of existing weed data for each area of interest. Areas of interest include those that may serve as a noxious weed seed source to downstream or downwind areas, developed linear corridors (roads, fences, utility easements), areas with high quality range, agricultural lands, or riparian habitat (dominated by >90% native species), and areas with high fire risk. The following is a list of considerations when preparing existing data.

1. Review geographic information system (GIS) maps of all existing information for an area, weed data, hydrology, roads and travel corridors, vegetation type, and primary use of the land.
2. Check with local BIA weed coordinators, county/state weed specialist, and the Southwest Exotic Mapping Program at Northern Arizona University to determine if noxious weed species are present on or adjacent to the area. For noxious weeds along non-forest roads and highways, contact ADOT, NMDOT, and/or UDOT. For tribal forest roads contact the Navajo Forestry Department (NFD) and BIA Branch of Forestry. Develop a list of possible species present.
3. Compare the habitat requirements for noxious weeds to the project area to determine if potential habitat for noxious weeds exists.
4. Determine the accessibility of the site and complete a habitat evaluation if necessary.
5. Determine if plant gathering sites could be affected by treatments based on input from the community.

Figure 5-1. Flow Chart Species Prioritization

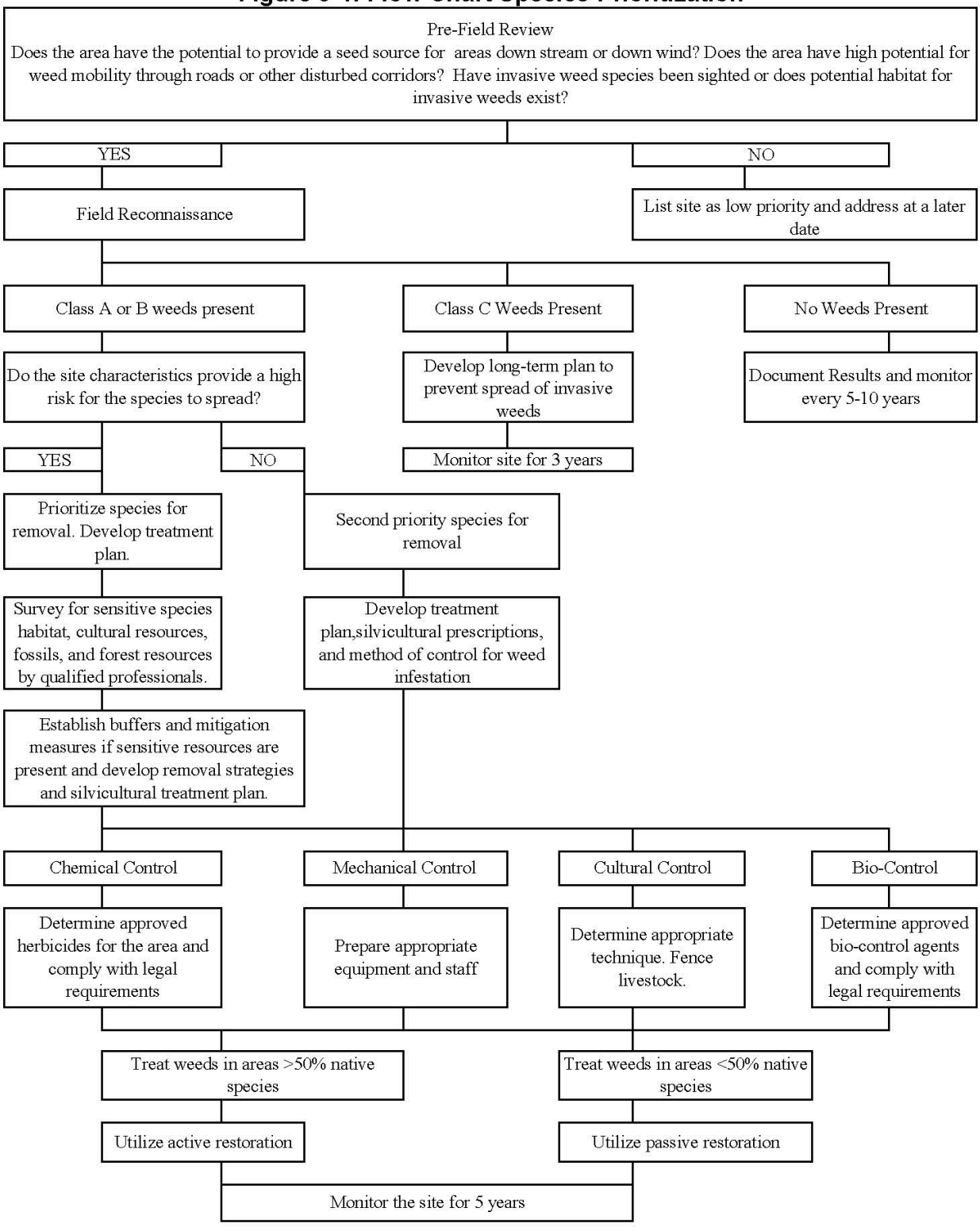

Figure 5-1. Flow chart for prioritizing noxious weeds identified at a project area.

6. Conduct a field reconnaissance to determine the presence of noxious weeds and their habitats in the area are indicated by the pre-field review (See 5.2.3).

7. Summarize results, including a list of the species considered and sources used to identify habitat in area.

5.2.3 Field Reconnaissance

Field reconnaissance should be conducted to determine the presence and distribution of noxious weed infestations and to evaluate spread risk if a weed inventory has not already been completed. If an inventory is conducted in forestlands, specific forest inventory methods may be required. Consultation with a professional Forester should be conducted to determine specific inventory requirements for the silvicultural prescription.

A reliable sampling design should be used, such as a systematic search using transects or plots to cover as much of the area as possible. If the area is large, a sub-sample of the area using transects can be used. The surveyor should walk the distance of the transects and map all noxious weeds with a Global Positioning System (GPS) handheld unit. Infestation data should include the name of the species encountered, a unique population identifier, and the species spread risk. Surveys should be conducted during the growing season for proper plant identification. When conducting field reconnaissance, note changes in weather conditions that may affect noxious weed growth at the site. Some noxious weeds may not be obvious or do not occur at certain times of the year (i.e. delayed monsoon season, early spring emergence). Site characteristics should also be noted, such as landform type, existing hydrology, and land use history.

The results from the field reconnaissance can be used to develop a removal strategy (e.g. silvicultural prescription) and include control methods, re-planting of native species, and monitoring. These inventories provide baseline information on the species present and size and location of the infestation.

The field reconnaissance should guide the following weed management actions based on noxious weed class and the risk of spread:

Category A or B weeds are present:

1. Develop and implement treatment measures to eliminate weeds, based on the following:
    a. Most effective removal techniques: chemical, mechanical, and biological control (Appendix E).
    b. Approved herbicides for the area.
    c. Legal requirements for herbicides.
    d. Active restoration in areas with >50% noxious weeds.
    e. Obtain applicable permits and coverage based on federal, tribal, and state requirements (Appendix C).
    f. Develop fire and safety plans.

2. Monitor management measures (qualitative and quantitative) for 5 years.

Category C weeds are present:

1. Develop and implement treatment measures to prevent spread or eliminate weeds.
2. Monitoring treatment area for 3 years.

No weeds are present

1. Document results.
2. Monitor every 5 – 10 years.

6.0 Weed Inventory and Mapping

Of the 17 million acres across the Navajo Nation, 3,600,015 acres (or 21% of the land area) have been inventoried for noxious weeds. Weed inventory and mapping should be conducted as part of this plan to identify and monitor weed populations in project areas. Weeds in each project site should be mapped starting with field reconnaissance to assess the size and scale of existing infestations and to provide valuable information for developing weed control projects. After treatments, populations should be monitored to determine the effectiveness of weed control efforts. Weed mapping should be conducted annually, if feasible, to inform project planning and to document changes to previously treated areas.

Figure 6-1. A field infested with Musk thistle on the Navajo Nation. Photo courtesy of R. Benally.

Weed mapping is an important tool for land managers to effectively manage weeds on the Navajo Nation. While it is impossible to map every single weed, mapping is a critical tool for identifying and monitoring problem populations. Annual or periodic weed mapping should be done in areas identified for treatment and management and should provide information on weed cover in project areas. Site-specific mapping, as described above in Field Reconnaissance, should be conducted throughout the year to assess new infestations identified for treatment by weed coordinators, range managers, or members of the community. While Field Reconnaissance will provide initial information to develop treatment plans, weed mapping focuses on documenting the size, severity, and diversity of weeds in an area.

In addition to mapping, processing the collected data is necessary to provide agency and region-wide assessments of recurring and emerging weed issues on the Navajo Nation. There are a wide

array of methods and tools used to map weeds, the following section explains the necessary information to document in a basic weed inventory protocol to assist in prioritizing weed control projects and assessing the effectiveness of control measures. A basic weed mapping protocol is provided in Appendix D

6.1 Field Mapping

Weed mapping requires field surveys of new and established weed infestations. Field surveys should be conducted annually or biannually to determine the presence and distribution of weed infestations and to evaluate spread risk. A reliable sampling design should be developed, such as a systematic search using grid cells or transects to cover as much of the area as possible. If the area is large, define a sub-sample of the area to estimate the coverage and size of observed weed populations. The parameters for defining a sub-sample and its size should be documented. The surveyor should walk the area of the grid cell or the distance of the transect and map all noxious weeds observed. All documented infestations should record the geographic location of the spread, noxious weed species observed, and the size and the density of the population. Weed map data can use point, line, or polygon data depending on the techniques used and the size of infestations. However, it is preferred to document infestations as polygons to make it easier to estimate acres and to assist in project planning. However, if infestations are documented using point or line data, it is recommended that acreage and coverage estimates be included to estimate the overall size of the population.

When conducting field mapping, surveyors should be briefed on the following:

- The size of the property being surveyed including property boundaries or areas to avoid (i.e. private property).
- How to clean off equipment and clothing after a survey is done to avoid inadvertently spreading weeds to other mapping locations.
- How to identify and avoid sensitive plant species (i.e. federally and tribally listed species).
- How to identify priority weed species.
- The best routes for accessing mapping locations and where to park to avoid damage to sensitive areas.

6.1.1 GPS Units

GPS, global positioning system, units are commonly used to collect geographic data on weeds. GPS units provide real-time data collection and navigation, allowing users to systematically collect data as they survey a project area. GPS units can provide accurate geographic location data and a platform to transfer the data to a computer where it can be used to create detailed maps and perform a variety of spatial analyses. Using GPS units, however, requires technical training on how to set them up and use them accurately and efficiently. For surveying, it is

important that users know how to set up the projection system, navigate to specific locations, and input relevant information and unique identifiers for individual data points or polygons.

Some GPS units may save geographic data in different file formats, which may make it difficult to use with GIS mapping software or between different GPS units. To help with these data issues, the State of Minnesota Department of Natural Resources has developed open source software called DNRGPS, that converts several popular GPS file formats compatible with different GPS models and GIS software (Available online here: http://www.dnr.state.mn.us/mis/gis/DNRGPS/DNRGPS.html).

GPS units can also be limited by satellite reception. While widespread use of GPS units has increased their accuracy, it may be hard to get accurate location data in some locations, such as slot canyons where topography or under dense canopy cover, which can interfere with the unit's reception. It may be necessary to note data points where accuracy is limited or questionable.

6.1.2 Smart Phone Mapping Apps

A wide array of GPS apps allow surveyors to use their personal phones as GPS devices. These apps use the phone's GPS technology to provide real-time location information and allow data collection. Smart phone apps may reduce the costs for survey equipment and can allow volunteer groups to assist with weed mapping. Apps such as Esri Collector, Survey123, iNaturalist, LandPKS, Fulcrum, and MapIt allow users to collect field data and create custom reports for mapping projects. Esri applications can provide easy integration with ArcGIS Online to update data in real-time, reducing the time needed to process and convert data. This method, however, depends on whether field surveyors have access to smart phones or if the cost for a weed mapping app is prohibitive (prices range from free to $20 per user). In some instances, the GPS signal on the smart phone may not provide the level of accuracy needed to document individual weed populations and a signal booster may be needed.

6.1.3 GIS Remote Mapping

GIS, or a Geographic Information System, is a powerful tool for creating geographic data for mapping and project planning. GIS software can compile and analyze data collected in the field. GIS software can identify potential populations through remote sensing or by documenting visible problem areas on aerial imagery. This method works well for noxious weed tree species, such as tamarisk or Russian olive, which can grow in dense stands and distinctive foliage cover. For example, dense stands of tamarisk can be delineated when using high resolution aerial imagery based on differences in infrared signals. Remote sensing is recommended where field mapping may not be feasible, such as in canyons or rivers, but may be expensive due to the costs for obtaining high resolution multi-spectral images needed for such analysis. While currently in development, remote sensing for smaller, less dense weed species such as thistles, grasses, or other herbaceous or annual weeds is limited due to their visual similarities to other native populations and the size of individual plants. However, new methods and imagery technology

may provide some guidance on how to use remote sensing for large-scale weed mapping projects.

6.2 Data Collection

Whether in digital or paper form, the information below represents the basic required information collected during all weed mapping surveys and will allow the BIA to share weed data with other agencies and weed management groups. This list can be updated as weed mapping efforts develop and evolve. A sample data sheet is provided in Appendix D

- Agency - As weed mapping is done, field surveys should identify the BIA Agency collecting the data and the weed coordinator managing the mapping effort.
- Date - Mapping surveys should document the month, day, and year the survey was conducted. This information can determine if certain weeds may have been missed due to the timing of the survey. For example, species that emerge in the fall may not be documented if surveys are conducted in the spring.
- Surveyor Information - Record the names and contact information of the individuals conducting the survey. There is always the possibility that follow-up may be needed to clarify recorded data or fill in missing information.
- Unique ID Code - Each infestation or area should have a unique identifier. It can be a unique combination of letters and numbers that correspond to specific geographic features, or sequential numbers. However, they should be unique to the infestation being documented to avoid confusion. The identifiers can be used to track projects over time.
- Information Source - Source information records how the BIA became aware of the infestation. It can identify previous survey dates, weed coordinators, specific land users, other federal, state, or tribal agencies, community groups, or other BIA Navajo Regional agencies. During the first years implementing the Integrated Weed Management Plan, knowledge of who identified each weed infestation may be incomplete but collecting this information over time can identify community members who can assist with weed management issues.
- Location Data- All weed inventories should identify where infestations are located. Location information includes the geographic coordinates used to pinpoint the exact location of the infestation. Location data should be recorded for each infestation during the survey. An infestation represents a collection of noxious weeds in a given area. While infestations of solitary plants may be collected, mapping efforts should focus on sites where infestations represent sizeable clusters of noxious weeds. Often this information is automatically collected with the data points.

  If using GPS, **the geographic projection system on the unit should be set to either NAD1983 UTM Zone 12N (Arizona) or 13N (New Mexico)**, depending on where the

survey is conducted. If this projection is not available on the device, coordinates can be recorded in Latitude and Longitude (Degrees, Minutes, Seconds, or Decimal Degrees), which can be converted into UTM coordinates later. To convert coordinates, the following website provides some limited coordinate conversion tools: https://www.earthpoint.us/Convert.aspx

Other location data may include the USGS quad map identifier (if used), state, county, watershed HUC codes, and range, township, and section information. However, such data is not required for basic weed mapping inventories.

- Size of the Survey Area. While weed mapping may focus on a specific area, such as a Land Management District or Range Unit, it is important to document the size of the area surveyed, especially of surveys will not cover the entire area. Defining the size of the survey area will allow the BIA to estimate weed cover.
- Weed Species- Weed species should be identified using the U.S. Department of Agriculture (USDA) PLANTS database symbol (http://plants.usda.gov). Individuals conducting field surveys should be given training to identify priority weed species and local vegetation. This training should teach field surveyors to identify sensitive species to avoid collection or damage. If a species is not easily identifiable in the field, a sample may be collected for identification. A collected plant specimen should include the entire plant, if possible, including flower, roots, stems, and leaves. Collected samples should note the date, location, the unique ID code for the population, and any other pertinent information about where the sample was taken. A data point should be recorded on the GPS unit to denote where the plant was collected.

  USDA PLANTS database symbols for the target weed species are provided in Appendix D. The table and symbols should be updated annually so the proper codes are used in the field to identify problem weeds.
- Native Species – For projects located in forestlands, an inventory of native species may be required in addition to weed species. Consult with a professional forester to determine the level of detail needed to develop weed treatments in forestlands. The historical and current species distribution of a forest stand(s) will determine the appropriate silvicultural system needed to ecologically restore an area or accomplish specific project goals and objectives in line with the current forest management plan. Baseline data collected during a forest inventory include but is not limited to species, age, diameter at breast height, diameter at root collar, percent canopy cover, height, and basal area, and understory species occupancy.
- Size and Extent- The size of the infestations should be documented in either square feet (for small sites) or an estimated acreage (for large sites). Size estimates for each documented infestation will be used to assess the severity and spread of identified weed species. Polygon data is the most accurate way to document the size of the infestation. If

point data is collected, surveyors should record a rough estimate of the population's size (e.g. >0.1 acres, 5-10 ft^2, etc.). If line data is collected, surveyors should set a buffer distance for the width of the infestation.

Size and extent should record the size of the infestation for **each species identified** at a recorded site. The size estimate should be an estimate for each weed population found in an area, not an estimate of the size of individual plants. This information can determine which control method to use, how to set up post-treatment monitoring, and how to assess the overall cover of priority weed species on the Navajo Nation.

- Vegetation Cover- Vegetation cover is an estimated percentage of the ground covered by the specified species. Cover is a measure of how densely the plants grow in an area. Some weeds may grow in a large area, but they may be widely spaced, allowing other vegetation to grow in the same area. Other weeds, such as tamarisk, can grow in dense stands or patches, which crowd out other plant species. Cover is best estimated by looking at how much foliage or canopy crown is covering the ground. For more detailed information on how to estimate vegetation cover refer to Elzinga et al. 1998 (https://digitalcommons.unl.edu/usblmpub/17/; pp. 178-186).

- Other Information
  Additional information to record but not required:
  - Nearby water sources or barriers that may limit the size of the infestation
  - Other dominant vegetation
  - If unique, sensitive, or protected plants were present
  - Problems encountered while collecting the data
  - Other sources that may document the infestation (e.g. maps, notes, etc.)
  - Photos of infestations along with photo file information

6.3 Data Processing

Once data is collected in the field, it will be compiled and analyzed using GIS software. The software can organize inventory data and use it to assess weed cover and treatment effectiveness. Most analyses can be performed using Esri ArcGIS software, which integrates attribute and spatial data for analyses. Some data may be compiled and analyzed on online mapping tools such as Google Earth or ArcGIS Online. Each weed coordinator should manage a spatial dataset of weed information. The BIA and Navajo Nation can provide training and access to Esri licensed software.

Spatial data in the form of vector data should be used to assess and summarize mapping efforts. All field surveys should be compiled into an annual geodatabase to provide a landscape view of infestations. Spatial data should include a table of attributes which will document the information from the datasheets, if infestations are new that year or if they are part of ongoing monitoring efforts, if they are part of a specific weed management project, and if they represent an expansion or reduction of weed coverage from previous years (if applicable).

Weed data should be assessed at the agency and regional level on an annual basis. Analyses should look at the size and extent of infestations for all priority species, the effectiveness of treatment methods to reduce the size and cover of target species, and locations where weed projects can make the best use of limited funds. Implementation of a basic weed mapping program will aid planning and long-term management of priority weed species on the Navajo Nation.

7.0 Permitting

The PEIS, Biological Assessment (BA), and Biological Opinion (BO) associated with this plan will provide federal coverage to implement weed management activities on the Navajo Nation. However, some permitting is needed on a project-by-project basis. Prior to implementing a project, the following agencies should be contacted to ensure project compliance and to obtain necessary permits and approvals. Additional information on how to apply or fulfill additional permitting and compliance requirements are outlined in the Weed Project Checklist (Appendix C)**.** Contact information for the agencies is available in Appendix I.

Navajo Nation Department of Fish and Wildlife (NNDFW)

Project sponsors conducting weed projects under this plan shall complete and submit a Data Request Form for the project area to NNDFW Natural Heritage Program, including weed treatment methods proposed and maps of the project area. NNDFW will determine if habitat for Federal or Navajo Listed Endangered, Threatened, or Proposed species or migratory birds exists through the Biological Resource Compliance Form (BRCF). If habitat exists a qualified biologist will conduct species specific surveys during the appropriate season to determine if the species is present or have a qualified biologist on site during construction to identify species locations. To conduct species surveys on the Navajo Nation, a biological research permit must be acquired from the NNDFW. If species are detected on the site, the agency shall implement the species conservation measures outlined in the BA, BO, and PEIS (see Appendix F). Any positive results from the habitat evaluation and species surveys (i.e., occurrences of listed species) should be reported to the NNDFW. If any projects affect wetland or riparian habitats, NNDFW will require a review and approval of the project.

Navajo Nation Historic Preservation Department (NNHPD)

Cultural surveys for individual weed projects will be conducted using the standard Section 106 process established between BIA and NNHPD (see Appendix G). The project sponsor, primarily BIA, will be responsible for obtaining all necessary cultural resource clearances for individual projects. Cultural surveys should be conducted by a qualified cultural resource specialist with an NNHPD approved permit. Prior to conducting surveys, the consultant shall obtain a Class B project-specific permit from NNHPD at least 10 days prior to the start of field work. Surveys will include records searches, ethnographic interviews, and field surveys for cultural resources,

including traditional cultural properties (TCPs), for all projects. After a survey is complete the consultant must complete an Archeological Inventory Report based on the NNHPD standards (Appendix G). NNHPD will recommend specific cultural resource mitigations to the BIA NRO Regional Director through a Cultural Resource Compliance Form (CRCF) and as part of the NEPA decision document to avoid adverse effects to historic properties or TCPs. Upon approval by the BIA NRO Regional Director, the project sponsor will distribute the CRCF to all project partners for their records, excluding the cultural resource consultant and the SHPO, who will receive their approved CRCF forms from NNHPD.

Navajo Nation Environmental Protection Agency (NNEPA)

Projects must comply with the Navajo Nation Clean Water Act, Navajo Nation Safe Drinking Water Act, Navajo Clean Air Act, Navajo Environmental Policy Act, and the Navajo Nation Pesticide Act. The following reports may be required to comply with the Navajo Nation EPA:

- Due to the size of the Navajo Nation, projects using herbicides must submit an eNOI to the U.S. Environmental Protection Agency (U.S. EPA) to document herbicide use. Each BIA Navajo Agency will serve as the Decision-Maker and Operator for the eNOI on the U.S. EPA's Region 9 Pesticide General Permit. This annual eNOI will provide the U.S. EPA with the project details (herbicides proposed, size of area, weeds managed, potential endangered species and watershed impacted, etc.). Copies of the Notice of Intent must be sent to the NNEPA Surface & Ground Water Protection Department and the NNEPA Pesticide Enforcement and Development Program. Information on the Pesticide General Permit requirements and eNOI submission requirements can be found in Appendix C**.**
- Any projects using restricted pesticides must have certified pesticide applicators who are certified through NNEPA. Project records must detail where, when, amount applied, and for whom herbicide was applied. These records will be subject to review by NNEPA to ensure compliance with the Navajo Nation Pesticide Act.
- Any projects that implement prescribed burns must be planned in coordination with NNEPA to address air quality concerns when developing the project Burn Plan. An air quality report may be necessary to document the effects of burning on regional air quality for specific communities on the Navajo Nation.
- Any actions that require a federal permit, license or approval to discharge into 'waters of the U.S. will require a Section 401 permit from the NNEPA Water Quality Program. These include projects that excavate or place materials or apply herbicide in a waterway or wetland (i.e. weed removal in a stream or wetland). Application for the Section 401 permit should be done at the same time the Section 404 permit (see below) is completed as these permits are done in conjunction with each other for all projects in riparian or wetland areas.

- If any projects are proposed in wetland or riparian areas, a wetland delineation will be required. NNEPA must review and approve all projects that may impact the waters of the Navajo Nation along with the NNDFW.
- Projects must survey for wellheads and coordinate activities with NNEPA Public Water Systems Supervision Program (PWSSP) to incorporate wellhead protection measures.
- Projects focused on removing large noxious trees, such as tamarisk or Russian olive, should consult with Navajo Forestry Department and BIA Navajo Region Branch of Forestry for removal requirements and whether the project involves potential Navajo trust assets. Navajo Forestry has a P.L. 93-638 Contract with the BIA for all forestland management activities on unallotted trust lands, which include woody invasive treatments.

United States Army Corps of Engineers (Corps)

The Corps regulates activities on waters of the U.S. and is charged with protecting harbors and navigation channels from destruction and encroachment, and with restoring and maintaining environmental quality. Pursuant to Section 404 of the Clean Water Act, projects along riparian and wetland areas that impact jurisdictional waters require Corps permits. The Corps has an obligation to ensure that permitted projects comply with NEPA, ESA, and NHPA. Weed projects that require mechanized removal of vegetation along riparian corridors or wetlands will require a Section 404 permit. The application for the permit should be submitted to the representative State Corps office (i.e., Arizona, New Mexico, or Utah).

Navajo Nation Forestry Department

Any projects involving the removal of woody invasive species in woodland areas should consult with the Navajo Nation Forestry Department to ensure that the proposed treatments align with their existing forest management plans. This applies to all woodland management areas, which include riparian habitats and commercial forests. Additional planning may be needed to ensure that forest management BMPs are followed and existing 638 contracts are enforced.

BIA Branch of Forestry

Projects planned and proposed on and adjacent to Navajo Nation forestlands, specifically on allotted lands should be developed in consultation with the BIA Navajo Region Branch of Forestry. Woody invasive treatments within allotment lands require consent of the majority Indian interest of the beneficial Indian owner(s), documented by their signature(s) on a Power of Attorney for the Sale of Allotment Timber, contract or permit. Refer to 25 CFR Part 163, IAM Part 53 Chapter 3 – Harvest of Forest Products, IAM Part 53 Chapter 9 – Silviculture, and other IAM's and handbooks for forestland management activities on Indian lands for additional guidance.

8.0 Mitigation Measures

The following measures are required when implementing weed management projects. These measures should be printed and checked off when implementing a project.

8.1 General Measures

Project Planning

- Complete all necessary permits and authorizations prior to implementing a project (see Section 7.0 and Appendix C).
- If treatments are planned for allotment lands, the project sponsor must contact the landowner(s) and obtain permission for the project before proceeding. Woody invasive treatments require consent of the majority Indian interest of the beneficial Indian owner(s), documented by their signature(s) on a Power of Attorney for the Sale of Allotment Timber, contract, or permit.
- Conduct surveys for cultural resources by a qualified cultural resource specialist before treatments in coordination with the Navajo Nation Historic Preservation Department (NNHPD).
- Surveys and clearance for paleontological resources are required before any surface disturbing activities, mechanical treatments, or chemical treatments in coordination with the Navajo Nation Minerals Department.
- Conduct ethnographic inquiries with local community members to identify plant gathering sites and other traditional cultural properties (TCPs) that may be affected by weed treatments. If TCPs and gathering sites are identified, the project sponsor will work with the community to identify alternative sites, treatment options, or other mitigation measures.
- Complete and submit two copies of the Archaeological Inventory Report and all site forms to the NNHPD Cultural Resource Compliance Section for review. The BIA NRO Regional Director will approve the CRCF to provide Section 106.
- Avoidance of all cultural resources is the preferred mitigation measure to avoid adverse effects, as well as identifying alternative gathering areas. All work must be coordinated with NNHPD to ensure compliance with Section 106 and NHPA.
- Develop a Safety and Communications Plan that identify specific safety measures for all treatment methods used in the project, including equipment handling, required Personal Protection Equipment (PPE), and emergency response communication.
- Woody invasive treatments require a forest product harvesting permit or contract and may require a silvicultural prescription to authorize a treatment in forestlands. The special

provision associated with the harvest document(s) should be reviewed and modified when appropriate to address unforeseen resource issues associated with the harvesting activities.

- All weed treatment personnel will be trained on the use of Personal Protection Equipment (PPE), equipment handling, and safety protocols. Personnel will be required to use PPEs during herbicide and mechanical (chainsaw, control burn, etc.) applications.
- Complete and submit a Data Request Form for the project area to NNDFW (https://www.nndfw.org/nnhp/drs2012.pdf) and obtain a Biological Resource Compliance Form (BRCF).
- If potential habitat for endangered or threatened species is present, conduct a habitat assessment by a qualified biologist. If potential habitat is found, protection measures, including species buffers will be applied or additional surveys for species presence will be conducted by a qualified biologist. If the species is present at the site, species protection measures will be employed, NNDFW will be notified, and a biological monitor will be present during all phases of project implementation (Appendix F).

Prior to Project Implementation

- Designate staging areas and/or equipment wash stations for cleaning and prep work before and after treatments. These sites will be used for mixing herbicides, refueling equipment and vehicles, and storage for the duration of the treatment. Equipment wash stations may be temporary and will have a filter system, for example at least 6 inches of large cinder or gravel spread over an area 10ft x 30ft. Filter cloth may be used for temporary stations. The area will be a perched drainage to allow excess moisture to drain after being filtered and will be located at least 300ft away from surface water, natural drainages or wellheads.
- Notify adjacent landowners, authorized land users, local authorities, and/or the public of treatments, treatment duration, and post-treatment measures before implementation to prevent exposure and limit re-infestations through education and outreach with the local grazing official, posting public notices, radio announcements, and/or chapter meeting announcements.
- To reduce the risk of weed spread, access routes will avoid heavy infestation areas. Access routes will be closed when the project is completed.
- Clearly mark boundaries of treatment sites (such as posting visible flags or signs) before and during treatments.
- Sites will be inspected, and potential hazards will be removed to ensure safety prior to treatments.

During Project Implementation

- Vehicles will use only established roads for accessing project sites. Vehicles will be parked at designated parking spots near established roadways during treatments.
- If camping, project personnel will use designated and established campsites, with approval from NNHPD or a qualified archeologist.
- On-site safety briefings will be given prior to any treatments to review required PPE, safety and emergency response measures, and what to do in the case of an injury or emergency.
- Inspect and clean equipment, heavy machinery, and clothing after treatments for mud, dirt, and plant parts to prevent spread to other project sites by the field crew.
- Minimize soil disturbance to the extent practical.
- No mechanical treatments or use of heavy mechanized equipment will be used in archeological sites or traditional cultural property boundaries.
- If potential habitat for an endangered or threatened species is present a qualified biological monitor will be on site during all phases of project implementation.

Post Project Implementation

- Post-treatment monitoring will evaluate treatment effectiveness, potential re-infestations or new introductions, and impacts to resources (Section 11.0)
- Limit the number of people and trips to sensitive areas for follow-up treatments and/or monitoring.

8.2 Chemical Treatments

Project Planning

- The on-site Pesticide Applicator will develop a Spill Contingency Plan that meets the minimum requirements specified by the BIA to eliminate contamination of water or soil resources in the case of accidental spills.
- If using herbicide, notify NNEPA Pesticide Enforcement of project, including location, herbicides used, and treatment dates.

Prior to Project Implementation

- All herbicides must be U.S. EPA approved and mixed and applied according to label instructions.
- Treatment sites will be closed according to label specifications when limiting exposure to humans, livestock, and pets is recommended.

During Project Implementation

- All herbicides will be used according to the U.S. EPA approved label.
- Certified Pesticide Applicators must be on site to supervise projects during herbicide treatments. Pesticide Applicators must be certified by the Navajo Nation.
- Use dye markers with herbicides to identify the physical spray location on weeds.
- An emergency spill kit must be present when herbicides are used to contain, absorb, and dispose of spill materials.
- Material Safety Data Sheets (MSDS) for herbicides and adjuvants must be accessible in the event of accidental exposure or spill.
- Avoid applying chemicals during times of high wind speeds, high temperature, and low humidity to prevent chemical drift to areas off site. Read the herbicide label for specific conditions.
- Use Water Quality Protection Zones (WQPZ) set by the NNEPA for mechanical treatments and aerial and vehicle-based herbicide applications within riparian and wetland areas. The buffer distance for the WQPZ is 200 ft unless a greater buffer is needed for a sensitive species or if indicated on the herbicide label.
- *Near riparian areas,* only aquatic formulations of 2,4-D, glyphosate, triclopyr, and imazapyr will used within 25 ft of the daily high-water mark.
- Herbicides that are practically non-toxic to fish and mollusks (White 2007) require a 25 ft (7.6 m) buffer from the daily high-water mark, including: aminopyralid, chlorsulfuron methyl, clopyralid, diflufenzopyr, imazapic, and thifensulfuron-methyl.
- Non-aquatic approved and moderate to high aquatic toxicity herbicides (White 2007) require a 300 ft (91 m) buffer from the daily high-water mark.
- Only aquatic approved herbicides are used for aerial applications by either fixed wing or rotary aircraft applications.
- Water for mixing herbicide and cleaning herbicide equipment will be potable water obtained off-site or through a Water Use Permit. For remote sites, there is a possibility of a Water Use Permit with the local water code. An anti-siphon and back flow preventer device are required to prevent contamination of the water source.
- Store equipment and materials away from riparian areas in safe and secure upland sites in close proximity of the project site. Herbicide containers and equipment must be stabilized with straw bales, filter cloth, or other appropriate means to prevent reentry into the waterway or wetlands.
- Herbicides will be stored in a secondary containment storage unit with impermeable materials such as concrete or metal so leaks and spills do not reach soils. Storage containers will be coordinated with BIA Safety Officer and Environmental Services.

Post Project Implementation

- Herbicide containers and application equipment will be triple rinsed at designated washing stations to minimize chemical residues left as per the MSDS and herbicide labels. Do not pour rinse water from empty containers or sprayer cleaning onto ground or any drainage system. Dispose as hazardous waste.
- Properly dispose of pesticide waste and containers according to federal, state, and tribal regulations.

8.3 Mechanical

Prior to Project Implementation

- If mechanical treatments increase the risk of erosion near waterways, erosion control measures will be implemented to stabilize and limit erosion.
- Establish and implement a burn plan if prescribed burning is used as a control method.
- Prescribed burning will not be conducted during migratory bird breeding season.

During Project Implementation

- Keep areas without vegetation wet to prevent fugitive dust. This can be accomplished with a sprayer mounted to a water truck.
- Use lightest/smallest off-road vehicle, utility vehicle, or tractors will be a priority for treatments. No such equipment will be used on wet soils or cryptobiotic soil crusts.

8.4 Cultural

During Project Implementation

- Targeted grazing must use fencing around the perimeter of the treatment area to contain livestock.
- Use targeted grazing only in sites where weeds are palatable and non-toxic and where desired native species will not be damaged.
- After targeted grazing is implemented, livestock will be placed in a separate fenced location for 48 hours to collect animal waste. Animal waste will be burned to destroy plant parts and seeds.
- Targeted grazing will not exceed more than 10 days on a range and/or wildland project site or 365 days on a cropland site.
- Passive restoration is preferred when native vegetation comprises >75% of the treated area. If natural re-vegetation fails, then active restoration is necessary. Active restoration includes planting of native species poles, root stocks, and seeds.

- Reseeding will be timed with precipitation events and at least 7 days after herbicide treatments are completed. Reseed disturbed areas with native vegetation to minimize opportunities for weed establishment and soil erosion.
- Only native vegetation, certified weed-free and preferably locally sourced, will be used for restoration activities.

Post Project Implementation

- Livestock grazing will be deferred during the growing season or until seeding has established.

9.0 Weed Management Techniques

An integrated weed management approach uses a combination of treatment methods to control aggressive and adaptable weed species. No single control method or any 1-year treatment program will achieve effective control of any weed-infested area. The fast growth, extensive root system and high reproductive capacity of weeds requires long-term cooperative and integrated management programs and planning to contain and reduce weed populations on the Navajo Nation. Weed removal efforts should coordinate resources with adjacent agencies (e.g., NTUA, ADOT, BLM) who conduct weed treatments to maximize cost effectiveness of weed treatments. Additionally, use of multiple, appropriately timed methods will increase the effectiveness of weed management projects. Mechanical and/or manual treatments followed by a chemical treatment is more effective than implementing each treatment by itself. Chemical treatments followed by seeding or planting native understory species, such as grasses, will help restore native plant diversity. Prior to noxious weed seed set, hand pulling, or grubbing is effective for small infestations followed with a mechanical or chemical treatment to ensure no target weeds set seed that year. Appropriate timing of a weed control techniques is the most important factor to improve effectiveness. Most annual and biennial plants should be treated early in the season before the plants bolt and flowering occurs. In contrast, many perennials are effectively treated with systemic herbicides in the fall when plants actively transport nutrients to their root system. The methods described below are recommendations for treating noxious weeds based on techniques used in other areas outside the Navajo Nation. Appendix E has a table of the best option for control of the priority weed species.

Biological control agents will not eliminate an infestation; however, they will enhance control and reduce the rate of expansion of large existing infestations. Biological control is most effective on large populations where other control methods are limited due to the size and scale of the infestation. The use of herbicides in combination with biological control is successful on large populations of several weed species. A more detailed discussion of the proposed weed treatments for the Navajo Nation is discussed below. Comprehensive weed management methods for each target weed species can be found in USDA Forest Service Southwest Region Weed

Field Guides (https://www.fs.usda.gov/detail/r3/forest-grasslandhealth/invasivespecies/?cid=stelprd3813522) and in the University of California, Davis Cooperative Extension and Agricultural Experiment Station (https://wric.ucdavis.edu/information/info_spec_weed.htm)

9.1 Prevention

Prevention is the most effective and least expensive method of control. Establishing a "weed-free" policy to include, but not limited to hay, grain, seed, and ballast, is crucial to reduce weed expansion and to prevent new weed introductions. A "weed-free" policy will require policy from the Navajo Nation Tribal Council. Maintenance of a vigorous, competitive native plant community will also reduce noxious weed establishment.

Cleaning tires, boots, hooves, and equipment when leaving infested areas will prevent weed introductions and limit the spread of existing infestations. Extensive disturbance gives noxious weeds an advantage over native plants as most weeds are well adapted to disturbed areas. Revegetating large, disturbed sites with vigorous, hardy native grass and perennial plants will prevent establishment of new noxious weed populations.

9.2 Early Detection/Rapid Response

The key to preventing new noxious weed introductions involves early detection and rapid response. The longer a species goes undetected during the early, non-invasive stage, the less opportunity there is to intervene. Once weeds are established, control or eradication methods become more expensive and limited in their effectiveness. Education programs on how to recognize noxious weeds may help community members detect infestations when they are still small. Repeated surveys can detect new weed infestations in high priority areas, such as wildlife habitat, areas for collecting traditional plants, or riparian areas. After detecting a new noxious weed on the Navajo Nation, a treatment plan should be developed based on the growth characteristics of each species, size of the infestation, and the personnel and equipment capacity of the BIA. Early detection and rapid response is most successful when new infestations are less than 1 acre in size. Early detection and rapid response to new noxious weed infestations is a high priority.

Since roads and rights-of-way corridors are primary vectors for introducing and spreading weeds, early detection and rapid response in these areas is important. Surveys along roads and rights-of-way and adjacent land can identify new weed populations with the potential to spread. Once these populations are identified, early treatment to maintain linear corridors will prevent or reduce the potential for large scale infestations on adjacent lands.

Early detection and rapid response techniques will follow those established by the U.S. Forest Service in 2005 and the Arizona Invasive Species Advisory Council in the Arizona Invasive Species Management Plan in 2008. Scattered plants and spot infestations around the perimeter of

the infestation should be treated first to contain the spread of the infestation. To limit seed dispersal, treatment of infestations along roads should be done at the same time as treatment around the infestation perimeter. Treatments should then move inward toward the core of the infestation. Treatments should be repeated until the seed bank is depleted. Treatments along linear corridors (roads and rights-of way) will be treated in a linear fashion in right-of-way easements. Linear corridors serve as both the core and/or the perimeter of the infestation and weed removal activities on adjacent infested areas should be done at the same time.

9.3 Manual Control

Photo courtesy of Fred Phillips Consulting.

Manual control techniques include the use of hand tools to cut, clear, or prune herbaceous or woody species. A maximum of 30 people (typically between 7-20 people) will conduct manual treatments. Manual treatments involve cutting undesirable plants above ground level; pulling, grubbing, or digging out root systems to prevent sprouting and regrowth; and removing competing plants around desired species. Manual control is conducted with hand tools, including handsaws, loppers, axes, shovels, rakes, machetes, grubbing hoes, mattocks (combination of cutting edge and grubbing hoe), Pulaskis (combination of axe and grubbing hoe), brush hooks, weed whackers, and hand clippers. Manual treatments, such as hand pulling and hoeing, are most effective where weeds are limited and soils allow for complete removal of the plant material, including, the root system (Rees et al. 1996).

Annual and biennial plants with shallow root systems that do not re-sprout and plants growing in sandy or gravelly soils will be hand pulled. Vegetation removed manually will be bagged and sent to a certified incinerator to prevent reinfestation from seeds or other plant materials. Repeated treatments will be necessary as seeds remain in the ground for multiple years. Manual techniques are most effective for small areas (<1 acre), areas where burning or herbicide treatments are not appropriate, areas that may be inaccessible to ground vehicles, and in areas where species of concern exist. For the most effective control, manual techniques will be used in combination with chemical techniques.

9.4 Mechanical Control

Mechanical control involves the use of power tools and heavy machinery to remove noxious weeds. The techniques described are adapted from the Bureau of Land Management (BLM)'s Vegetation Treatments for 17 Western States (BLM 2007). These techniques are utilized when

clearing large areas where weeds are widespread and provide dense coverage, often limiting the growth of native vegetation to very confined areas (**Figure 9-1**). Mechanical equipment should be cleaned before treatments and before leaving the treatment area in designated facilities or equipment wash stations (see 8.0 Mitigation Measures for specifications).

Figure 9-1. Examples of mechanical treatments. (Left) Tractors grubbing root systems for large tamarisk stands. (Right) A site cleared of invasive tamarisk using mechanical treatments. Photos courtesy of Fred Phillips Consulting, LLC.

- **Grubbing** - Grubbing removes a plant by digging out its root system. If a species has a shallow root system, a shovel or mower is used to remove the plant. Noxious weeds with deep root systems require the use of a crawler-type tractor and a brush or root rake attachment. Brush is uprooted and roots are combed from the soil by placing the base of the blade below the soil surface. Grubbing disturbs perennial grasses, so grubbed areas will be reseeded to prevent extensive runoff and erosion, if possible. This removal technique requires a maximum of 5 people to drive the heavy machinery and prepare the site. Grubbing will not be used in areas with active prairie dog colonies or in habitats with other burrowing animals.

- **Tillage** - Tilling involves the use of angled disks (disk tilling) or pointed metal-toothed implements (chisel plowing) to uproot, chop, and mulch vegetation. Tilling is done with either a brushland plow, a single axle with an arrangement of angle disks that covers about 10-foot swaths, or an offset disk plow, which consists of multiple rows of disk sets at different angles to each other. These plows are pulled by a crawler-type tractor or a large rubber tire tractor. This technique is best used where complete removal of vegetation or thinning is desired and is followed with seeding. Tilling leaves mulched vegetation near the soil surface, which encourages the growth of newly planted native seeds. This method is also used for removal of sagebrush and similar shrubs and works best on areas with smooth terrain, and deep, rock-free soils. Chisel plowing is used to break up compact soils. This removal technique requires a maximum of 5 people to drive the heavy machinery and prepare the site. Tillage will not be used in areas with active prairie dog colonies or in habitats with other burrowing animals.

- **Mowing -** Mowing tools, such as rotary mowers or straight-edged cutter bar mowers are used to cut herbaceous and woody vegetation, and is most effective on annual and biennial plants, above the ground surface. Power tools such as chainsaws and power brush saws are used for thick-stemmed plants. Mowing is done along highway ROWs to reduce fire hazards, improve visibility, prevent snow buildup, and/or improve the appearance of an area. Weeds are rarely killed by mowing, and an area often needs to be mowed repeatedly for treatments to be effective (Colorado Natural Area Programs 2000). The use of a "wet blade," in which an herbicide flows along the mower blade and is applied directly to the cut surface of the plant, has greatly improved the control of some species. Chipping equipment is used to cut and chip vegetation. This removal technique requires a maximum of 2- 5 people to operate the chainsaws, power brush saws or Bobcat and to prepare the site. Heavy machinery (Bobcats) with a mowing attachment may require off-road use and have medium ground disturbance (**Figure 9-2**).

Figure 9-2. A Bobcat with a brush hog mower attachment removing noxious weeds. Photo courtesy of Fred Phillips Consulting, LLC.

- **Prescribed Fire** - The use of controlled burns, or prescribed fire, to treat noxious weeds is the intentional application of fire under specified conditions. Controlled burns can provide many benefits to an area by controlling vegetation, enhancing growth, reproduction, and vigor of desired vegetation, reducing fuel loads, and maintaining some vegetation communities. Pile burning is an effective method to reduce fuel loads after mechanical treatments. A Burn Plan must be developed for each project prior to implementing this technique. The Burn Plan may include but will not be limited to 1) project objectives; 2) prescription; 3) scheduling; 4) pre-burn considerations and weather;

Photo courtesy of Fred Phillips Consult LLC

5) site assessment and topography considerations; 6) organization and equipment; 7) communication; 8) public and personnel safety and medical information 9) smoke management plan; 10) ignition and holding plans; 11) contingency plan; 12) mop up plan, and 13) restoration plan. Prescribed fire will be followed by habitat restoration.

Prescribed fires will be used in areas where there is no threat to human life or property to maintain ecosystems that are functioning within a normal fire regime. Prescribed fires are evaluated for potential risks and implemented with adequate fire management personnel and equipment. Prescribed fires will follow the guidelines outlined in the BIA NRO Programmatic Pile Burn Agreement with the Navajo Nation and all permits and authorizations will be obtained prior to implementing this technique. Prescribed fires minimize soil disturbance and will not be conducted during the migratory bird breeding season.

- **Heavy Machinery**- Heavy machinery includes large chipping equipment or masticators, roller chopping tools, feller-bunchers, bulldozers, and extracting equipment and requires special training for operation. Bulldozers or extracting equipment is used to uproot dense woody vegetation or tree species. Large chippers, or "tub-grinders" and masticators, are used to chip the limbs, bark, and trunks of trees to generate mulch or biomass. Feller-bunchers are used to cut trees at the base, pick them up, and move them into a pile or onto the bed of a truck (Bonneville Power Administration [BPA] 2000). Rolling chopping tools are heavy bladed drums that cut and crush vegetation up to 5 inches in diameter with a rolling action. The drums are pulled by crawler-type tractors, farm tractors, or a special type of self-propelled vehicle designed for forest or range improvement projects. Blading uses a crawler-type tractor with a blade shear attachment to cut small brush at ground level and scrape topsoil with the brush to pile into windrows. Blading is only employed in areas where the degradation of the soil is acceptable, such as along ROWs or in borrow ditches. Heavy machinery highly disturbs soils. This technique requires a maximum of 5 people to operate the heavy machinery and prepare the site.

9.5 Cultural Control

Cultural treatments include targeted grazing, replanting native species (see Chapter 10), cultivation and crop rotation, using weed-free hay, and mulching around desired vegetation to limit competition with undesired plants. Targeted grazing is the application of a specific kind of livestock at a determined season, duration, and intensity to accomplish defined vegetation or landscape goals (Daines 2006). Targeted grazing will only be used around Community Development Areas and in agricultural fields, and will be prohibited in perennial waterways, Highly Sensitive Areas, and where sensitive species do not occur because of the high degree of ground disturbance. Targeted grazing alone will not eradicate a weed population and must be used in combination with other methods as a long-term land management strategy (Daines 2006). Targeted grazing should aim to reduce growth and vigor of established weed populations, increasing the effectiveness of more direct removal and control methods. To successfully

implement target grazing at a local level, public outreach and education, workshops, and training on identification, reporting, and monitoring weeds is necessary.

The key to success with targeted grazing is selecting the most appropriate animal to browse or graze the target weed species (**Table 9-1**, Daines 2006). Additionally, weeds must be consumed at the most appropriate life stage to be palatable to livestock and livestock should be specifically trained to consume weed species. Livestock will avoid plants that are novel, low in nutrients, or high in toxins (Daines 2006). Timing and intensity of targeted grazing should be designed to maximize damage to the target weed while minimizing impacts to native vegetation. Targeted grazing requires containing livestock in an isolated area with fencing for up to 24 hours after grazing treatments to isolate and collect defecated seed. Feces will be collected, bagged, and destroyed by incineration. A robust monitoring program is also required to understand the effectiveness of the targeted grazing treatment and should include the following metrics: livestock type, performance, and/or weight gain, consumption of vegetation (utilization and residue), and changes in vegetation structure (biomass, canopy cover or basal area, and plant density) (see 11.1.1 Treatment Effectiveness Monitoring). Targeted grazing has limited effects on Japanese brome, common Mediterranean grass, camelthorn, several annual brome grasses, and jointed goatgrass and is not recommended to control these species. The Society for Range Management maintains a website with research, management recommendations, and training on updated information (https://targetedgrazing.org/).

Table 9-1. Targeted grazing by weed species, livestock class, grazing objective, plant growth stage, and potential effectiveness (Daines 2006). Only the weed species listed in the table showed reductions in populations from target grazing treatments and weeds that are not listed are not recommended for target grazing.

Target Weed	Livestock Class	Grazing Objective	Growth Stage for Treatment	Potential Effectiveness
Diffuse knapweed (*Centaurea diffusa*)	Sheep, Goats, Cattle	Graze heavily at least twice each year for three or more years.	Sheep - rosette or bolted stage. Goats - all growth stages Cattle - before bolting stage	Reduce plant vigor, size, and flower production. Remove livestock for about 2 weeks and re-graze to prevent seed head formation. Grazing most effective when combined with herbicide treatments.
Tall Whitetop (*Cardaria draba*)	Sheep and Goats	Prevent flowering and maintain removal of 85% of top growth during growing season.	Graze before flowering. Repeat at least 2 times a year for at least 3 years.	Repeated grazing may reduce plant vigor and flower production.
Leafy Spurge (*Euphorbia esula*)	Sheep and Goats	Remove 95% of top growth; graze regrowth after 1st treatment; prevent flowering and seed production	Graze in vegetative to flowering stage. Sheep - prefer young plants Goats - eat all growth stages	Effective at reducing biomass on an annual basis when grazed moderate to heavy from vegetative to flowering growth stages. Grazing effectiveness can be low 1st year. Suppression of high-density infestations will occur after 4 or more consecutive years of grazing. Used in combination with herbicides and biological control may be an effective strategy for long-term management.

Target Weed	Livestock Class	Grazing Objective	Growth Stage for Treatment	Potential Effectiveness
Perennial Pepperweed (*Lepidium latifolium*)	Sheep and Goats	Remove 85% of top growth with repeated grazing (every 3-4 weeks)	Graze until early flowering stage, with preference for early vegetative stages. Repeat grazing for several years is necessary.	Repeat, intensive grazing can reduce biomass, density, and height in single season, but root system replenishes infestation. Grazing must be continued for several years. Can be combined with herbicide spraying.
Russian Knapweed (*Acroptilon repens*)	Sheep (particularly dry ewes) and goats	Removal of 80% biomass	Early vegetative to flowering. Graze at least 3 times per season, allowing 8-10 in. of regrowth between treatments. 3 or more years necessary.	Graze repeatedly multiple times each season for several years. May result in reduced biomass and density of plants but may return to pre-gazing density when grazing ceases. Long-term management requires integrated program with herbicides and competitive planting.
Spotted Knapweed (*Centaurea maculosa*)	Sheep and Goats	Graze to prevent seed production and reduce biomass.	Graze heavily during the rosette or bolting stage. Two grazing periods per year during rosette to bolting and bud stages provide best control.	Grazing can reduce plant vigor, density, size, flower stems, and seed production. Sheep digestive systems may suffer if diets are composed of >70% knapweed. Most effective when combined with herbicide treatments.
Yellow Starthistle (*Centaurea solstitialis*)	Sheep, Goats, and Cattle	Graze heavily at least twice a year to prevent flowering and for several years to deplete seedbank and reduce plant density.	Sheep and goats will graze at all growth stages. Cattle will graze in the rosette to bolting stage. 2-3 treatments are needed if grazed in rosette or bolting stage, goats grazing during or after flowering may require 1 year.	Goats are most effective. Grazing reduces plant vigor and plant size and suppresses flower production. Graze twice a year over several years to prevent flower and seed production.
Bull Thistle (*Circium vulgare*)	Sheep, Goats, and Cattle	Prevent seed production, reduce plant size and vigor	Graze heavily during rosette to bolting stage. Repeat grazing at approximately 2-week intervals. May need to graze once a season if in early flowering stage. 3 consecutive years needed.	Cattle will not graze beyond late bud stage. Grazing works best when combined with a fall herbicide treatment. Grazing reduced plant size, density, and reproductive efficiency.
Canada Thistle (*Cirsium arvense*)	Sheep, Goats, and Cattle	Begin grazing when rosettes are green and begin to sprout. Remove animals when grazing shifts to desirable species and re-graze new sprouts	Graze during seedling to late vegetative stage with regular removal of top growth throughout the season. Graze to prevent flowering. Repeat at least 3 years.	Goats will graze all stages. Sheep and cattle prefer when young before spines develop. Most effective with repeated treatments for multiple seasons to prevent seed production and prevent root reserves. Best results when combined with herbicide treatments.
Musk Thistle (*Carduus nutans*)	Sheep, Goats, Cattle	Prevent seed production, reduce plant size and vigor.	Graze heavily during the rosette to bolting stage. Repeat grazing at two-week intervals to prevent flowering and seed production. May need to graze once a season if in early flowering stage and site conditions limit regrowth.	Grazing reduces plant size, density, and reproductive efficiency. Cattle will not graze beyond early bud stage. Works best when combined with fall herbicide treatment.

Target Weed	Livestock Class	Grazing Objective	Growth Stage for Treatment	Potential Effectiveness
			Graze at least 3 consecutive years.	
Scotch Thistle (*Onopordum acanthium*)	Sheep, Goats, Cattle	Prevention of flowering and reduction of stem density.	Graze at the rosette to bolting stage. Heavy to severe utilization, using short-duration, high-intensity grazing provides the best results when repeated for several years to deplete seedbank.	Grazing is effective at suppressing flowering and reducing stem density 30 to 50%. Several years may be needed to reduce populations. Native perennial grass competition is essential. Effective when used in combination with follow-up herbicide treatment.
Saltcedar (*Tamarix ramosissima*) **Russian olive** (*Elaeagnus angustifolia*)	Goats	Severe defoliation to deplete root reserves and prevent establishment of new plants	Prefer young shoots but will browse 4-year-old shoots. Repeated browsing is needed to limit resprouting and remove new seedlings.	Browsing is effective to reduce size and density of trees and eliminate from specific sites. Goats must consume most or all resprouts and seedlings for at least 3-5 years. Maintain native perennial grass understory to prevent seedling establishment for long-term management.
Cheatgrass (*Bromus tectorum*)	Sheep, Goats, and Cattle	Intense flash grazing to remove biomass, decrease plant density, and suppress flowering.	Graze when green, as early as possible, without harming desirable perennial plants. Repeat to prevent seed production. Minimum of 2 treatments per year for 2 or more years to suppress populations.	Heavy repeated grazing for 2 or more years will reduce plant density, size and seed production. Grazing must be closely monitored to avoid damage to desirable perennial plant species. Can be used in conjunction with mechanical, herbicides, and controlled burn.

9.6 Biological Control

Biological control agents are U.S. Department of Agriculture (USDA)-approved insects and pathogens that undergo rigorous testing prior to availability for release. Initial testing occurs in quarantined laboratories to determine their effectiveness in controlling the target organism and host specificity. Testing includes potential effects on economic crops, rare plants, and similar species found in North America. An agent is approved for release only after it is determined that it is unlikely to feed or cause injury to any native or agricultural species. It generally takes between 15-20 years for an agent to be cleared for release. Prior to the release of a new agent, an environmental analysis is prepared by USDA APHIS (Agricultural Plant Health Inspection Service). The analysis assumes that agents will spread throughout North America following release. The BIA is using only those biological agents approved by APHIS as listed in **Table 9-2**.

The BIA will not consider the release of the tamarisk leaf beetle (*Diorhabda carniulata*). This species was released near Moab, Utah in 2004 along the Colorado River with the expectation that it could not migrate below the 38º N latitude. However, the beetles moved and were introduced to sites south of the 38º N latitude, migrating down the Colorado River past Lake Mead. This unexpected migration decimated the nesting habitat of the endangered Southwestern Willow Flycatcher, which has affected the reproductive success of this species. The leaf beetle occurs in

riparian areas across the Navajo Nation. The BIA NRO monitors the leaf beetle to document its extent and impact on the Navajo Nation.

Table 9-2. Target noxious weeds and proposed biological control agents.

Target Weed Common Name	Proposed Control Agents by Scientific Name	Proposed Control Agents by Common Name
Leafy spurge	*Aphthona abdominalis*	Minute flea beetle
	Aphthona cyparissiae	Brown dot flea beetle
	Aphthona czwalinae	Black flea beetle
	Aphthona flava	Copper flea beetle
	Aphthona lacertosa	Brown-legged flea beetle
	Aphthona nigriscutis	Black dot flea beetle
Dalmatian toadflax	*Brachypterolus pulicarius*	Flower feeding beetle
	Calophasia lunula	Toadflax moth
	Eteobalea intermediella	Root-boring moth
	Eteobalea serratella	Root-boring moth
	Mecinus janthinus	Stem-mining weevil
	Gymnetron antirrhini	Seed capsule weevil
	Gymnetron linariae	Root-galling weevil
Spotted knapweed	*Bangasternus fausti*	Seed head feeding weevil
	Bangasternus orientalis	Seed head feeding weevil
	Cyphocleonus achates	Root feeding weevil
	Larinus minutus	Seed head feeding weevil
	Larinus obtusus	Seed head feeding weevil
Diffuse knapweed	*Bangasternus fausti*	Seed head feeding weevil
	Bangasternus orientalis	Seed head feeding weevil
	Cyphocleonus achates	Root feeding weevil
	Larinus minutus	Seed head feeding weevil
Russian knapweed	*Subanguina picridis*	Nematode
	Jaapiella ivannikovi	Diptera: Cecidomyiidae
	Urophora kasachstanica	Flower gall fly
	Urophora xanthippe	Flower gall fly
Yellow starthistle	*Eustenopus villosus*	Starthistle hairy weevil
	Bangasternus orientalis	Starthistle bud weevil
	Chaetorellia australis	Starthistle peacock fly
	Urophora sirunaseva	Starthistle gall fly
Field bindweed	*Aceria malherbae*	Bindweed gall mite
	Tyta luctuosa	Bindweed moth
Puncturevine	*Microlarinus lypriformis*	Puncturevine seed feeding weevil

The BIA and Cooperating Agencies will consult with Navajo Nation Department of Fish and Wildlife (NNDFW) on a project-by-project basis to approve the use of biological control agents. Also, prior to the release of any biological control agent, the BIA will obtain a permit from APHIS. The Coconino, Kaibab, and Prescott National Forests and the City of Flagstaff have conducted biological control treatments near the Navajo Nation for Dalmatian toadflax, diffuse and spotted knapweed, yellow starthistle, and leafy spurge (Dewey Murray, personal

communication 2013). The greatest success has occurred with biological controls released to control diffuse knapweed.

9.7 Chemical Control

Chemical methods include the use of herbicides to control noxious weeds. Herbicides are categorized as selective or non-selective. Selective herbicides kill only a specific type of plant. For example, a selective herbicide for broad-leaved plants will not affect grasses. Non-selective herbicides will kill all vegetation that it contacts. Therefore, it is important not to spray desirable vegetation when using non-selective herbicides. The herbicides for use on the Navajo Nation are listed in **Table 9-3**.

Photo courtesy of Fred Phillips Consulting.

There are several herbicide application methods. The method chosen for a particular project site may depend on the size of the infestation, the species present, accessibility to the site, topography, resources and equipment available, and finances. All herbicides will be used according to their labels and a Navajo Nation Certified Pesticide Applicator will be on site. Water for mixing herbicide and cleaning herbicide equipment will be potable water obtained off-site or through a Water Use Permit. For remote sites, a Water Use Permit may be obtained with the local water code. An anti-siphon and back flow preventer device is required to prevent contamination of the water source. Up to 30 people are needed to implement chemical treatments. Some herbicide application methods are described below.

- **Cut Stump** - This method uses both chemical and mechanical/manual techniques and is effective on tree species that sparsely populate an area or in areas where heavy machinery is not an option. The plant is cut as close to the ground as possible using a chainsaw or loppers. The cut stump is then immediately (within 15 minutes) sprayed or painted with a systemic herbicide to prevent vigorous re-sprouting. It is important to cover the entire cut stump with herbicide. For the most effective and safe treatment, skilled sawyers are recommended.
- **Basal Bark** - Basal bark spraying is most effective on dormant and leafless woody plants with less than a 6-inch stem diameter. This method involves spraying the bottom 12-18 inches of a stem with herbicide. Care is taken to apply herbicide around the entire stem. The herbicide is mixed with a penetrating oil that allows it to pass through the bark. This method results in a dead standing snag.
- **Frill or "Hack and Squirt"**- This method involves making spaced cuts around the entire tree trunk with an ax, machete, or hatchet. It is important that the cut penetrates to the cambium layer. Herbicide is then applied to the cuts using a spray bottle or similar tool.

- **Foliar spray** – Foliar sprays are most effective when plants are in full leaf. Foliar spray is applied using a backpack sprayer, spray bottle, a boom or boomless sprayer mounted on an ATV or truck, fixed-wing airplane or helicopter to distribute over a large area.
- **Pelletized Treatment**- Herbicides made into small pellets can be buried around the plant's base.
- **Pre-Emergent Treatment**- This treatment method involves applying herbicide to the soil before the target noxious weed species germinates or emerges.

Herbicide applications require certain precautions and protocols. U.S. Environmental Protection Agency (U.S. EPA) categorizes pesticides as either "unclassified" or "restricted use." A pesticide, or some of its uses, can be classified as restricted if it causes harm to humans (pesticide handlers or other persons) or to the environment. Herbicide applications will comply with the Navajo Nation Pesticide Act as enforced by the Navajo Nation Environmental Protection Agency, which includes annual reporting on projects that use herbicide treatments and proper disposal of unused herbicide. Herbicides must be applied by applicators with a state applicators license and a U.S. EPA Certified Pesticide applicator card for the Navajo Nation. The U.S. EPA Certified Pesticide applicator card can be obtained through the Navajo Nation EPA.

Near riparian areas, only aquatic formulations of 2,4-D, glyphosate, triclopyr, and imazapyr can be used within 25 ft of the daily high-water mark. Herbicides that are practically non-toxic to fish and mollusks (White 2007) require a 25 ft (7.6 m) buffer from the daily high-water mark, including: aminopyralid, chlorsulfuron, clopyralid, diflufenzopyr, imazapic, and thifensulfuron-methyl. Imazapic and imazapyr have no risk to aquatic invertebrates and fish even if there is an accidental direct spray or spill to the aquatic habitat (BLM 2007). Non-aquatic approved and moderate to high aquatic toxicity herbicides (White 2007) require a 300 ft (91 m) buffer from the daily high-water mark. Only aquatic herbicides will be used for aerial applications by either fixed wing or rotary aircraft within riparian areas.

When applying herbicides, weather conditions such as wind speed, wind direction, inversions, humidity, and precipitation should be taken into consideration. Herbicides should always be used as directed on their labels. Caution is required to prevent overspray on non-target species. Extreme caution is used when mixing herbicides. Dermal exposure to a small amount of a concentrated herbicide is equivalent to the exposure received after a full day of working in a treated field. Herbicides are applied using the proper equipment and applicators are required to use personal protective equipment. Application rates for each herbicide are in **Table 9-4.**

9.8 Roads and Rights-of-Way Treatments

While noxious weed treatments on roads and rights-of-way (linear corridors) use the same techniques described above, treatments occur on a regular basis and are aimed at moving quickly to disrupt traffic as little as possible. The techniques used to treat noxious weeds in linear corridors include:

- Chemical spraying using trucks or All-Terrain Vehicles (ATV) for efficient application,
- Mechanical mowing timed to occur prior to seed-head maturation,
- Boom axe or chainsaw used to cut vegetation within 15-30 ft of pavement edge,
- Cut-stump treatments,
- Pile burning of collected plan material,
- Controlled burns, and
- Maintenance of fire guards along road shoulder or fence line.

Other measures used to prevent weed introduction and retain native vegetation along linear corridors include techniques that reduce erosion and other disturbances (keeping equipment off unstable slopes), re-seeding areas with native species, use of weed free materials (straw, wattles, fill, and seed), cleaning vehicles and equipment before beginning treatment and leaving a treatment area, and coordination with landowners to treat weeds on the roads and adjacent areas.

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Table 9-3. Herbicides considered for use on the Navajo Nation and their recommended uses based on the identified priority areas.

Herbicide	Herbicide Characteristics and Target Vegetation	Riparian	Rangeland	Agricultural Lands	Right-of-Ways	Roadsides	Residence/ Communities
2,4-D	Selective herbicide used to control broadleaf weeds by interfering with plant metabolism. It is moderately to highly mobile in the soil, which restricts its use in and around high ground water tables or open water. Key species include biennial thistles, Canada thistle, diffuse knapweed, leafy spurge, blue mustard, perennial pepperweed, Russian knapweed, squarrose knapweed, sulfur cinquefoil, Dalmatian toadflax, whitetop, halogeton, puncturvine, spreading wallflower, horehound, California burclover, Russian thistle, and yellow starthistles.	X	X	X	X	X	X
Aminopyralid	Selective herbicide used for broadleaf weed control. It is relatively immobile in the soil and remains in upper 12" of soil profile. Target weeds include yellow starthistle, squarrose knapweed, bull thistle, Canada thistle, musk thistle, scotch thistle, spotted knapweed, whitetop, sulfur cinquefoil, diffuse knapweed, Russian knapweed, and Russian olive.	X	X	X	X	X	X
Atrazine	Selective herbicide that controls pre- and post- emergence broadleaf and grassy weeds. It is mostly absorbed through the roots inhibiting photosynthesis. Atrazine degrades in soil primarily by action of microbes. It is common chemical contaminant in ground and surface water. Key species include red brome and kochia.		X	X			
Chlorsulfuron	Registered for general use to control many broadleaf weeds and some annual grasses. This herbicide inhibits enzyme activity. Chlorsulfuron tends to leach into soils with a textural range from sand to silt loam and degrades more rapidly at higher temperatures with adequate moisture contents. It is broken down to smaller compounds by soil microorganisms. Chlorsulfuron may be used to treat blue mustard, Dalmatian toadflax, perennial pepperweed, puncturevine, Russian thistle, kochia and thistles.		X	X	X	X	X
Clopyralid	Selective post-emergence herbicide controlling broadleaf species. This herbicide affects the target weed by mimicking the plant hormone auxin and causes uncontrolled plant growth and eventual death. Once applied to the ground, it rapidly disassociates, which results in having a high potential to contaminate ground or surface water. It is used to treat biennial thistles, Canada thistle, perennial pepperweed, diffuse knapweed, Russian knapweed, squarrose knapweed, and yellow starthistle.		X	X	X	X	
Dichlobenil	Selective weed control of annual grassy and broad-leafed weeds and certain perennial weeds. It is water soluable and moves slowly in the soil. Can be used to treat leafy spurge, biennial thistles, Canada thistle, perennial pepperweed, Russian knapweed, field bindweed, and kochia.			X	X	X	X
Fluroxypyr	A pyridinoxy acid herbicide used to control annual and perennial broadleaf weeds and woody brush. Potential to leach to groundwater is high and potential for loss on eroded soil is low. Plants take up through leaves and roots and translocated to other plant parts. Target weeds include kochia and knapweeds.		X		X	X	

Herbicide	Herbicide Characteristics and Target Vegetation	Riparian	Rangeland	Agricultural Lands	Right-of-Ways	Roadsides	Residence/ Communities
Fluazifop-p butyl	Selective herbicide for post-emergence control of annual and perennial grass weeds. Breaks down rapidly in moist soils. It is actively taken up by plants and translocated throughout the plant where it interferes with plant cell's ability to produce energy. Target weeds include: fountaingrass, common Mediterranean grass, and red brome.			X	X	X	
Glyphosate	Broad-spectrum, nonselective herbicide used for control of annual and perennial plants including grasses, sedges, broadleaf weeds, and woody plants. Method of action is to inhibit amino acid and protein synthesis. It is moderately persistent in the soil. Glyphosate is strongly absorbed in most soils and normally does not leach out of the profile. Glyphosate is successful in controlling annual, biennial, and perennial grasses, broadleaf weeds, and woody shrubs and trees.	X	X	X	X	X	X
Imazapic	Selective herbicide for both pre- and post-emergent control of some annual and perennial grasses and broadleaf weeds. It affects plants by inhibiting the production of amino acids that ultimately reduces cell growth. It is considered moderately persistent in soils. Effective in control of biennial thistles, Canada thistle, leafy spurge, Dalmatian toadflax, perennial pepperweed, whitetop, halogeton, jointed goatgrass, red brome, and cheatgrass.		X	X	X	X	X
Imazapyr	Broad-spectrum herbicide that is applied pre- or post-emergence. Absorbed by the leaves and roots and moves rapidly through the plant. It has a strong affinity to bind to soils and rarely moves beyond the top few inches. Low potential for leaching to ground water but may reach surface water during storm events over recently treated land. Imazapyr is effective on African rue, Tree of Heaven, Fountaingrass, yellow starthistle, perennial pepperweed, whitetop, Uruguayan pampas grass, common Mediterranean grass, saltcedar, Siberian elm, camelthorn, Russian knapweed, and Russian olive.		X		X	X	
Isoxaben	Used for pre-emergence control of broadleaf weeds. It is absorbed through the roots and inhibits cellulose biosynthesis in the cell walls. It is moderately persistent in soil and potential for ground and surface water contamination is low. Target weed species include: kochia, mustards, Russian thistle, and leafy spurge.			X	X	X	
Metsulfuron methyl	Control brush and certain unwanted woody plants, annual and perennial broadleaf weeds, and annual grassy plants. Affects plants by inhibiting cell division in the roots and shoots, thereby stopping growth. It dissolves easily in water and can leach through the soil to contaminate ground water but confined to soils that are either sandy or porous. It can control biennial thistles, Canada thistle, Russian knapweed, African rue, yellow starthistle, blue mustard, perennial pepperweed, halogeton, camelthorn, horehound and whitetop.		X	X	X	X	
Metribuzin	Selective herbicide that inhibits photosynthesis. It controls annual grasses and broadleaf weeds. Highly soluble in water and low tendency to adsorb to most soils. Target weeds include Japanese brome, field sandbur, Johnson grass, puncturevine, bromes, Russian thistle, and kochia.			X			

Herbicide	Herbicide Characteristics and Target Vegetation	Riparian	Rangeland	Agricultural Lands	Right-of-Ways	Roadsides	Residence/ Communities
Paraquat	Non-selective herbicide that destroys green plant tissue on contact and by translocation within the plant. It is a "Restricted Use" herbicide. Quickly adsorbed by soil particles and is long-lived in soil. Target species include field sandbur.		X	X	X	X	X
Pendimethalin	Selective herbicide used to control most annual grasses and certain broadleaf weeds. It can be used on both pre- and post-emergence weeds. Adsorbs strongly to soil organic matter and clay and does not leach through soil to contaminate ground water. It is used to control puncturevine and kochia.			X	X	X	
Picloram	A “Restricted Use” herbicide due to its mobility in water combined with the sensitivity of many crops that can be damaged with use. It interferes with the weed’s ability to make proteins and nucleic acids. It dissolves easily in water. This herbicide controls biennial thistles, Canada thistle, knapweeds, Dalmatian toadflax, camelthorn, Russian thistle, leafy spurge, Russian knapweed, Scotch thistle, whitetop, and yellow starthistle.		X	X	X	X	
Prodiamine	A selective, pre-emergent herbicide for the control of broadleaf weeds and grasses by inhibiting plant growth. Used for control of kochia, rescuegrass, and Johnsongrass				X	X	X
Thifensulfuron-methyl	This is a broad spectrum, post-emergent herbicide for control of broadleaf weeds. Absorbed through foliage of plants to inhibit growth. This herbicide controls spreading wallflower, kochia, and Russian thistle.		X	X	X	X	
Triclopyr	Works by disrupting plant growth. It is absorbed by green bark, leaves, and roots and moves to the meristem of the plant. It has a moderate to low solubility in water and normally binds to clay and organic matter, so it has a slight potential to contaminate ground water. Triclopyr is effective in treatment of yellow starthistle, squarrose knapweed, perennial pepperweed, spotted knapweed, diffuse knapweed, horehound, tamarisk, tree of Heaven, Russian olive, and Siberian elm.	X	X	X	X	X	X

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Table 9-4. Herbicides and recommended application concentrations per acre for priority weed species. Rates listed are general according to label instructions, the USFS Field Guide for Managing Weed Species in the Southwest; Montana, Utah and Wyoming Cooperative Extension Service Weed Management Handbook; and Lake Mead Exotic Plant Management Plan. Herbicides should be applied according to the label instructions by certified pesticide applicators.

Category A - HIGH																
Noxious Weed		2,4-D					Aminopyralid			Atrazine	Chlorsulfuron methyl		Clopyralid		Dichlobenil	
Common Name	**Scientific Name**	**Various**	**Grazon P+D (+picloram)**	**Curtail: (+clopyralid)**	**GrazonNext (+aminopyralid)**	**Crossbow (+triclopyr)**	**Milestone**	**Chaparral (+metsulfuron)**	**Milestone + Garlon 4**	**Aatrex**	**Telar XP**	**Cimmaron Plus (+metasulfuron)**	**Transline**	**Reclaim**	**Redeem (+triclopyr)**	**Casoron**
Leafy spurge[1]	*Euphorbia esula*		2 qts													0.92 - 3.84 qt
African rue[1]	*Peganum harmala*															
Tree-of-Heaven[1]	*Ailantus altissima*															
Ravenna grass[2]	*Saccharum ravennae*															
Fountain grass[1]	*Pennisetum setaceum*															
Yellow starthistle[1]	*Centaurea solstitialis*	1 qt	2 qt (1:4 mixture)	0.25 - 1 pt			3-5 oz						0.25-0.67 pt	0.25-0.67 pt		
Blue mustard[3]	*Chorispora tenella* (Pall.) DC.	½ - ¾ pt for 4 lb/gal product									0.125 oz					
Squarrose knapweed[1]	*Centaurea virgata*	1-2 qt	2-3 qt	4 pt			5-7 oz						⅔- 1 pt	⅓- 1 ⅓ pt	2 pt	
Bull thistle[1]	*Cirsium vulgare*		1 - 2 pt	1 - 2 qt	2 pt		3-5 oz						0.33-1.3 pt	0.33-1.3 pt	1.5 - 2 pt	0.92 - 3.84 qt
Canada thistle[1]	*Cirsium arvense*	2 qt (based on 1 qt of 4 lb per gal)		6 pints			5-7 oz						0.67-1.3 pt	0.67-1.3 pt	2.5-4 pt	0.92 - 3.84 qt
Dalmatian toadflax[1]	*Linaria dalmatica*										2-2.6 oz					
Musk thistle[1]	*Carduus nutans*		2 - 4 pt	1 - qt	1.5 - 2 pt		3-5 oz						0.33-1.3 pt	0.33-1.3 pt	1.5 - 2 pt	0.92 - 3.84 qt
Perennial pepperweed[1]	*Lepidum latifolium*	1-2 lbs/ac									1-2 oz					0.92 - 3.84 qt
Scotch thistle[1]	*Onopordum acanthium*		2 - 4 pt	1 - 2 qt	2 - 2.6 pt		5-7 oz						0.33-1.3 pt	0.33-1.3 pt	1.5 - 2 pt	0.92 - 3.84 qt
Spotted knapweed[1]	*Centaurea maculosa*	1 - 2 qt	2 - 3 qt	4 pt			5-7 oz						⅔- 1 pt	⅓- 1 ⅓ pt	2 pt	
Tall whitetop[1]	*Cardaria draba*							2.5 - 3.33 oz			1 oz	1.25 oz				
Sahara mustard[4]	*Brassica tournefortii*	3-6 pt					¼ to 1/3 pint	2.5-3.3 oz					2-3 qts			
Uruguayan pampas grass[6]	*Cortaderia sellonana*															
Yellow nutsedge[3]	*Cyperus esculentus*															
Sulphur cinquefoil[3]	*Potentilla rect L.*		2-4 pt				4-6 oz									
Common Mediterranean grass	*Schismus barbatus*															
Tamarisk,other	*Tamarix* spp., including hybrids															
Camelthorn[1]	*Alhagi camelorum*												1- 1/3 pt	1- 1/3 pt		

Category A - HIGH

Noxious Weed			Fluazifop-p									Metsulfuron				Thifensulfuron-			
Common Name	Scientific Name	Vista	Fusilade 2000, Fusilade DX	Rodeo	Round Up	Plateau	Journey (+ Glyphosate)	Arsenal	Arsenal + Rodeo	Chopper	Gallery	Ally, Allie, Gropper, Escort	Sencor	Gramoxone	Tordon 22K	Volta	Garlon	Pendulum	Evade
Leafy spurge[1]	*Euphorbia esula*			1 qt	1 qt	8-12 oz + 1.5-2 pt MSO									1-2 qt				
African rue[1]	*Peganum harmala*							3 pt				3.2 - 6.4 oz							
Tree-of-Heaven[1]	*Ailantus altissima*			2 -5 qt				1-1.5 pt		2-3 pt							3-6 qts		
Ravenna grass[2]	*Saccharum ravennae*			5% soln															
Fountain grass[1]	*Pennisetum setaceum*		1-1.5 pt	0.5-1 pt						2-3 pt									
Yellow starthistle[1]	*Centaurea solstitialis*			4.5-7.5 pt	1.5-4 qt			1 pt				1 oz			1-1.5 pt		3 pts		
Blue mustard[3]	*Chorispora tenella* (Pall.) DC.			1.5 pt	11-12 oz							0.125 oz							
Squarrose knapweed[1]	*Centaurea virgata*	8 oz													1-2 pt				
Bull thistle[1]	*Cirsium vulgare*					8-12 oz									0.5-2 pt				
Canada thistle[1]	*Cirsium arvense*														1 qt				
Dalmatian toadflax[1]	*Linaria dalmatica*					8-12 oz + 1 qt MSO									1-2 qt				
Musk thistle[1]	*Carduus nutans*					8-12 oz									0.5-2 pt				
Perennial pepperweed[1]	*Lepidum latifolium*			3 qt	1 gal	12 oz				2-3 pt		0.75-1 oz					3 qts		
Scotch thistle[1]	*Onopordum acanthium*					8-12 oz									0.5-2 pt				
Spotted knapweed[1]	*Centaurea maculosa*	8 oz													1-2 pt				
Tall whitetop[1]	*Cardaria draba*			3 qt	4 qt	12 oz				2-3 pt		0.75-1 oz							
Sahara mustard[4]	*Brassica tournefortii*											0.5-1.0 oz					3 qts		
Uruguayan pampas grass[6]	*Cortaderia sellonana*			0.5-1 pt						2-3 pt									
Yellow nutsedge[3]	*Cyperus esculentus*			1-5 qt															
Sulphur cinquefoil[3]	*Potentilla rect L.*														1 pt				
Common Mediterranean grass	*Schismus barbatus*		1-1.5 pt plants;8 oz for seedlings	1-3 pt						2-3 pt									
Tamarisk, Saltcedar[1]	*Tamarix* spp., including hybrids							2 qts	1.5 qt + 1.5 qt										
Camelthorn[1]	*Alhagi camelorum*							0.75-1.5 qt				1-3 oz			2 qt				

Category B - MEDIUM

Noxious Weed		2,4-D					Aminopyralid			Atrazine	Chlorsulfuron methyl		Clopyralid		Dichlobenil	
Common Name	**Scientific Name**	**Various**	**Grazon P+D (+picloram)**	**Curtail: (+clopyralid)**	**GrazonNext (+aminopyralid)**	**Crossbow (+triclopyr)**	**Milestone**	**Chaparral (+metsulfuron)**	**Milestone + Garlon 4**	**Aatrex**	**Telar XP**	**Cimmaron Plus (+metasulfuron)**	**Transline**	**Reclaim**	**Redeem (+triclopyr)**	**Casoron**
Halogeton[3]	*Halogeton glomeratus*	2 - 2.7 qt														
Siberian elm[1]	*Ulmus pumila*															
Tamarisk, Saltcedar[1]	*Tamarix ramosissima*															
Diffuse knapweed[1]	*Centaurea diffusa*	1 - 2 qt	2 - 3 qt	4 pt			5-7 oz						⅔- 1 pt	⅓- 1 ⅓ pt	2 pt	
Russian knapweed[1]	*Acroptilon repens*			1-2 qt			4-6 oz						1- 1 ⅓ pt	1- 1 ⅓ pt		0.92 - 3.84 qt
Russian olive[1]	*Elaeagnus angustifolia*					2 gal			7 oz + 2 qt							
Johnsongrass[3]	*Sorghum halepense*															

Category B - MEDIUM

Noxious Weed		Fluroxpyr	Fluazifop-p butyl	Glyphosate		Imazapic		Imazapyr			Isoxaben	Metsulfuron methyl	Metribuzon	Paraquat	Picloram	Thifensulfuron-methyl	Triclopyr	Pendimethalin	Prodiamine
Common Name	Scientific Name	Vista	Fusilade 2000, Fusilade DX	Rodeo	Round Up	Plateau	Journey (+ Glyphosate)	Arsenal	Arsenal + Rodeo	Chopper	Gallery	Ally, Allie, Gropper, Escort	Sencor	Gramoxone	Tordon 22K	Volta	Garlon	Pendulum	Evade
Halogeton[3]	*Halogeton glomeratus*					4-12 oz						0.5-1 oz							
Siberian elm[1]	*Ulmus pumila*			3-7.5 pt	1.5-3.3 qt			1-1.5 pt		2-3 pt							3-6 qt		
Tamarisk, Saltcedar[1]	*Tamarix ramosissima*							2 qt	1.5 qt + 1.5 qt										
Diffuse knapweed[1]	*Centaurea diffusa*	8 oz													1-2 pt				
Russian knapweed[1]	*Acroptilon repens*			3-7.5 pt	4-4.8 qt			2 pt							1-2 qt				
Russian olive[1]	*Elaeagnus angustifolia*			1-5 qt	1.5-3.3 qt			2.4 pt	1.5 qt + 1.5 qt								1-3 qt		
Johnsongrass[3]	*Sorghum halepense*												0.5 lb						1 lb

Category C - LOW

Noxious Weed																
Common Name	**Scientific Name**	**Various**	**Grazon P+D (+picloram)**	**Curtail: (+clopyralid)**	**GrazonNext (+aminopyralid)**	**Crossbow (+triclopyr)**	**Milestone**	**Chaparral (+metsulfuron)**	**Milestone + Garlon 4**	**Aatrex**	**Telar XP**	**Cimmaron Plus (+metasulfuron)**	**Transline**	**Reclaim**	**Redeem (+triclopyr)**	**Casoron**
Cheatgrass[1]	*Bromus tectorum*															
Field bindweed[3]	*Convolvulus arvensis*		2-4 pt													0.92 - 3.84 qt
Jointed goatgrass[1]	*Aegilops cylindrica*															
Puncturevine[3]	*Tribulus terrestris*	2 qt														
Rescuegrass[3]	*Bromus catharticus*															
Ripgut brome[3]	*Bromus diandrus*															
Smooth brome[3]	*Bromus inermis*															

Category C - LOW

Noxious Weed		2,4-D					Aminopyralid			Atrazine	Chlorsulfuron methyl		Clopyralid		Dichlobenil	
Common Name	**Scientific Name**	**Various**	**Grazon P+D (+picloram)**	**Curtail: (+clopyralid)**	**GrazonNext (+aminopyralid)**	**Crossbow (+triclopyr)**	**Milestone**	**Chaparral (+metsulfuron)**	**Milestone + Garlon 4**	**Aatrex**	**Telar XP**	**Cimmaron Plus (+metasulfuron)**	**Transline**	**Reclaim**	**Redeem (+triclopyr)**	**Casoron**
Bald brome[3]	*Bromus racemosus*															
	Bromus rubens									1-2 pt						
Spreading wallflower	*Erysimum repandum*	1/4-3/8 lb														
	Marrubium vulgare	1-4 pt														
California burclover[4]	*Medicago polymorpha*	0.67-4 pt														
	Salsola kali	0.75-4 pt											2-4 pt	2-4 pt		
Field brome	*Bromus arvensis*															
	Bassia scoparia									3.2-4 pt						0.92 - 3.84 qt

Category C

Noxious Weed			Fluazifop-p									Metsulfuron				Thifensulfuron-			
Common Name	Scientific Name	Vista	Fusilade 2000, Fusilade DX	Rodeo	Round Up	Plateau	Journey (+ Glyphosate)	Arsenal	Arsenal + Rodeo	Chopper	Gallery	Ally, Allie, Gropper, Escort	Sencor	Gramoxone	Tordon 22K	Volta	Garlon	Pendulum	Evade
Cheatgrass[1]	*Bromus tectorum*			0.5-1 pt		2-12 oz + 1 qt MSO	16-21 oz + 1 qt MSO												
Field bindweed[3]	*Convolvulus arvensis*				0.25-5 qt										0.5 pt- 2 qt				
Jointed goatgrass[1]	*Aegilops cylindrica*			2.5-3 pt		0.063-0.188 lbs													
Puncturevine[3]	*Tribulus terrestris*			0.75-4 pt														1.2-4.8 qt	
Rescuegrass[3]	*Bromus catharticus*			0.5-3 qt									0.5-0.6 lb						1 lb
Ripgut brome[3]	*Bromus diandrus*			0.5-3 qt									0.5-1 pt						
Smooth brome[3]	*Bromus inermis*			0.5-3 qt									0.5-1 pt						
Bald brome[3]	*Bromus racemosus*			0.5-3 qt									0.5-1 pt						
Red brome[4]	*Bromus rubens*		1-1.5 pt	0.5-1 pt		2-12 oz + 1 qt MSO	1⅓- 2 pt													
Spreading wallflower	*Erysimum repandum*															0.3-0.6 oz			
Horehound[5]	*Marrubium vulgare*											0.2-1 oz			2-4 pt		2.5- 3.33 pt		
California burclover[4]	*Medicago polymorpha*				24-32 oz														
Russian thistle[3]	*Salsola kali*				8 oz- 5 qt						16 oz		0.25-0.75 pt		1-1.5 oz				
Field brome	*Bromus arvensis*			0.5-3 qt									0.5-1 pt						

MSO=Methylated seed oil

[1]USFS. 2012. Field guide for managing Weed Species in the Southwest. United States Department of Agriculture. Forest Service. Southwestern Region. http://www.fs.usda.gov/main/r3/forest-grasslandhealth/invasivespecies.

[2]McMaster, M.A., L.J. MaKarick, J. Spence, C. Deuser, and T. Dow. 2012. Beware the ravenous ravenna: management of the highly invasive exotic Ravenna grass (*Saccharum ravennae*) in Colorado River Parks. 2011 Tamarisk Research Conference - Tamarisk Coalition. Tucson, AZ.

[3]Montana, Utah, Wyoming Cooperative Extension Services. 2006-2007. Weed Management Handbook. Pp 288.

[4]National Park Service. 2010. Exotic Plant Management Plan - Lake Mead National Recreation Area. Clark County, Nevada. Mohave County, Arizona

[5] U.S.G.S Southwest Biological Science Center. 2003. USGS Weeds in the West Project: Status of Introduced Plants in Southern Arizona State Parks. Fact Sheet for: *Marrubium vulgare* L.

[6] USDA Forest Service, Forest Health Staff, Newtown Square, PA. Invasive Plants website: https://www.fs.fed.us/foresthealth/protecting-forest/invasive-species/invasive-plants.shtml

10.0 Native Vegetation Re-Planting

It is highly recommended that native species revegetation occurs after noxious weeds are removed from areas where weeds comprised 50% or more of the vegetation community. Areas dominated by noxious weeds for long periods of time likely do not have the native seed bank necessary for passive native species recolonization. Also, revegetating with native species prevents recolonizing noxious weeds, restores native pastures, and provides habitat for wildlife. Below are recommendations for native species revegetation scenarios based on native to noxious weeds ratios prior to clearing.

10.1 Passive Restoration

Passive restoration can occur in habitats dominated by native vegetation. Noxious weeds can be removed by hand and the native seed bank and surrounding vegetation is left to recolonize cleared areas. These are areas where weeds comprise less than 50% of vegetative cover.

10.2 Active Restoration

Habitats with more than 50% noxious weeds cover prior to treatments require native species replanting after weed treatments occur. If a ground water is deep or no natural flooding occurs on a regular basis, planted vegetation will require supplemental irrigation. Below are different techniques for planting native vegetation.

10.2.1 Direct Seeding

Direct seeding offers many advantages over other techniques. When conditions are optimal, it produces large numbers of plants over an extensive area in a relatively short period. Through sheer volume, seeded plants out-compete recolonizing noxious weeds and survive harsh environmental conditions that would decimate smaller populations. Seeding is less expensive than other native planting techniques, especially for large tracts of land. Grass and herbaceous vegetation establish best from seed. Seeds from regional genetic stock have the most success germinating and surviving in the conditions found on the Navajo Nation. However, many seeds can only be obtained from commercial growers in other regions. USDA Natural Resource Conservation Service (NRCS) can provide information on the most appropriate seeds or seed mix for the desired area (https://www.nrcs.usda.gov/wps/portal/nrcs/main/plantmaterials/pmc/west/azpmc/). Additional native plant seed resources also include the NNDFW Diné Native Plants Program, NNDFW Botanist, State Cooperative Extension programs, local BIA Branch of Natural Resource Office, and the Navajo Nation Department of Agriculture Window Rock Office. Planting locally gathered seeds is successful but requires more time and effort than purchasing seed from a commercial source.

Prior to planting, some seeds with hard seed coats should be scarified mechanically or chemically. Scarification, a pre-germination process, opens the seed coat so water and gas can penetrate. When seeds naturally pass through the digestive tracts of animals, they undergo both

chemical and mechanical scarification as part of the digestion process. As a substitute, seeds can be mechanically scarified by grinding them in a blender for about 10 seconds or by scraping a hole in the coat using sandpaper. Chemical scarification uses strong acids or other chemicals to partially open the seed coat; however, it is more dangerous and less effective than mechanical methods.

10.2.2 Propagating Cuttings

Vegetative propagation is more predictable and often quicker than starting with seeds. Desirable traits can be selected—for example, a superior flower color or thornless branch. However, plants propagated from the same stock over a long period may become susceptible to sudden environmental changes, insect attacks, and diseases. Harvesting cuttings from a variety of populations or from different areas ensures greater diversity and resistance to such problems. Native cottonwood and willows have high survival rates when planted as vegetative cuttings.

Photo courtesy of Fred Phillips Consulting.

Cutting Guidelines. Check recommendations for individual species to identify the optimal season to harvest cuttings. In general, the best time to cut is when the plants are dormant—usually from December to early February. Ideally, cuttings are planted within a week of harvesting, after they are submerged in water for at least 7 days. If cuttings are not planted for a few months, refrigerate them at 35ºF to maintain dormancy. Try to select juvenile plants (1-2 years or younger if big enough) for cuttings, especially for woody species like cottonwood and willow. Younger plants are less likely to have growth inhibitors. If you must cut older plants, target the newest, most flexible growth near the base. When possible, prune older plants to generate new growth.

Preparing Cuttings. Before planting (either on site or in pots), re-cut and, for some species, apply rooting hormone. Make a new cut just above the original one but below a leaf node or bud, where concentrations of growth-influencing hormones or auxins are highest. This cut can be diagonal or straight. The diagonal method makes the cutting easier to plant and creates more surface area for water uptake. A straight cut lessens water loss and makes it easier to recognize the top and bottom ends. If rooting hormone is used, dip the cut end into an IBA (Indole-3-butyric acid) rooting hormone, such as Rootone, and gently tap to remove excess powder. This hormone speeds up root development. To prevent contamination, remove and apply the estimated amount of hormone for the cuttings present and discard extra after use. Cuttings from some species, like willow, are soaked for at least 7 days, but no longer than 12-14 days because the roots will begin to

grow and will risk breaking off during planting. Once poles are removed from water they should not spend more than 12 hours out of water before planting.

Planting Techniques. Techniques for planting cuttings vary considerably; virtually all are effective for fast-rooting species such as cottonwood and willow. Rooting times vary by species from under a week to several months. Planting areas with a 6-inch – 4-foot depth to water table are recommended for planting cottonwood and willow tree species. Willows can be planted in clusters with 3 poles at least 7 feet in length with a minimum diameter of ½ inch. Holes are augured to a 6-inch diameter and at least 4 feet deep or just below the water table. All poles are planted at least 4 feet deep in the augured holes at the lowest water table of the year. Insert the cutting into the soil with the nodes pointing upward. The above ground portion of the pole is cut at a maximum height of 2 feet high and a minimum height of 18 inches. When planted all poles are slurred in with a water auger leaving no air gaps between pole and soil to maintain maximum soil to stem contact. Coat the tops of all poles with latex paint to seal in moisture. If planted in the ground water, planting areas should not require supplemental irrigation.

10.2.3 Deep Pot Upland Plants

Upland trees benefit from being grown in deep pots. Deep potted plants are planted in a hand augured planting holes that are 4-in wide and deep enough to reach the capillary fringe of the lowest water table of the year. One to three feet of the plant with budding sites above the ground. The plant root ball is not planted in saturated soil, but just right above the saturated soil zone.

10.2.4 Containerized Plants

Containerized plants are available all year and can establish quickly if they have well-established root systems. This method is expensive, time consuming, and difficult to transport, and is not practical for sites that are hard to access. Tree species are often planted in five-gallon containers while shrubs and forbs are planted as one-gallon containers. Herbaceous plants that naturally grow with multiple stems or rhizomatous roots are grown in flats of various sizes. If plants are not planted into the water table, drip irrigation may be necessary.

Augured or excavated 3-18-inch planting holes are dug to the lowest water table of the year. The native soil from the holes is utilized to secure the plant. When the plants are removed from the container, the root ball is pulled apart and loosened prior to planting. Once planted, a water well ring is formed on the surface soil around all tree plantings to enhance water retention. Remove noxious weeds present in the native tree containers prior to planting.

10.2.5 Bioengineering and Erosion Control

Figure 10-1. Harvested willow poles are planted along a bankline to provide additional erosion protection. *Left*: Work crews prep the bundles of willow poles after they have soaked in the Colorado River. *Right*: the same location one year after planting. Photos courtesy of Fred Phillips Consulting.

Bioengineering is implemented to prevent erosion and noxious weed recolonization along stream, wash, and riverbanks (**Figure 10-1**). This technique uses native vegetation poles, bundles, and plugs cut or harvested from local native stock. Poles are collected using the methods discussed above under Propagating Cuttings. They are planted individually or as bundles (approximately 3 poles per bundle) using a power auger or punch to create a narrow hole perpendicular to water flow that extends to the water table. Two rows of poles are planted along the bank line, one at the average low-water mark and one at the average high-water mark. When the water table is reached, a pole or bundle is immediately placed in the hole down to the water table. Soil is packed around the cutting to prevent air pockets.

Willow bundle plantings are good for areas with fluctuating water levels (**Figure 10-2**). To make bundles, 3-5 poles are tied into bundles of approximately 3 to 18 inches in diameter with the growing tips oriented up. The terminal bud is removed so the energy is re-routed to the lateral buds for more efficient root and stem sprouting. Vertical trenches are excavated approximately on 3-foot centers with a slope of 2:1 or more to ensure adequate protections of the bank line and to encourage rapid growth. Ensure that the bottom of the trench is still under water during low flows and place bundles in them with the cut ends in the water. Bundles are secured with a wooden stake and the bundle is back filled with soil.

Figure 10-2. Bundles of fast-growing plants planted along the streambank can provide erosion control when steep banks cannot be re-graded. *Left*: grass bundles installed along a steep bank with willow bundles planted in between to stabilize and capture soils on the bankline. *Right*: The same bankline one year later. Photos courtesy of Fred Phillips Consulting.

The toe of the slope is highly erodible and is planted with fast growing native wetland vegetation plugs if perennial water is present. Wetland plugs are planted during the lowest water flow of the year to ensure that plants are submerged in the water table. A hole is dug at the toe of the slope, in the water table and the wetland plug's roots are submerged in the water.

Other erosion control techniques include the following:

- **Erosion blankets:** This technique helps hold soil and seed in place during inundation and create a microclimate conducive to germination of native grass and forb seeds. Blankets consisting of all-natural materials break down between one to 2 years after vegetation is established and are wildlife friendly. The blanket is installed over the prepared seed bed and staked into place with wooden stakes and/or metal staples by hand crews. The edges of the blanket are buried in a shallow trench.
- **Fiberschines**: This technique uses a coconut-fiber roll product to protect the streambank by stabilizing the toe of the slope and trapping sediment from the sloughing streambank. Cuttings and herbaceous riparian plants are planted into the fiberschine and behind it so that riparian vegetation stabilizes the streambank when the fiberschine decomposes.
- **Brush Layer:** This technique uses bundles of willow cuttings buried in trenches along the slope of an eroding streambank. This willow "terrace" is used to reduce the length of the slope of the streambank. The willow cuttings will sprout and take root, thus stabilizing the streambank with a dense matrix of roots. Some toe protection such as a wattle, fiberschine, or rock may be necessary with this technique.
- **Mulch Over Reseeding:** Straw mulch consists of wheat, barley, oat or rye straw, hay, and grass cut from native grasses that are "weed free". Straw mulch could be applied at a rate of 2 tons per acre to designated seeding areas to provide a protective environment for seed

germination. Mulching will occur in the upper overbank zone and portions of the transition zone.

- **Brush revetment:** This method is used to protect and build the toe of eroding banks. This practice consists of a series of evergreen or other brushy trees tied end to end, placed along the toe of the stream bank, and anchored by bolster rock, earth anchors, or fence posts. The revetment provides temporary structural protection to the toe while vegetation becomes established by slowing velocities and diverting the current away from the bank edges. Over time, fine sediments accumulate, partially burying the degrading material. The mass of tree limbs also has the added benefit of creating aquatic habitat as the revetment material generally does not sprout. Once bank vegetation is established, T-posts are removed.

11.0 Project Maintenance and Monitoring

Monitoring and maintenance are essential to successful weed management projects. Monitoring a site after treatment can determine the effectiveness of the project. Monitoring guides adaptive management and can determine the need for alternative treatments. Maintenance, including follow-up weed treatments and native species planting, is an integral part of an integrated weed management plan. Most weed species require multiple treatments before complete eradication occurs. Often once one weed species is removed from a site, secondary weed infestations can occur. Planting native vegetation can reduce re-colonizing weed species by out-competing them. Follow-up maintenance is critical for reducing the re-colonization of primary and secondary weed species of concern. For woody invasive weed treatments in forestlands, intermediate and maintenance treatments are prescribed for a given rotation age, based on the goals and objectives of each treatment.

11.1 Project Monitoring

Establishing and implementing a monitoring program determines the success of the project activities and a long-term adaptive management strategy. Monitoring is necessary to determine the efficacy of proposed treatments on priority weed species, identify infestations of new and emerging weed species, and better understand the factors that influence weed spread within the Navajo Nation. To determine the effectiveness of treatment activities a monitoring report will be prepared. The monitoring report will include the species controlled, method of treatment(s) used, a map of the treated area, issues encountered, and overall control achieved at the site. If using chemical treatments, the name and amount of herbicide used, dates sprayed, time of day sprayed, wind speed, and temperature at time of herbicide application is also required.

11.1. Treatment Effectiveness Monitoring

Monitoring weed spread and/or treatment effectiveness is conducted through annual weed mapping of treatment sites (see Chapter 6). During the project planning phase, the perimeter of the affected area is mapped (using methods outlined in Chapter 6) and percent cover calculated.

If the treatment area is a long linear corridor (road or right-of-way) the infested areas is mapped by vehicle along the corridor. This baseline measurement is used to compare acreage of infestation against future acreage calculations following treatments to determine treatment effectiveness. Results from monitoring will be presented in annual weed monitoring reports. By tracking the size of the weed infestation, BIA can determine if treatment methods are successful and objectives are being met. If necessary, treatments will be adjusted through the adaptive management process to ensure that the project objectives are achieved.

If treated weed populations are large, monitoring plots located along transects may be established to sub-sample smaller areas. Plots are established by stretching a 100m tape measure across the treatment area. The start and end points of the transect are recorded with a GPS and the bearing of the transect is recorded to help relocate transects in subsequent surveys. Plots (1 x 0.5m) are established every 10 meters along the transect, and noxious weed cover is estimated using the methods outlined in Elzinga et al. 1998. Multiple transects are necessary if the treatment site is large. Data collected from the plots is measured over time and is compared year-to-year. For long linear corridors (roads and rights-of-way) vehicles will stop at established intervals to estimate vegetation cover in an established larger plot area. An example monitoring plot data sheet located in Appendix H.

11.1.2 Photo Monitoring

Photo monitoring is a qualitative way to show change over time in an area of interest. This is the most effective method for visualizing and capturing landscape conditions at a given point in time. Photo points are established immediately after treatment occurs, marked with permanent markers, and GPS coordinates are recorded. Care is taken to ensure that the photo point locations are described in detail so they can be found during follow-up visits. To relocate points and replicate photos, photos from previous sessions are taken to the field. Photos are immediately transferred to a database and labeled with a unique identifier and description so that information does not get lost with time. An example Photo Monitoring Datasheet is located in Appendix H.

11.1.3 Adaptive Management

Adaptive management is 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 the outcomes. This document is a living document that will revised through adaptive management. Weed populations are dynamic. Revisions to the plan will be done every five years with updates to the priority weed list and revised recommendations for techniques utilized in weed management projects. They decline when managed with integrated weed treatments and expand when no weed treatments occur. Currently, it is unknown how expansive weed populations are across the Navajo Nation without extensive weed mapping efforts. Even if there were extensive weed mapping efforts, weed populations continually change and expand. There are many uncertainties that can occur in a dynamic system due to weed expansion, the effectiveness of a

treatment, and different management priorities. Monitoring through adaptive management will help determine if the project objectives are being met and if the treatments are staying within the environmental effects that were anticipated with this PEIS. If the parameters discussed above are not being met, the techniques, timing and frequency of treatments, etc. can be changed through adaptive management. Implementing an integrated weed management program increases the chance of overall success and decreases the risk of any large failures (Sheley and Petroff 1999, Bormann and Kiester 2004).

The BIA is required to involve the public in adaptive management by:

1. Maintaining open channels of information to the public, including transparency of the monitoring process that precedes adaptive management and the decision-making process by which it is implemented.

2. Providing post-activity opportunity for public and affected outside agency review of adaptive management practices, including practices that were exceptions to any resource management plan or that had permitting and/or other regulatory requirements not satisfied by prior coordination.

11.2 Project Maintenance

As discussed above, follow-up maintenance is required to effectively eradicate many weed species. For example, successful long-term management programs for tamarisk require more than five years of treatments using multiple control methods, including: mechanical, fire, and chemical treatments (USFS 2012). Secondary weeds (i.e., camelthorn) may colonize a treatment site once it is cleared. Planting native vegetation at treatment sites reduces re-colonizing noxious weeds. Periodic weeding using hand pulling or spraying or small mechanical tools is necessary until native vegetation matures and creates a canopy. Weed treatments should occur every other month during the growing season (April-September) to treat re-sprouting and secondary infestations. Consistent maintenance after the first treatment is the most cost-effective way to ensure eradication or control of weeds, because less time and materials are required for small, young weed. Treatment sites, especially those planted with native vegetation, should be fenced to prevent livestock from entering so native vegetation can establish and mature. Fencing will require maintenance to ensure that it is effective at preventing livestock intrusions.

12.0 Demonstration Projects

A number of demonstration projects were identified by BIA Navajo Region Agencies to initiate noxious weed treatments and serve as models for future projects (**Table 12-1**). Demonstration projects have completed weed mapping, compliance, permitting, and reporting, and departmental funding has been requested or confirmed. Monitoring and maintenance of these sites will provide valuable information that can improve and enhance weed treatment methods for future projects.

Table 12-1. Demonstration Projects identified by the five BIA Navajo Region Agencies including Western, Shiprock, Chinle, Eastern (Crownpoint), Navajo Partitioned Land, and Fort Defiance Agencies. The table outlines the weed species mapped at the site, habitat and land use, proposed methods, and funding years for project implementation.

Agency	Project Name	Habitat Type	Methods	Weed Mapping (ac)	Species Mapped	FY
Western	Tsah Bii Kin (Tonalea Lake)	Riparian	Mechanical, Chemical	38	TAMAR	2014 - 2015
Western	Tsegi Canyon	Riparian	Mechanical, Chemical	32	ELAN	2014-2015
Western	San Juan River	Riparian	Mechanical, Chemical, Manual	1850	TAMAR, ELAN, ACRE, ALMA, SARA	2014-2015
Western	Oljato Wash and Parrish Creek (Tyende)	Riparian	Not Specified	52	Not Specified	2014-2015
Western	Nitsin Canyon (Navajo Canyon)	Riparian	Mechanical, Chemical	150	ELAN, TAMAR	2014-2015
Western	Shonto Wash – Phase 1	Riparian	Chemical, Mechanical, Biological	14	TAMAR, ELAN	2020 to 2021
Western	WNA – Phase 2	Rangeland	Mechanical, Chemical, Biological	206,389	ELAN	2014 to 2015
Fort Defiance	Kin Dah Lichi	Sagebrush, Pinon, Juniper	Mechanical, Chemical	1,516	ELAN, BRTE, COAR, SAKA, CANU, CIVU	2014 to 2015
Fort Defiance	New Lands	Stream Corridor	Mechanical, Chemical	227	PEHA, CIVU, LIDA, ONAC, ELAN, TAMAR ALMA13, ULPU, BRTE, COAR4, TRTE, MAVU, SAKA	2015 to 2016
Fort Defiance	District 14	Stream Corridor	Chemical	1,661	ELAN, TAMAR, CIVU, BRTE, COAR, CEIN, HAGL, CANU, TRTE	2016 & 2017
Fort Defiance	Commercial Forest	Forest	Chemical and Mechanical	324	BRRA, ULPU, CIVU, BRTE, SOAR, CANU, TRTE, ACRE, ELAN, SAKA, CIAR	2018-2019
Fort Defiance	District 7 (BIA 15)	Rangeland	Mechanical, Chemical, Biological	4,570	ACRE3, CEDI3, CEBI2, LIDA	2020-2021
Fort Defiance	HWY 264 and 191	Roads	Mechanical, Chemical	21,230	ACRE3, CEDI3, CEBI2, LIDA	2020-2021
Fort Defiance	Colorado Pueblo Wash	Riparian	Mechanical, Chemical	1,821	TAMAR, ELAN	2020-2021
Fort Defiance	Kinlichee	Riparian	Mechanical, Chemical	1,500	TAMAR, ELAN	2020-2021
Northern	LMD 13	Stream Corridor	Mechanical, Chemical, Biological	398,196	TAMA, ELAN, ACRE3, CANU	2020 & 2021
Eastern	Canoncito/Alamo			2,000	Not specified	2015 & 2016
Navajo Partitioned Land	Precinct 1, 2, and 3	Stream Corridor and Rangeland	Chemical and Mechanical	1,500	ACRE, BRTE, TAMA, SALSOL	2015-2016
Chinle	Many Farms Plot	Agricultural field		1,990	TAMAR, ELAN	2020-2021

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Appendix B. Herbicide Mitigation Measures for Listed Species

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides						
	2,4-D (acid)	**2,4-D (aquatic amine salt)**	**2,4-D (non-aquatic amine salt)**	**2,4-D (aquatic ester)**	**2,4-D (non-aquatic ester)**	**Aminopyralid**	**Atrazine**
Federally Listed Species							
California condor	No buffer zone in ROW. Spot and mechanized ground treatments- 1/4 mile from suitable nests, roosts, and release sites. Low and high aerial spraying- 1 1/2 mile from suitable nests, roosts, and release sites. Aerial spraying made in swaths parallel to nest site and aerial buffer zone.						
Southwestern willow flycatcher and Yellow-billed cuckoo	All treatments require1/4 mile buffer from habitat patches or potential habitat until surveyed. No activity within migratory habitat from May 1- June 15.						
Mexican spotted owl	All formulations: Spot- 80ft from the PAC during breeding season. Mechanized ground, Low aerial and High Aerial- 1/4 mile from PAC during breeding season. May be sprayed along road or utility ROW during breeding season. May be sprayed in PAC outside the breeding season.						
Kanab ambersnail	Liquid formulations: Spot- no buffer from edge of the habitat. Mechanized ground- 30ft Low aerial- 150ft High aerial- 1/8 mile	Spot applications around habitat: Liquid- 10ft buffer ULV- 150ft buffer				No buffer	Liquid formulations: Spot- no buffer from edge of the habitat. Mechanized ground- 30ft Low aerial- 150ft High aerial- 1/8 mile
Colorado pikeminnow, Humpback chub, Razorback sucker, Roundtail chub, Zuni bluehead sucker	No buffer			Spot applications in following areas: one-half mile upstream (including tributaries), all species habitat, and 300ft downstream of habitat. Spot applications- 300ft buffer from waterway		No buffer	Spot applications in following areas: one-half mile upstream (including tributaries), all species habitat, and 300ft downstream of habitat. Liquid- 10ft Mechanized ground-80ft Low aerial- 200ft High aerial- 1/8 mile
Welsh's milkweed, Brady pincushion cactus , Fickeisen plains cactus, Zuni/Rhizome fleabane, Navajo sedge, Mesa Verde cactus	Spot and mechanized spraying - 200ft from identified species locations. Low and high aerial applications- 1 mile from identified species locations.	Spot applications from edge of occupied sites: 1/8 mile Mechanized ground: 2 miles, in non-habitat areas can have buffer of 80ft from occupied habitat during flower period if application is made no later than one hour after sunrise or early evening (6pm or later). Low and high aerial: 2 miles; in non-habitat areas can have buffer of 1/4 mile from occupied habitat during flower period if application is made no later than one hour after sunrise or early evening (6pm or later).				Spot and mechanized spraying - 200ft from identified species locations. Low and high aerial applications- 1 mile from identified species locations.	
Mancos milk-vetch	Spot and mechanized spraying - 200ft from suitable habitat. Low and high aerial applications- 1 mile from suitable habitat.						
Migratory birds	Spot and mechanized ground applications- 1/4 mile buffer from active nests. No low or high aerial or prescribed burn during breeding season (March-August).						

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides				
	Chlorsulfuron methyl	**Clopyralid**	**Dichlobenil**	**Diflufenzopyr**	**Fluroxpyr**
Federally Listed Species					
California condor	No buffer zone in ROW. Spot and mechanized ground treatments- 1/4 mile from suitable nests, roosts, and release sites. Low and high aerial spraying- 1 1/2 mile from suitable nests, roosts, and release sites. Aerial spraying made in swaths parallel to nest site and aerial buffer zone.				
Southwestern willow flycatcher and Yellow-billed cuckoo	All treatments require1/4 mile buffer from habitat patches or potential habitat until surveyed. No activity within migratory habitat from May 1- June 15.				
Mexican spotted owl	All formulations: Spot- 80ft from the PAC during breeding season. Mechanized ground, Low aerial and High Aerial- 1/4 mile from PAC during breeding season. May be sprayed along road or utility ROW during breeding season. May be sprayed in PAC outside the breeding season.				
Kanab ambersnail	No buffer		Liquid formulations: Spot- no buffer from edge of the habitat. Mechanized ground- 30ft Low aerial- 150ft High aerial- 1/8 mile	No buffer	
Colorado pikeminnow, Humpback chub, Razorback sucker, Roundtail chub, Zuni bluehead sucker	No buffer	No buffer	Spot applications in following areas: one-half mile upstream (including tributaries), all species habitat, and 300ft downstream of habitat. Liquid- 10ft Mechanized ground-80ft Low aerial- 200ft High aerial- 1/8 mile	No buffer	Spot applications in following areas: one-half mile upstream (including tributaries), all species habitat, and 300ft downstream of habitat. Liquid- 10ft Mechanized ground-80ft Low aerial- 200ft High aerial- 1/8 mile
Welsh's milkweed, Brady pincushion cactus , Fickeisen plains cactus, Zuni/Rhizome fleabane, Navajo sedge, Mesa Verde cactus	Spot and mechanized spraying - 200ft from identified species locations. Low and high aerial applications- 1 mile from identified species locations.				
Mancos milk-vetch	Spot and mechanized spraying - 200ft from suitable habitat. Low and high aerial applications- 1 mile from suitable habitat.				
Migratory birds	Spot and mechanized ground applications- 1/4 mile buffer from active nests. No low or high aerial or prescribed burn during breeding season (March-August).				

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides				
	Fluazifop-p butyl	**Glyphosate (aquatic)**	**Glyphosate (non-aquatic)**	**Imazapic**	**Imazapyr (aquatic)**
Federally Listed Species					
California condor	No buffer zone in ROW. Spot and mechanized ground treatments- 1/4 mile from suitable nests, roosts, and release sites. Low and high aerial spraying- 1 1/2 mile from suitable nests, roosts, and release sites. Aerial spraying made in swaths parallel to nest site and aerial buffer zone.				
Southwestern willow flycatcher and Yellow-billed cuckoo	All treatments require1/4 mile buffer from habitat patches or potential habitat until surveyed. No activity within migratory habitat from May 1- June 15.				
Mexican spotted owl	All formulations: Spot- 80ft from the PAC during breeding season. Mechanized ground, Low aerial and High Aerial- 1/4 mile from PAC during breeding season. May be sprayed along road or utility ROW during breeding season. May be sprayed in PAC outside the breeding season.				
Kanab ambersnail	Liquid formulations: Spot- no buffer from edge of the habitat. Mechanized ground- 30ft Low aerial- 150ft High aerial- 1/8 mile	No buffer	Liquid formulations: Spot- no buffer from edge of the habitat. Mechanized ground- 30ft Low aerial- 150ft High aerial- 1/8 mile	No buffer	
Colorado pikeminnow, Humpback chub, Razorback sucker, Roundtail chub, Zuni bluehead sucker	Spot applications in following areas: one-half mile upstream (including tributaries), all species habitat, and 300ft downstream of habitat. Spot applications- 300ft buffer from waterway	No buffer	Spot applications in following areas: one-half mile upstream (including tributaries), all species habitat, and 300ft downstream of habitat. Liquid- 10ft Mechanized ground-80ft Low aerial- 200ft High aerial- 1/8 mile	No buffer	
Welsh's milkweed, Brady pincushion cactus , Fickeisen plains cactus, Zuni/Rhizome fleabane, Navajo sedge, Mesa Verde cactus	Spot and mechanized spraying - 200ft from identified species locations. Low and high aerial applications- 1 mile from identified species locations.				
Mancos milk-vetch	Spot and mechanized spraying - 200ft from suitable habitat. Low and high aerial applications- 1 mile from suitable habitat.				
Migratory birds	Spot and mechanized ground applications- 1/4 mile buffer from active nests. No low or high aerial or prescribed burn during breeding season (March-August).				

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides			
	Imazapyr (non-aquatic)	**Isoxaben**	**Metsulfuron methyl**	**Metribuzon**
Federally Listed Species				
California condor	No buffer zone in ROW. Spot and mechanized ground treatments- 1/4 mile from suitable nests, roosts, and release sites. Low and high aerial spraying- 1 1/2 mile from suitable nests, roosts, and release sites. Aerial spraying made in swaths parallel to nest site and aerial buffer zone.			
Southwestern willow flycatcher and Yellow-billed cuckoo	All treatments require1/4 mile buffer from habitat patches or potential habitat until surveyed. No activity within migratory habitat from May 1- June 15.			
Mexican spotted owl	All formulations: Spot- 80ft from the PAC during breeding season. Mechanized ground, Low aerial and High Aerial- 1/4 mile from PAC during breeding season. May be sprayed along road or utility ROW during breeding season. May be sprayed in PAC outside the breeding season.			
Kanab ambersnail	No buffer	Liquid formulations: Spot- no buffer from edge of the habitat. Mechanized ground- 30ft Low aerial- 150ft High aerial- 1/8 mile	No buffer	Liquid formulations: Spot- no buffer from edge of the habitat. Mechanized ground- 30ft Low aerial- 150ft High aerial- 1/8 mile
Colorado pikeminnow, Humpback chub, Razorback sucker, Roundtail chub, Zuni bluehead sucker	Spot applications in following areas: one-half mile upstream (including tributaries), all species habitat, and 300ft downstream of habitat. Liquid- 10ft Mechanized ground-80ft Low aerial- 200ft High aerial- 1/8 mile			
Welsh's milkweed, Brady pincushion cactus , Fickeisen plains cactus, Zuni/Rhizome fleabane, Navajo sedge, Mesa Verde cactus	Spot and mechanized spraying - 200ft from identified species locations. Low and high aerial applications- 1 mile from identified species locations.			
Mancos milk-vetch	Spot and mechanized spraying - 200ft from suitable habitat. Low and high aerial applications- 1 mile from suitable habitat.			
Migratory birds	Spot and mechanized ground applications- 1/4 mile buffer from active nests. No low or high aerial or prescribed burn during breeding season (March-August).			

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides			
	Picloram	**Thifensulfuron-methyl**	**Triclopyr (amine salt)**	**Triclopyr (ester)**
Federally Listed Species				
California condor	No buffer zone in ROW. Spot and mechanized ground treatments- 1/4 mile from suitable nests, roosts, and release sites. Low and high aerial spraying- 1 1/2 mile from suitable nests, roosts, and release sites. Aerial spraying made in swaths parallel to nest site and aerial buffer zone.			
Southwestern willow flycatcher and Yellow-billed cuckoo	All treatments require1/4 mile buffer from habitat patches or potential habitat until surveyed. No activity within migratory habitat from May 1- June 15.			
Mexican spotted owl	All formulations: Spot- 80ft from the PAC during breeding season. Mechanized ground, Low aerial and High Aerial- 1/4 mile from PAC during breeding season. May be sprayed along road or utility ROW during breeding season. May be sprayed in PAC outside the breeding season.			
Kanab ambersnail	Liquid formulations: Spot- no buffer from edge of the habitat. Mechanized ground- 30ft Low aerial- 150ft High aerial- 1/8 mile	No buffer		Liquid formulations: Spot- no buffer from edge of the habitat. Mechanized ground- 30ft Low aerial- 150ft High aerial- 1/8 mile
Colorado pikeminnow, Humpback chub, Razorback sucker, Roundtail chub, Zuni bluehead sucker	Spot applications in following areas: one-half mile upstream (including tributaries), all species habitat, and 300ft downstream of habitat. Liquid- 10ft Mechanized ground-80ft Low aerial- 200ft High aerial- 1/8 mile	No buffer	No buffer	Spot applications in following areas: one-half mile upstream (including tributaries), all species habitat, and 300ft downstream of habitat. Spot applications- 300ft buffer from waterway
Welsh's milkweed, Brady pincushion cactus , Fickeisen plains cactus, Zuni/Rhizome fleabane, Navajo sedge, Mesa Verde cactus	Spot and mechanized spraying - 200ft from identified species locations. Low and high aerial applications- 1 mile from identified species locations.			
Mancos milk-vetch	Spot and mechanized spraying - 200ft from suitable habitat. Low and high aerial applications- 1 mile from suitable habitat.			
Migratory birds	Spot and mechanized ground applications- 1/4 mile buffer from active nests. No low or high aerial or prescribed burn during breeding season (March-August).			

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	**Herbicides**	
	Pendimethalin	**Prodiamine**
Federally Listed Species		
California condor	No buffer zone in ROW. Spot and mechanized ground treatments- 1/4 mile from suitable nests, roosts, and release sites. Low and high aerial spraying- 1 1/2 mile from suitable nests, roosts, and release sites. Aerial spraying made in swaths parallel to nest site and aerial buffer zone.	
Southwestern willow flycatcher and Yellow-billed cuckoo	All treatments require1/4 mile buffer from habitat patches or potential habitat until surveyed. No activity within migratory habitat from May 1- June 15.	
Mexican spotted owl	All formulations: Spot- 80ft from the PAC during breeding season. Mechanized ground, Low aerial and High Aerial- 1/4 mile from PAC during breeding season. May be sprayed along road or utility ROW during breeding season. May be sprayed in PAC outside the breeding season.	
Kanab ambersnail	Spot applications around habitat: Liquid- 10ft buffer ULV- 150ft buffer	
Colorado pikeminnow, Humpback chub, Razorback sucker, Roundtail chub, Zuni bluehead sucker	Spot applications in following areas: one-half mile upstream (including tributaries), all species habitat, and 300ft downstream of habitat. Spot applications- 300ft buffer from waterway	
Welsh's milkweed, Brady pincushion cactus , Fickeisen plains cactus, Zuni/Rhizome fleabane, Navajo sedge, Mesa Verde cactus	Spot applications from edge of occupied sites: 1/8 mile Mechanized ground: 2 miles, in non-habitat areas can have buffer of 80ft from occupied habitat during flower period if application is made no later than one hour after sunrise or early evening (6pm or later). Low and high aerial: 2 miles; in non-habitat areas can have buffer of 1/4 mile from occupied habitat during flower period if application is made no later than one hour after sunrise or early evening (6pm or later).	
Mancos milk-vetch	Spot and mechanized spraying - 200ft from suitable habitat. Low and high aerial applications- 1 mile from suitable habitat.	
Migratory birds	Spot and mechanized ground applications- 1/4 mile buffer from active nests. No low or high aerial or prescribed burn during breeding season (March-August).	

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides						
	2,4-D (acid)	2,4-D (aquatic amine salt)	2,4-D (non-aquatic amine salt)	2,4-D (aquatic ester)	2,4-D (non-aquatic ester)	Aminopyralid	Atrazine
Navajo Listed Species							
Pronghorn	All formulations- 1 mile buffer from potential lambing areas from May 1- June 15						
Townsend's big eared bat	All formulations require a 197ft buffer from occupied roost site.						
Chisel-toothed kangaroo rat, Banner-tailed kangaroo rat, Navajo Mountain vole, Arizona (Wupatki) pocket mouse	No restrictions						
Kit fox	All formulations require a 1/8 mile buffer from active den from December 1- August 31.						
Bald and golden eagles	All formulations: 1/4 mile buffer from active nest during the breeding season January 15- July 15. Buffer zone is unnecessary outside of breeding season for spot and mechanized ground treatments. Aerial applications should be made in swaths parallels to a nest and 3/4 mile buffer zone. If aerial flight over a nest site is necessary, an elevation of 500ft should be maintained over the nest.						
Ferruginous hawk	Brief (1hr) spot- 1/2 mile buffer. Mechanized ground- 5/8 mile buffer. Low and high aerial- 3/4 mile.						
American dipper	All formulations- spot- 350ft buffer. Mechanized ground, low or high aerial within 1/8 mile from active nest during March 15- August 15.						
Northern goshawk	All formulations require 1/4 mile buffer from nest site during March 1- August 15. All formulations require 0.21 mile buffer from the nest site year-round.						
Clark's grebe	All formulations: Spot- 328ft buffer from active nest during May 1-July 31. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during May 1- July 31.						
Northern saw-whet owl	All formulations require 1/8 mile buffer from the nest site year-round.						
Burrowing owl	All formulations require 1/4 mile buffer from the active nest burrow during March 1- August 15.						
Dusky grouse	All formulations: Spot- 328ft buffer from active nest during April 1-July 15. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during April 1-July 15.						
Yellow warbler	All formulations: Spot- 1/8 mile buffer from active nest from April 15- July 31. Mechanized ground and low and high aerial- 1/8 mile buffer year-round						
Belted kingfisher and Mountain plover	All formulations: No treatments in nesting habitat year-round. Spot- 328ft buffer from active nest during April 15-August 15. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during April 15-August 15.						
Hammond's flycatcher	All formulations: Spot- 328ft from active nest during May 15- August 15. Mechanized ground and low and high aerial- 1/8 mile from nest year-round.						
Northern pygmy owl	All formulations: spot- 1/8 mile buffer from nest April 1-August 15. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.						
Flammulated owl	All formulations: spot- 1/8 mile buffer from nest May 1-August 15. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.						
Band-tailed pigeon, American three-toed woodpecker, Tree swallow	All formulations: spot- 328ft buffer from nest May 1-August 1. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.						

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides				
	Chlorsulfuron methyl	**Clopyralid**	**Dichlobenil**	**Diflufenzopyr**	**Fluroxpyr**
Navajo Listed Species					
Pronghorn	All formulations- 1 mile buffer from potential lambing areas from May 1- June 15				
Townsend's big eared bat	All formulations require a 197ft buffer from occupied roost site.				
Chisel-toothed kangaroo rat, Banner-tailed kangaroo rat, Navajo Mountain vole, Arizona (Wupatki) pocket mouse	No restrictions				
Kit fox	All formulations require a 1/8 mile buffer from active den from December 1- August 31.				
Bald and golden eagles	All formulations: 1/4 mile buffer from active nest during the breeding season January 15- July 15. Buffer zone is unnecessary outside of breeding season for spot and mechanized ground treatments. Aerial applications should be made in swaths parallels to a nest and 3/4 mile buffer zone. If aerial flight over a nest site is necessary, an elevation of 500ft should be maintained over the nest.				
Ferruginous hawk	Brief (1hr) spot- 1/2 mile buffer. Mechanized ground- 5/8 mile buffer. Low and high aerial- 3/4 mile.				
American dipper	All formulations- spot- 350ft buffer. Mechanized ground, low or high aerial within 1/8 mile from active nest during March 15- August 15.				
Northern goshawk	All formulations require 1/4 mile buffer from nest site during March 1- August 15. All formulations require 0.21 mile buffer from the nest site year-round.				
Clark's grebe	All formulations: Spot- 328ft buffer from active nest during May 1-July 31. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during May 1- July 31.				
Northern saw-whet owl	All formulations require 1/8 mile buffer from the nest site year-round.				
Burrowing owl	All formulations require 1/4 mile buffer from the active nest burrow during March 1- August 15.				
Dusky grouse	All formulations: Spot- 328ft buffer from active nest during April 1-July 15. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during April 1-July 15.				
Yellow warbler	All formulations: Spot- 1/8 mile buffer from active nest from April 15- July 31. Mechanized ground and low and high aerial- 1/8 mile buffer year-round				
Belted kingfisher and Mountain plover	All formulations: No treatments in nesting habitat year-round. Spot- 328ft buffer from active nest during April 15-August 15. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during April 15-August 15.				
Hammond's flycatcher	All formulations: Spot- 328ft from active nest during May 15- August 15. Mechanized ground and low and high aerial- 1/8 mile from nest year-round.				
Northern pygmy owl	All formulations: spot- 1/8 mile buffer from nest April 1-August 15. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.				
Flammulated owl	All formulations: spot- 1/8 mile buffer from nest May 1-August 15. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.				
Band-tailed pigeon, American three-toed woodpecker, Tree swallow	All formulations: spot- 328ft buffer from nest May 1-August 1. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.				

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides				
	Fluazifop-p butyl	**Glyphosate (aquatic)**	**Glyphosate (non-aquatic)**	**Imazapic**	**Imazapyr (aquatic)**
Navajo Listed Species					
Pronghorn	All formulations- 1 mile buffer from potential lambing areas from May 1- June 15				
Townsend's big eared bat	All formulations require a 197ft buffer from occupied roost site.				
Chisel-toothed kangaroo rat, Banner-tailed kangaroo rat, Navajo Mountain vole, Arizona (Wupatki) pocket mouse	No restrictions				
Kit fox	All formulations require a 1/8 mile buffer from active den from December 1- August 31.				
Bald and golden eagles	All formulations: 1/4 mile buffer from active nest during the breeding season January 15- July 15. Buffer zone is unnecessary outside of breeding season for spot and mechanized ground treatments. Aerial applications should be made in swaths parallels to a nest and 3/4 mile buffer zone. If aerial flight over a nest site is necessary, an elevation of 500ft should be maintained over the nest.				
Ferruginous hawk	Brief (1hr) spot- 1/2 mile buffer. Mechanized ground- 5/8 mile buffer. Low and high aerial- 3/4 mile.				
American dipper	All formulations- spot- 350ft buffer. Mechanized ground, low or high aerial within 1/8 mile from active nest during March 15- August 15.				
Northern goshawk	All formulations require 1/4 mile buffer from nest site during March 1- August 15. All formulations require 0.21 mile buffer from the nest site year-round.				
Clark's grebe	All formulations: Spot- 328ft buffer from active nest during May 1-July 31. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during May 1- July 31.				
Northern saw-whet owl	All formulations require 1/8 mile buffer from the nest site year-round.				
Burrowing owl	All formulations require 1/4 mile buffer from the active nest burrow during March 1- August 15.				
Dusky grouse	All formulations: Spot- 328ft buffer from active nest during April 1-July 15. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during April 1-July 15.				
Yellow warbler	All formulations: Spot- 1/8 mile buffer from active nest from April 15- July 31. Mechanized ground and low and high aerial- 1/8 mile buffer year-round				
Belted kingfisher and Mountain plover	All formulations: No treatments in nesting habitat year-round. Spot- 328ft buffer from active nest during April 15-August 15. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during April 15-August 15.				
Hammond's flycatcher	All formulations: Spot- 328ft from active nest during May 15- August 15. Mechanized ground and low and high aerial- 1/8 mile from nest year-round.				
Northern pygmy owl	All formulations: spot- 1/8 mile buffer from nest April 1-August 15. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.				
Flammulated owl	All formulations: spot- 1/8 mile buffer from nest May 1-August 15. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.				
Band-tailed pigeon, American three-toed woodpecker, Tree swallow	All formulations: spot- 328ft buffer from nest May 1-August 1. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.				

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides			
	Imazapyr (non-aquatic)	**Isoxaben**	**Metsulfuron methyl**	**Metribuzin**
Navajo Listed Species				
Pronghorn	All formulations- 1 mile buffer from potential lambing areas from May 1- June 15			
Townsend's big eared bat	All formulations require a 197ft buffer from occupied roost site.			
Chisel-toothed kangaroo rat, Banner-tailed kangaroo rat, Navajo Mountain vole, Arizona (Wupatki) pocket mouse	No restrictions			
Kit fox	All formulations require a 1/8 mile buffer from active den from December 1- August 31.			
Bald and golden eagles	All formulations: 1/4 mile buffer from active nest during the breeding season January 15- July 15. Buffer zone is unnecessary outside of breeding season for spot and mechanized ground treatments. Aerial applications should be made in swaths parallels to a nest and 3/4 mile buffer zone. If aerial flight over a nest site is necessary, an elevation of 500ft should be maintained over the nest.			
Ferruginous hawk	Brief (1hr) spot- 1/2 mile buffer. Mechanized ground- 5/8 mile buffer. Low and high aerial- 3/4 mile.			
American dipper	All formulations- spot- 350ft buffer. Mechanized ground, low or high aerial within 1/8 mile from active nest during March 15- August 15.			
Northern goshawk	All formulations require 1/4 mile buffer from nest site during March 1- August 15. All formulations require 0.21 mile buffer from the nest site year-round.			
Clark's grebe	All formulations: Spot- 328ft buffer from active nest during May 1-July 31. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during May 1- July 31.			
Northern saw-whet owl	All formulations require 1/8 mile buffer from the nest site year-round.			
Burrowing owl	All formulations require 1/4 mile buffer from the active nest burrow during March 1- August 15.			
Dusky grouse	All formulations: Spot- 328ft buffer from active nest during April 1-July 15. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during April 1-July 15.			
Yellow warbler	All formulations: Spot- 1/8 mile buffer from active nest from April 15- July 31. Mechanized ground and low and high aerial- 1/8 mile buffer year-round			
Belted kingfisher and Mountain plover	All formulations: No treatments in nesting habitat year-round. Spot- 328ft buffer from active nest during April 15- August 15. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during April 15-August 15.			
Hammond's flycatcher	All formulations: Spot- 328ft from active nest during May 15- August 15. Mechanized ground and low and high aerial- 1/8 mile from nest year-round.			
Northern pygmy owl	All formulations: spot- 1/8 mile buffer from nest April 1-August 15. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.			
Flammulated owl	All formulations: spot- 1/8 mile buffer from nest May 1-August 15. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.			
Band-tailed pigeon, American three-toed woodpecker, Tree swallow	All formulations: spot- 328ft buffer from nest May 1-August 1. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.			

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides			
	Picloram	**Thifensulfuron-methyl**	**Triclopyr (amine salt)**	**Triclopyr (ester)**
Navajo Listed Species				
Pronghorn	All formulations- 1 mile buffer from potential lambing areas from May 1- June 15			
Townsend's big eared bat	All formulations require a 197ft buffer from occupied roost site.			
Chisel-toothed kangaroo rat, Banner-tailed kangaroo rat, Navajo Mountain vole, Arizona (Wupatki) pocket mouse	No restrictions			
Kit fox	All formulations require a 1/8 mile buffer from active den from December 1- August 31.			
Bald and golden eagles	All formulations: 1/4 mile buffer from active nest during the breeding season January 15- July 15. Buffer zone is unnecessary outside of breeding season for spot and mechanized ground treatments. Aerial applications should be made in swaths parallels to a nest and 3/4 mile buffer zone. If aerial flight over a nest site is necessary, an elevation of 500ft should be maintained over the nest.			
Ferruginous hawk	Brief (1hr) spot- 1/2 mile buffer. Mechanized ground- 5/8 mile buffer. Low and high aerial- 3/4 mile.			
American dipper	All formulations- spot- 350ft buffer. Mechanized ground, low or high aerial within 1/8 mile from active nest during March 15- August 15.			
Northern goshawk	All formulations require 1/4 mile buffer from nest site during March 1- August 15. All formulations require 0.21 mile buffer from the nest site year-round.			
Clark's grebe	All formulations: Spot- 328ft buffer from active nest during May 1-July 31. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during May 1- July 31.			
Northern saw-whet owl	All formulations require 1/8 mile buffer from the nest site year-round.			
Burrowing owl	All formulations require 1/4 mile buffer from the active nest burrow during March 1- August 15.			
Dusky grouse	All formulations: Spot- 328ft buffer from active nest during April 1-July 15. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during April 1-July 15.			
Yellow warbler	All formulations: Spot- 1/8 mile buffer from active nest from April 15- July 31. Mechanized ground and low and high aerial- 1/8 mile buffer year-round			
Belted kingfisher and Mountain plover	All formulations: No treatments in nesting habitat year-round. Spot- 328ft buffer from active nest during April 15-August 15. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during April 15-August 15.			
Hammond's flycatcher	All formulations: Spot- 328ft from active nest during May 15- August 15. Mechanized ground and low and high aerial- 1/8 mile from nest year-round.			
Northern pygmy owl	All formulations: spot- 1/8 mile buffer from nest April 1-August 15. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.			
Flammulated owl	All formulations: spot- 1/8 mile buffer from nest May 1-August 15. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.			
Band-tailed pigeon, American three-toed woodpecker, Tree swallow	All formulations: spot- 328ft buffer from nest May 1-August 1. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.			

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides	
	Pendimethalin	**Prodiamine**
Navajo Listed Species		
Pronghorn	All formulations- 1 mile buffer from potential lambing areas from May 1- June 15	
Townsend's big eared bat	All formulations require a 197ft buffer from occupied roost site.	
Chisel-toothed kangaroo rat, Banner-tailed kangaroo rat, Navajo Mountain vole, Arizona (Wupatki) pocket mouse	No restrictions	
Kit fox	All formulations require a 1/8 mile buffer from active den from December 1- August 31.	
Bald and golden eagles	All formulations: 1/4 mile buffer from active nest during the breeding season January 15- July 15. Buffer zone is unnecessary outside of breeding season for spot and mechanized ground treatments. Aerial applications should be made in swaths parallels to a nest and 3/4 mile buffer zone. If aerial flight over a nest site is necessary, an elevation of 500ft should be maintained over the nest.	
Ferruginous hawk	Brief (1hr) spot- 1/2 mile buffer. Mechanized ground- 5/8 mile buffer. Low and high aerial- 3/4 mile.	
American dipper	All formulations- spot- 350ft buffer. Mechanized ground, low or high aerial within 1/8 mile from active nest during March 15- August 15.	
Northern goshawk	All formulations require 1/4 mile buffer from nest site during March 1- August 15. All formulations require 0.21 mile buffer from the nest site year-round.	
Clark's grebe	All formulations: Spot- 328ft buffer from active nest during May 1-July 31. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during May 1- July 31.	
Northern saw-whet owl	All formulations require 1/8 mile buffer from the nest site year-round.	
Burrowing owl	All formulations require 1/4 mile buffer from the active nest burrow during March 1- August 15.	
Dusky grouse	All formulations: Spot- 328ft buffer from active nest during April 1-July 15. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during April 1-July 15.	
Yellow warbler	All formulations: Spot- 1/8 mile buffer from active nest from April 15- July 31. Mechanized ground and low and high aerial- 1/8 mile buffer year-round	
Belted kingfisher and Mountain plover	All formulations: No treatments in nesting habitat year-round. Spot- 328ft buffer from active nest during April 15-August 15. Mechanized ground and low and high aerial- 1/8 mile buffer from active nest during April 15-August 15.	
Hammond's flycatcher	All formulations: Spot- 328ft from active nest during May 15- August 15. Mechanized ground and low and high aerial- 1/8 mile from nest year-round.	
Northern pygmy owl	All formulations: spot- 1/8 mile buffer from nest April 1-August 15. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.	
Flammulated owl	All formulations: spot- 1/8 mile buffer from nest May 1-August 15. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.	
Band-tailed pigeon, American three-toed woodpecker, Tree swallow	All formulations: spot- 328ft buffer from nest May 1-August 1. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.	

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides						
	2,4-D (acid)	**2,4-D (aquatic amine salt)**	**2,4-D (non-aquatic amine salt)**	**2,4-D (aquatic ester)**	**2,4-D (non-aquatic ester)**	**Aminopyralid**	**Atrazine**
Navajo Listed Species							
Sora	All formulations: spot- 328ft buffer from nest May 1- August 1. Mechanized ground, low and high aerial- 1/8 mile from nest site May 1-August 1.						
Gray vireo	All formulations: spot- 328ft buffer from nest May 1-August 31. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.						
Great Basin Silverspot	All formulations required a 60m buffer from occupied habitat						
Rocky mountainsnail and Yavapai mountainsnail	No restrictions						
Northern leopard frog	Applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream. Liquid- Spot- 30ft buffer Mechanized- 350ft Low aerial- 450ft High aerial-1/8 mile					Spot applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream	Applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream. Liquid- Spot- 100ft buffer Mechanized- 400ft Low aerial- 1/8 mile High aerial-1/2 mile
Milk snake and chuckwalla	No restrictions						
Cutler's milk-vetch, Marble Canyon milk-vetch, Cronquist milk-vetch, Naturita milk-vetch, Acoma fleabane, Round dunebroom, Navajo bladderpod, Navajo Penstemon, Alcove rock daisy, Alcove bog-orchid, Alcove death camas, Gooding's onion, Aztec gilia, San Juan milkweed, Heil's milkvetch, Navajo saltbush, Atwood's camissonia, Rydberg's thistle, Utah bladder-fern, Sivinski's fleabane, Sarah's buckwheat, Bluff phacelia, Cave primrose, Marble Canyon dalea, Parish's alkali grass, Arizona rose sage, Brack hardwall cactus, Welsh' American-aster	Spot and mechanized spraying - 200ft from identified species locations. Low and high aerial applications - 1 mile from identified species locations.						

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides				
	Chlorsulfuron methyl	**Clopyralid**	**Dichlobenil**	**Diflufenzopyr**	**Fluroxpyr**
Navajo Listed Species					
Sora	All formulations: spot- 328ft buffer from nest May 1- August 1. Mechanized ground, low and high aerial- 1/8 mile from nest site May 1-August 1.				
Gray vireo	All formulations: spot- 328ft buffer from nest May 1-August 31. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.				
Great Basin Silverspot	All formulations required a 60m buffer from occupied habitat				
Rocky mountainsnail and Yavapai mountainsnail	No restrictions				
Northern leopard frog	Spot applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream		Applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream. Liquid- Spot- 30ft buffer Mechanized- 350ft Low aerial- 450ft High aerial-1/8 mile	Spot applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream	Applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream. Liquid- Spot- 30ft buffer Mechanized- 350ft Low aerial- 450ft High aerial-1/8 mile
Milk snake and chuckwalla	No restrictions				
Cutler's milk-vetch, Marble Canyon milk-vetch, Cronquist milk-vetch, Naturita milk-vetch, Acoma fleabane, Round dunebroom, Navajo bladderpod, Navajo Penstemon, Alcove rock daisy, Alcove bog-orchid, Alcove death camas, Gooding's onion, Aztec gilia, San Juan milkweed, Heil's milkvetch, Navajo saltbush, Atwood's camissonia, Rydberg's thistle, Utah bladder-fern, Sivinski's fleabane, Sarah's buckwheat, Bluff phacelia, Cave primrose, Marble Canyon dalea, Parish's alkali grass, Arizona rose sage, Brack hardwall cactus, Welsh' American-aster	Spot and mechanized spraying - 200ft from identified species locations. Low and high aerial applications- 1 mile from identified species locations.				

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides				
	Fluazifop-p butyl	**Glyphosate (aquatic)**	**Glyphosate (non-aquatic)**	**Imazapic**	**Imazapyr (aquatic)**
Navajo Listed Species					
Sora	All formulations: spot- 328ft buffer from nest May 1- August 1. Mechanized ground, low and high aerial- 1/8 mile from nest site May 1-August 1.				
Gray vireo	All formulations: spot- 328ft buffer from nest May 1-August 31. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.				
Great Basin Silverspot	All formulations required a 60m buffer from occupied habitat				
Rocky mountainsnail and Yavapai mountainsnail	No restrictions				
Northern leopard frog	Applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream. Liquid- Spot- 50ft buffer Mechanized- 350ft Low aerial- 1/8 mile High aerial-1/4 mile	Spot applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream	Applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream. Liquid- Spot- 30ft buffer Mechanized- 350ft Low aerial- 450ft High aerial-1/8 mile	Spot applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream	
Milk snake and chuckwalla	No restrictions				
Cutler's milk-vetch, Marble Canyon milk-vetch, Cronquist milk-vetch, Naturita milk-vetch, Acoma fleabane, Round dunebroom, Navajo bladderpod, Navajo Penstemon, Alcove rock daisy, Alcove bog-orchid, Alcove death camas, Gooding's onion, Aztec gilia, San Juan milkweed, Heil's milkvetch, Navajo saltbush, Atwood's camissonia, Rydberg's thistle, Utah bladder-fern, Sivinski's fleabane, Sarah's buckwheat, Bluff phacelia, Cave primrose, Marble Canyon dalea, Parish's alkali grass, Arizona rose sage, Brack hardwall cactus, Welsh' American-aster	Spot and mechanized spraying - 200ft from identified species locations. Low and high aerial applications- 1 mile from identified species locations.				

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides			
	Imazapyr (non-aquatic)	**Isoxaben**	**Metsulfuron methyl**	**Metribuzin**
Navajo Listed Species				
Sora	All formulations: spot- 328ft buffer from nest May 1- August 1. Mechanized ground, low and high aerial- 1/8 mile from nest site May 1-August 1.			
Gray vireo	All formulations: spot- 328ft buffer from nest May 1-August 31. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.			
Great Basin Silverspot	All formulations required a 60m buffer from occupied habitat			
Rocky mountainsnail and Yavapai mountainsnail	No restrictions			
Northern leopard frog	Applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream. Liquid- Spot- 30ft buffer Mechanized- 350ft Low aerial- 450ft High aerial-1/8 mile			
Milk snake and chuckwalla	No restrictions			
Cutler's milk-vetch, Marble Canyon milk-vetch, Cronquist milk-vetch, Naturita milk-vetch, Acoma fleabane, Round dunebroom, Navajo bladderpod, Navajo Penstemon, Alcove rock daisy, Alcove bog-orchid, Alcove death camas, Gooding's onion, Aztec gilia, San Juan milkweed, Heil's milkvetch, Navajo saltbush, Atwood's camissonia, Rydberg's thistle, Utah bladder-fern, Sivinski's fleabane, Sarah's buckwheat, Bluff phacelia, Cave primrose, Marble Canyon dalea, Parish's alkali grass, Arizona rose sage, Brack hardwall cactus, Welsh' American-aster	Spot and mechanized spraying - 200ft from identified species locations. Low and high aerial applications- 1 mile from identified species locations.			

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

Species	Herbicides			
	Picloram	**Thifensulfuron-methyl**	**Triclopyr (amine salt)**	**Triclopyr (ester)**
Navajo Listed Species				
Sora	All formulations: spot- 328ft buffer from nest May 1- August 1. Mechanized ground, low and high aerial- 1/8 mile from nest site May 1-August 1.			
Gray vireo	All formulations: spot- 328ft buffer from nest May 1-August 31. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.			
Great Basin Silverspot	All formulations required a 60m buffer from occupied habitat			
Rocky mountainsnail and Yavapai mountainsnail	No restrictions			
Northern leopard frog	Applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream. Liquid- Spot- 30ft buffer Mechanized- 350ft Low aerial- 450ft High aerial-1/8 mile	Spot applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream		Applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream. Liquid- Spot- 50ft buffer Mechanized- 350ft Low aerial- 1/8 mile High aerial-1/4 mile
Milk snake and chuckwalla	No restrictions			
Cutler's milk-vetch, Marble Canyon milk-vetch, Cronquist milk-vetch, Naturita milk-vetch, Acoma fleabane, Round dunebroom, Navajo bladderpod, Navajo Penstemon, Alcove rock daisy, Alcove bog-orchid, Alcove death camas, Gooding's onion, Aztec gilia, San Juan milkweed, Heil's milkvetch, Navajo saltbush, Atwood's camissonia, Rydberg's thistle, Utah bladder-fern, Sivinski's fleabane, Sarah's buckwheat, Bluff phacelia, Cave primrose, Marble Canyon dalea, Parish's alkali grass, Arizona rose sage, Brack hardwall cactus, Welsh' American-aster	Spot and mechanized spraying - 200ft from identified species locations. Low and high aerial applications- 1 mile from identified species locations.			

Figure 1. Required protection measures for herbicide application in Federally and Navajo Nation listed species habitats.

	Herbicides	
Species	**Pendimethalin**	**Prodiamine**
Navajo Listed Species		
Sora	All formulations: spot- 328ft buffer from nest May 1- August 1. Mechanized ground, low and high aerial- 1/8 mile from nest site May 1-August 1.	
Gray vireo	All formulations: spot- 328ft buffer from nest May 1-August 31. Mechanized ground, low and high aerial- 1/8 mile from nest site year-round.	
Great Basin Silverspot	All formulations required a 60m buffer from occupied habitat	
Rocky mountainsnail and Yavapai mountainsnail	No restrictions	
Northern leopard frog	Applications on land below or above high water line of species habitat, one-half mile upstream (including tributaries) and 300ft downstream. Liquid- Spot- 50ft buffer Mechanized- 350ft Low aerial- 1/8 mile High aerial-1/4 mile	
Milk snake and chuckwalla	No restrictions	
Cutler's milk-vetch, Marble Canyon milk-vetch, Cronquist milk-vetch, Naturita milk-vetch, Acoma fleabane, Round dunebroom, Navajo bladderpod, Navajo Penstemon, Alcove rock daisy, Alcove bog-orchid, Alcove death camas, Gooding's onion, Aztec gilia, San Juan milkweed, Heil's milkvetch, Navajo saltbush, Atwood's camissonia, Rydberg's thistle, Utah bladder-fern, Sivinski's fleabane, Sarah's buckwheat, Bluff phacelia, Cave primrose, Marble Canyon dalea, Parish's alkali grass, Arizona rose sage, Brack hardwall cactus, Welsh' American-aster	Spot and mechanized spraying - 200ft from identified species locations. Low and high aerial applications- 1 mile from identified species locations.	

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Appendix C. Potential Habitat for Federally Listed Species

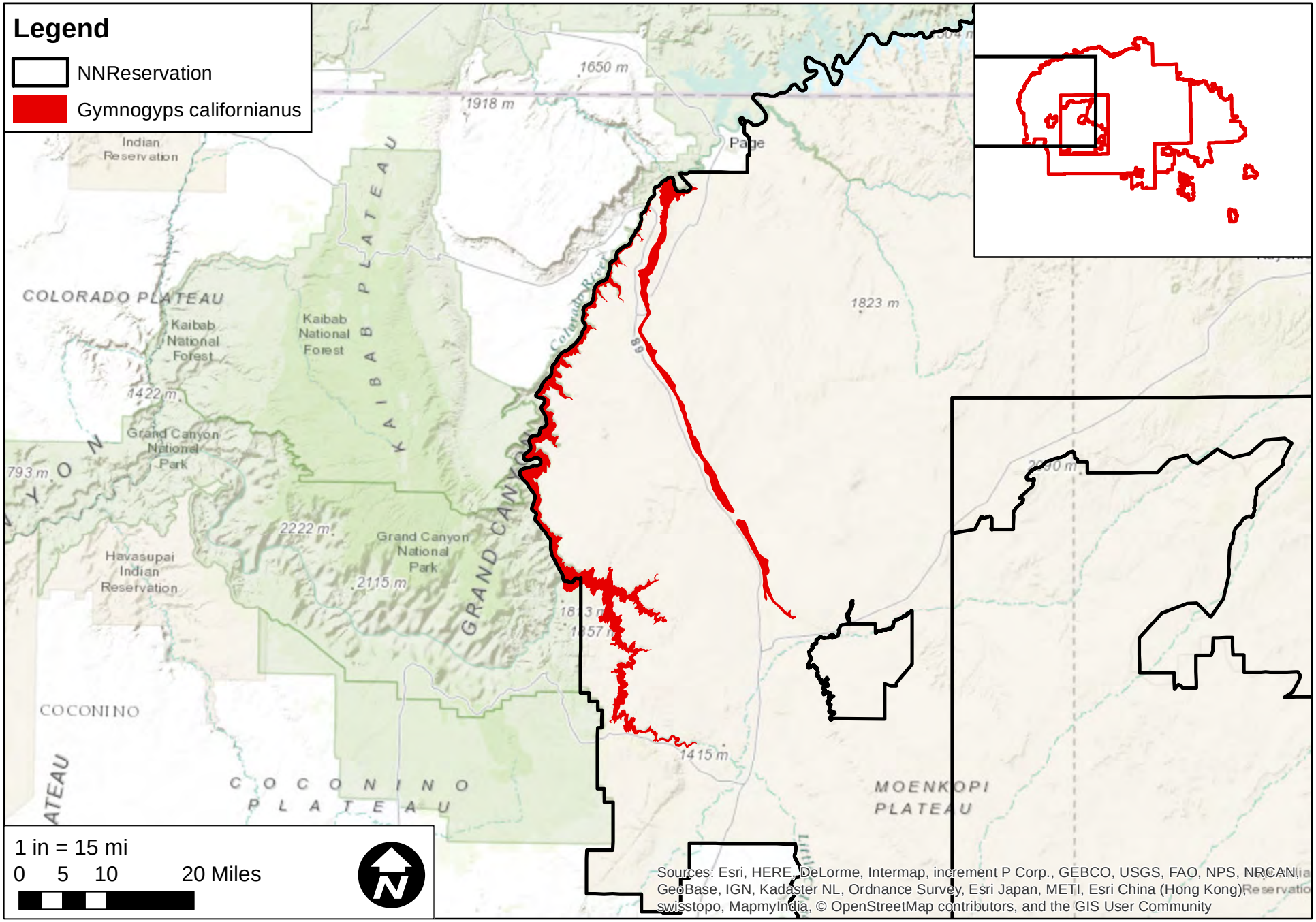

Figure C-1. Potential habitat - California condor

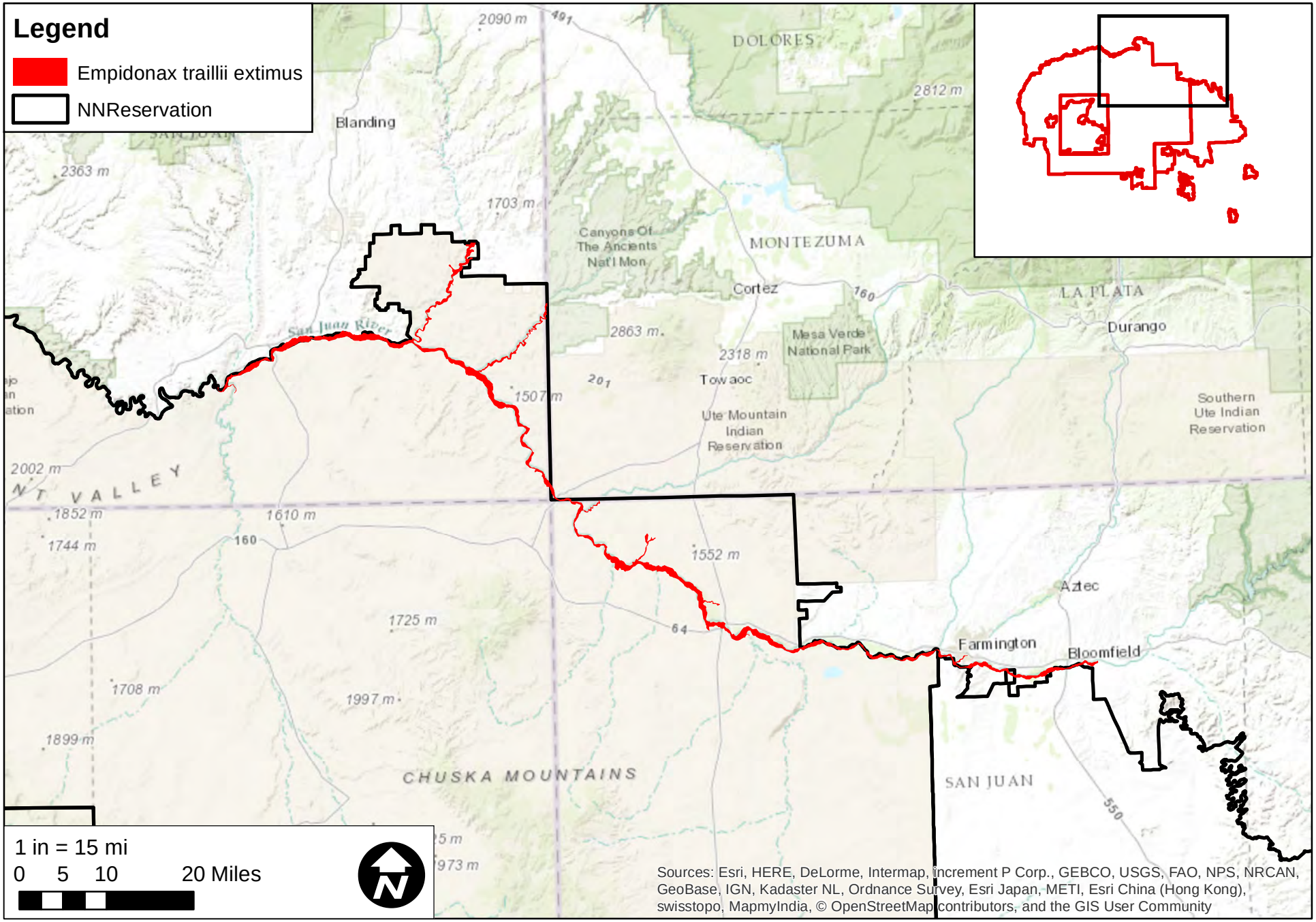

Figure C-2. Potential habitat - Southwestern willow flycatcher

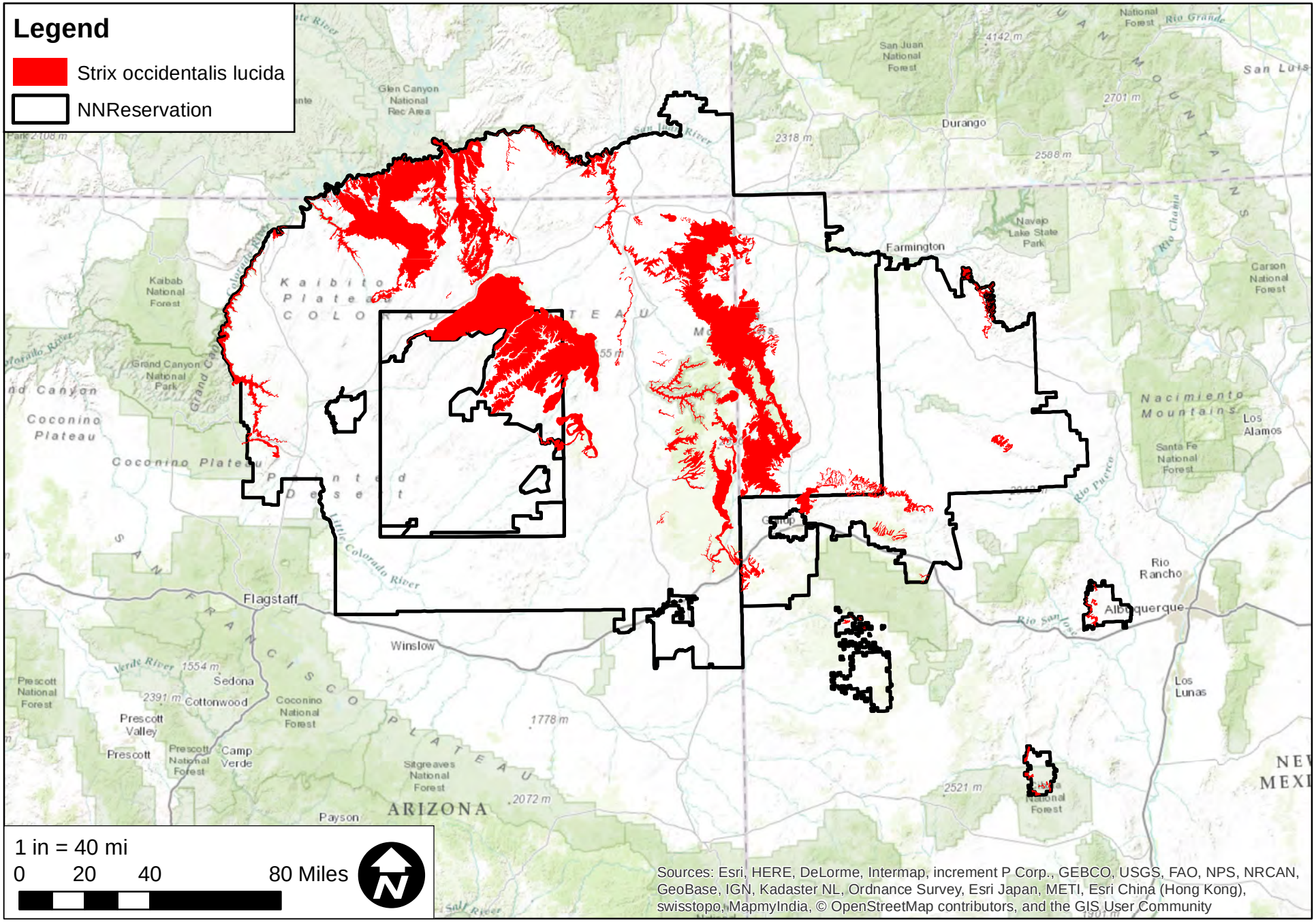

Figure C-3. Potential habitat - Mexican spotted owl

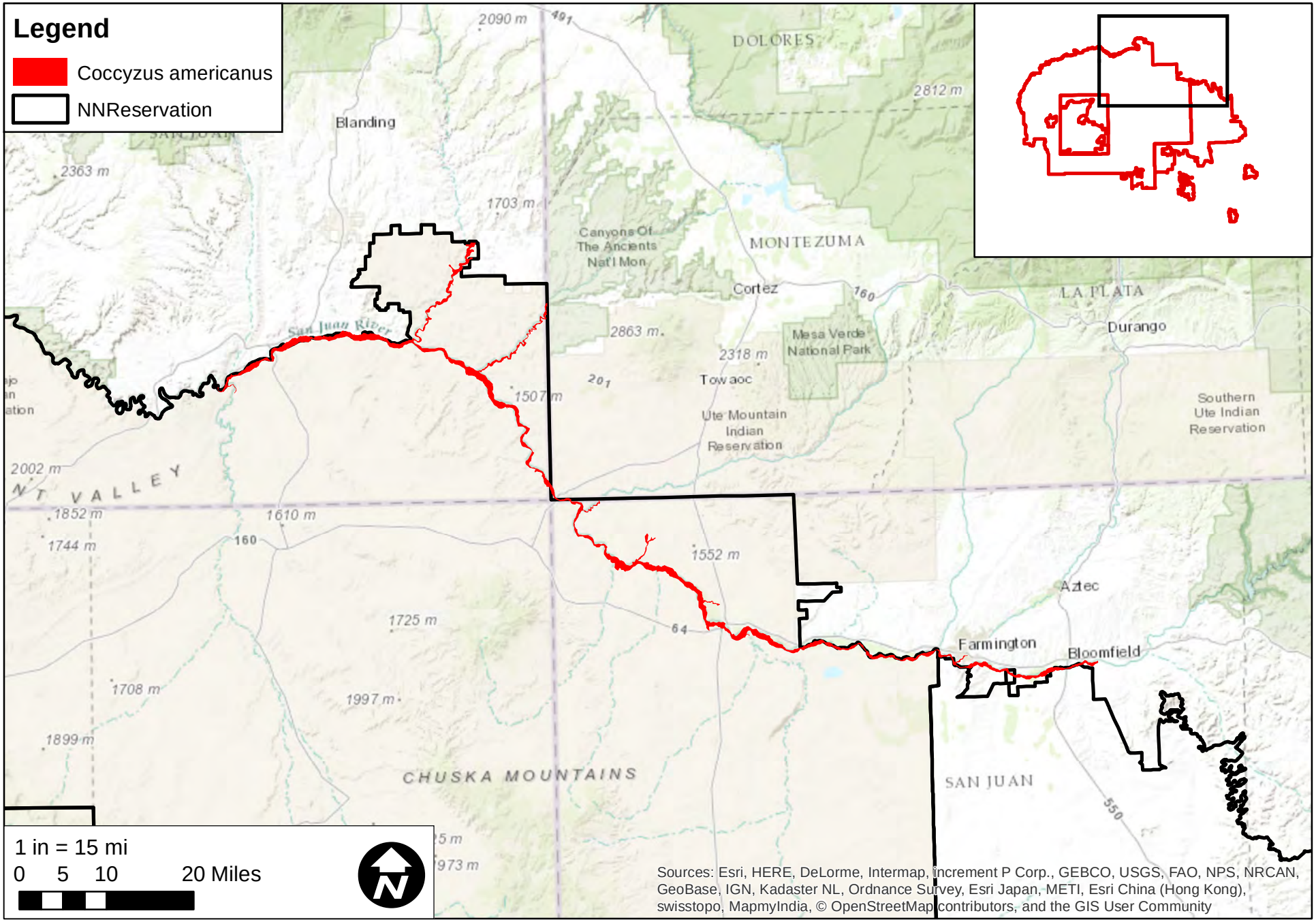

Figure C-4. Potential habitat - Western yellow-billed cuckoo

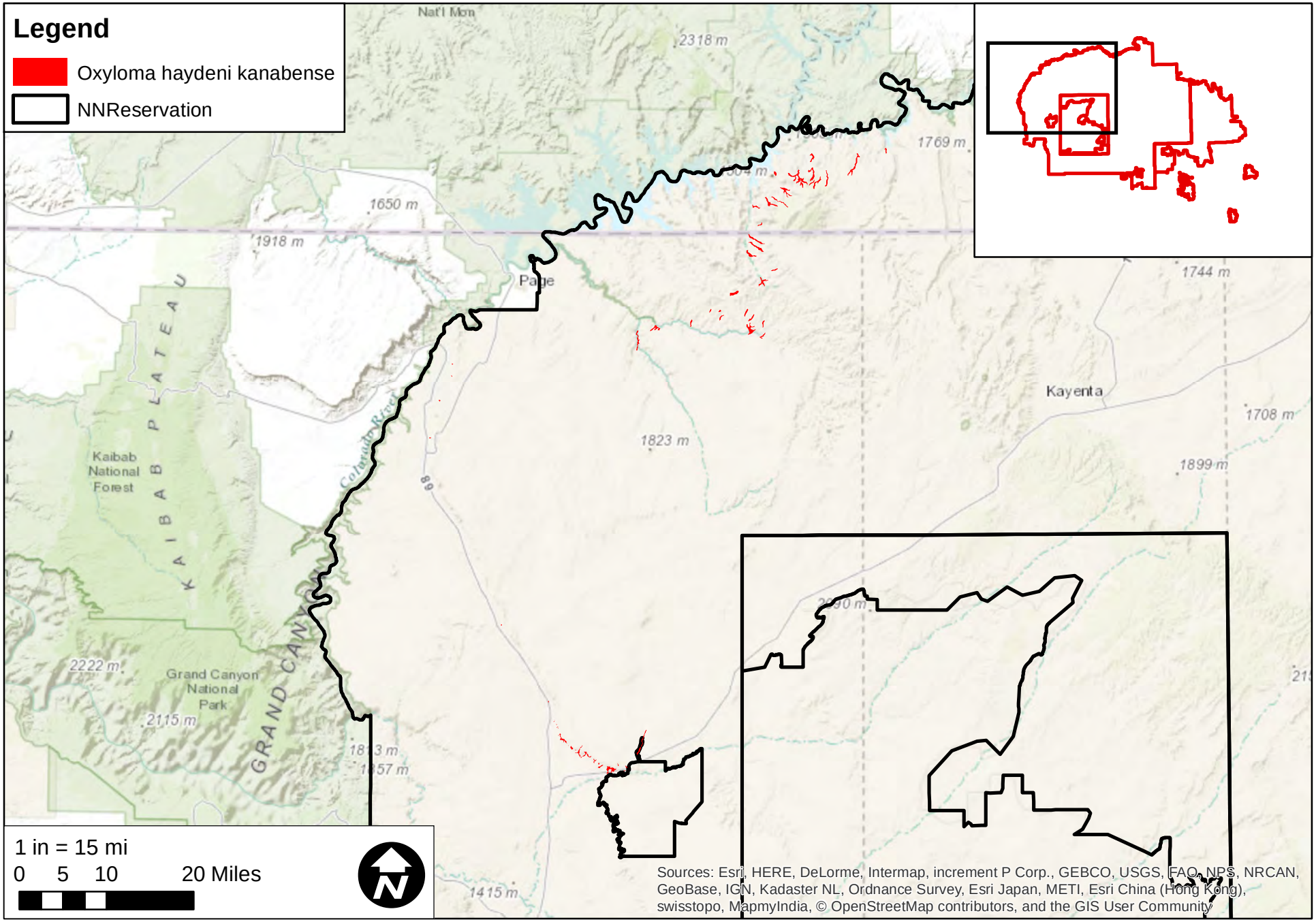

Figure C-5. Potential habitat - Kanab ambersnail

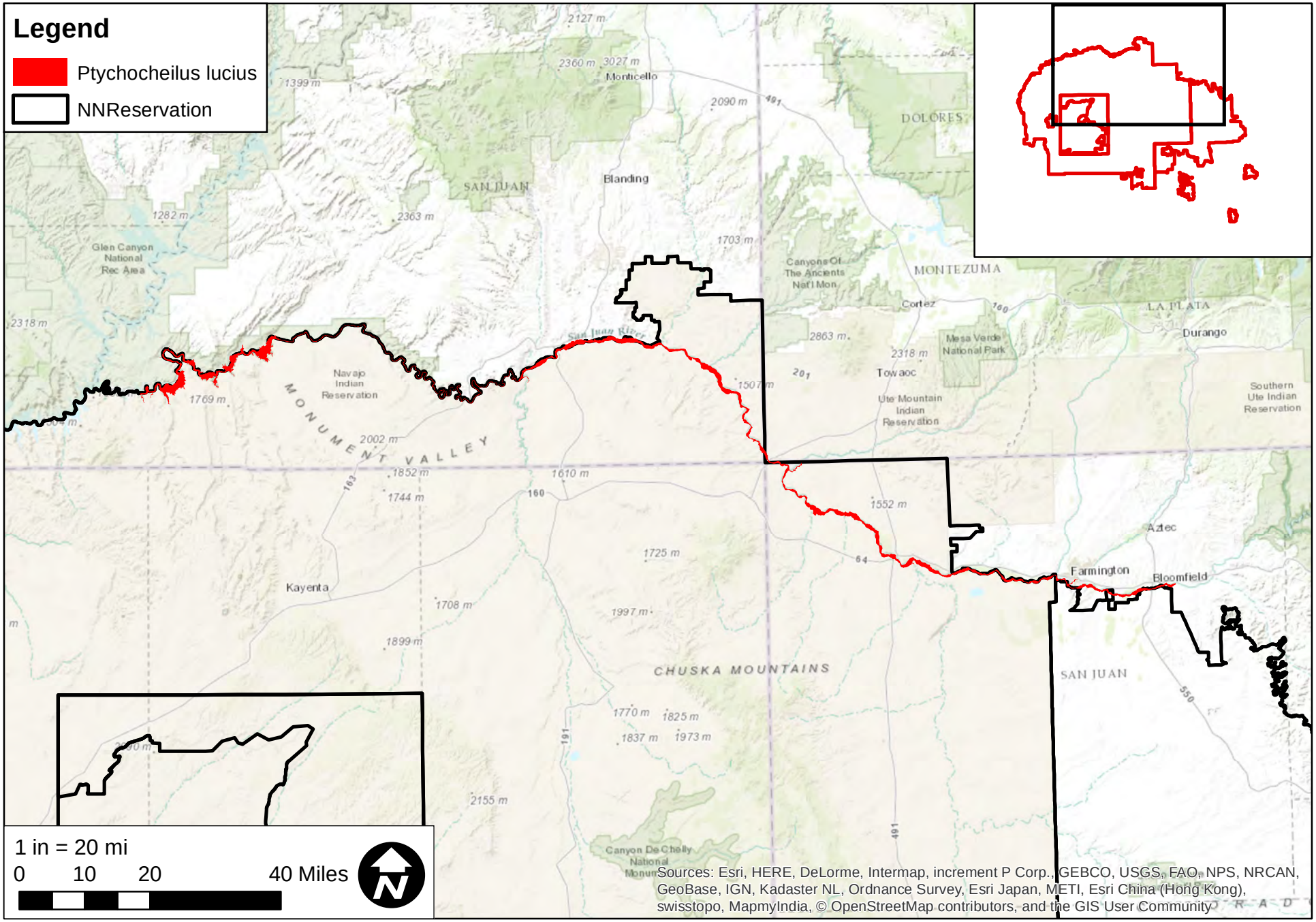

Figure C-6. Potential habitat - Colorado pikeminnow

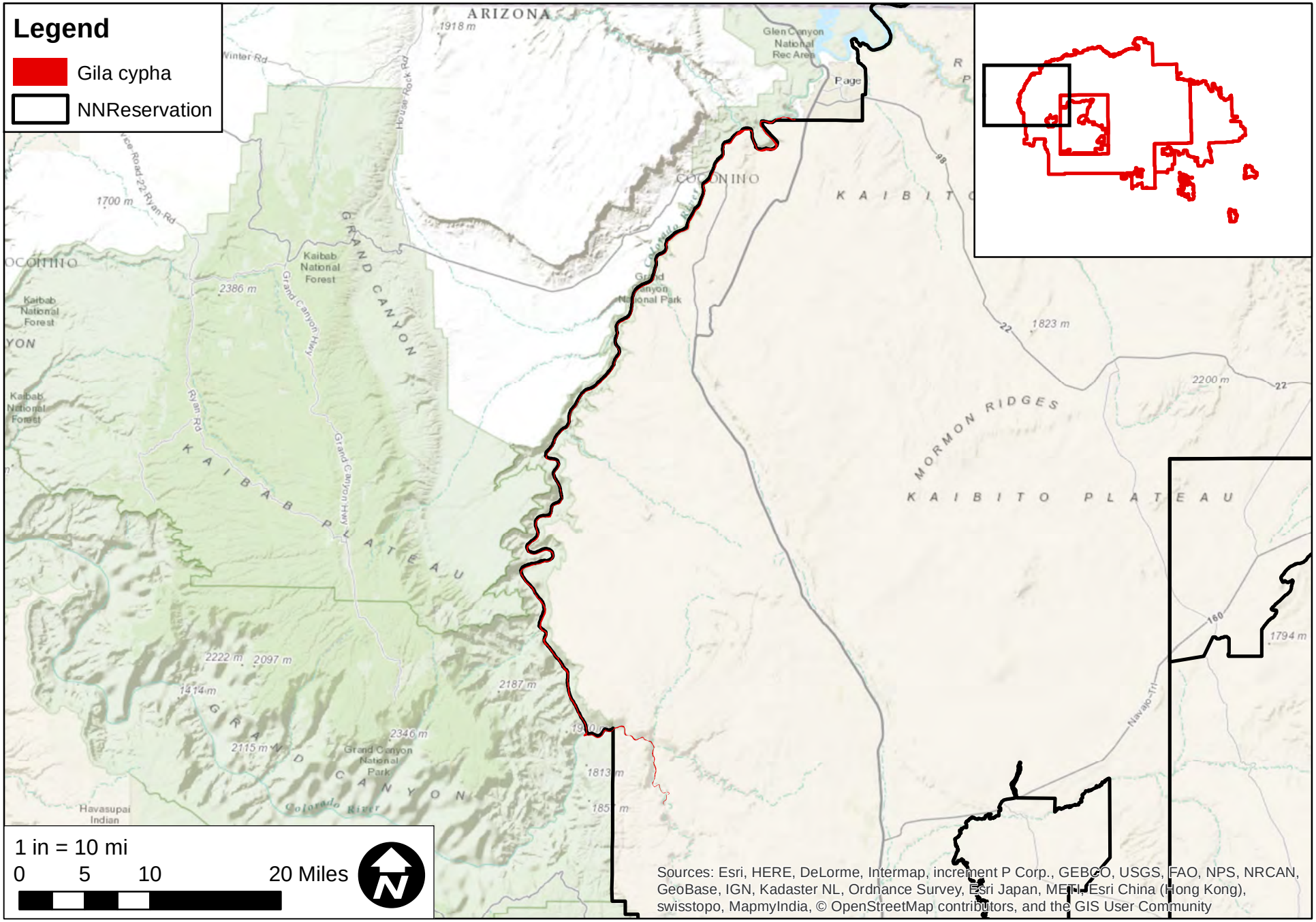

Figure C-7. Potential habitat - Humpback chub

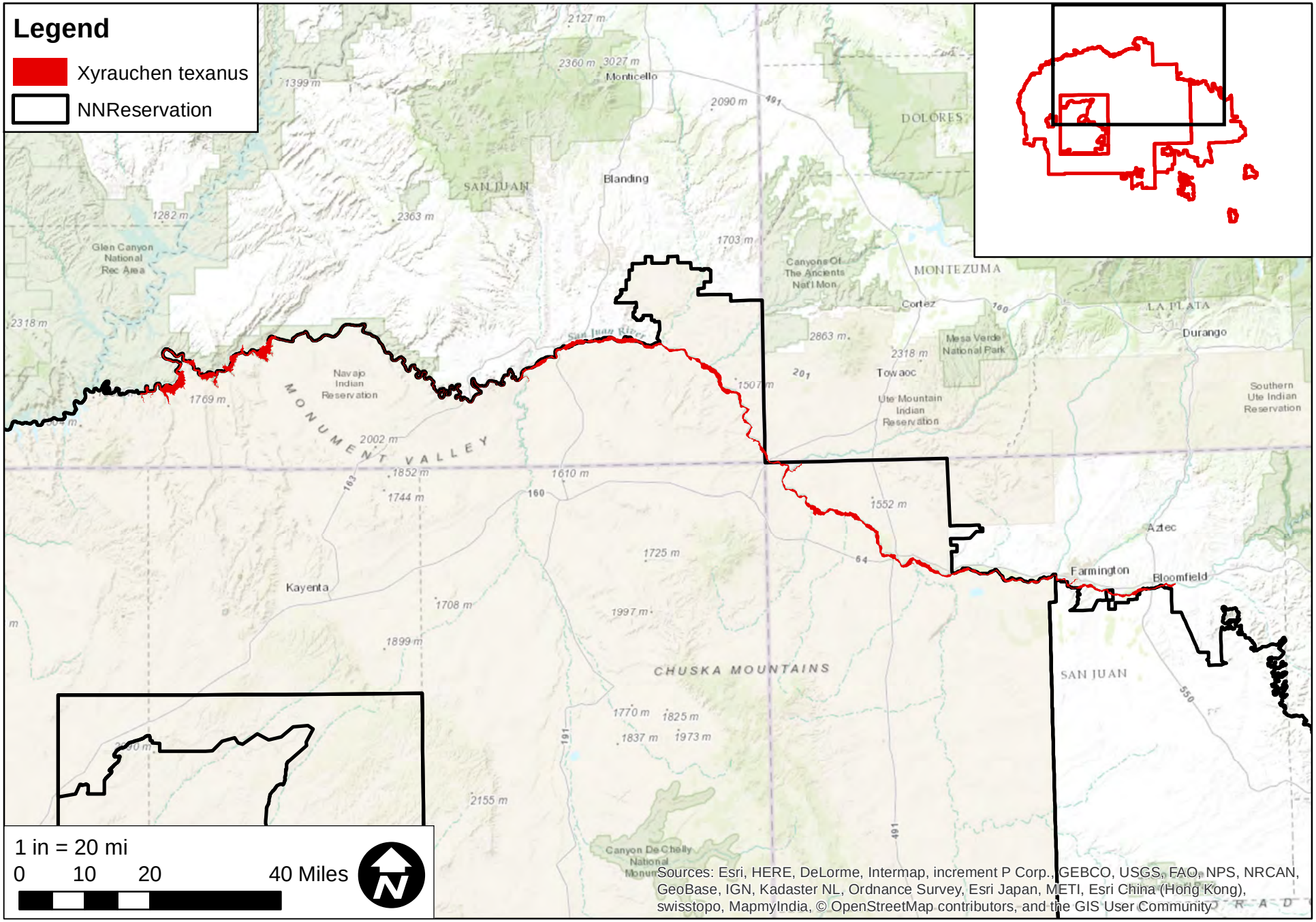

Figure C-8. Potential habitat - Razorback sucker

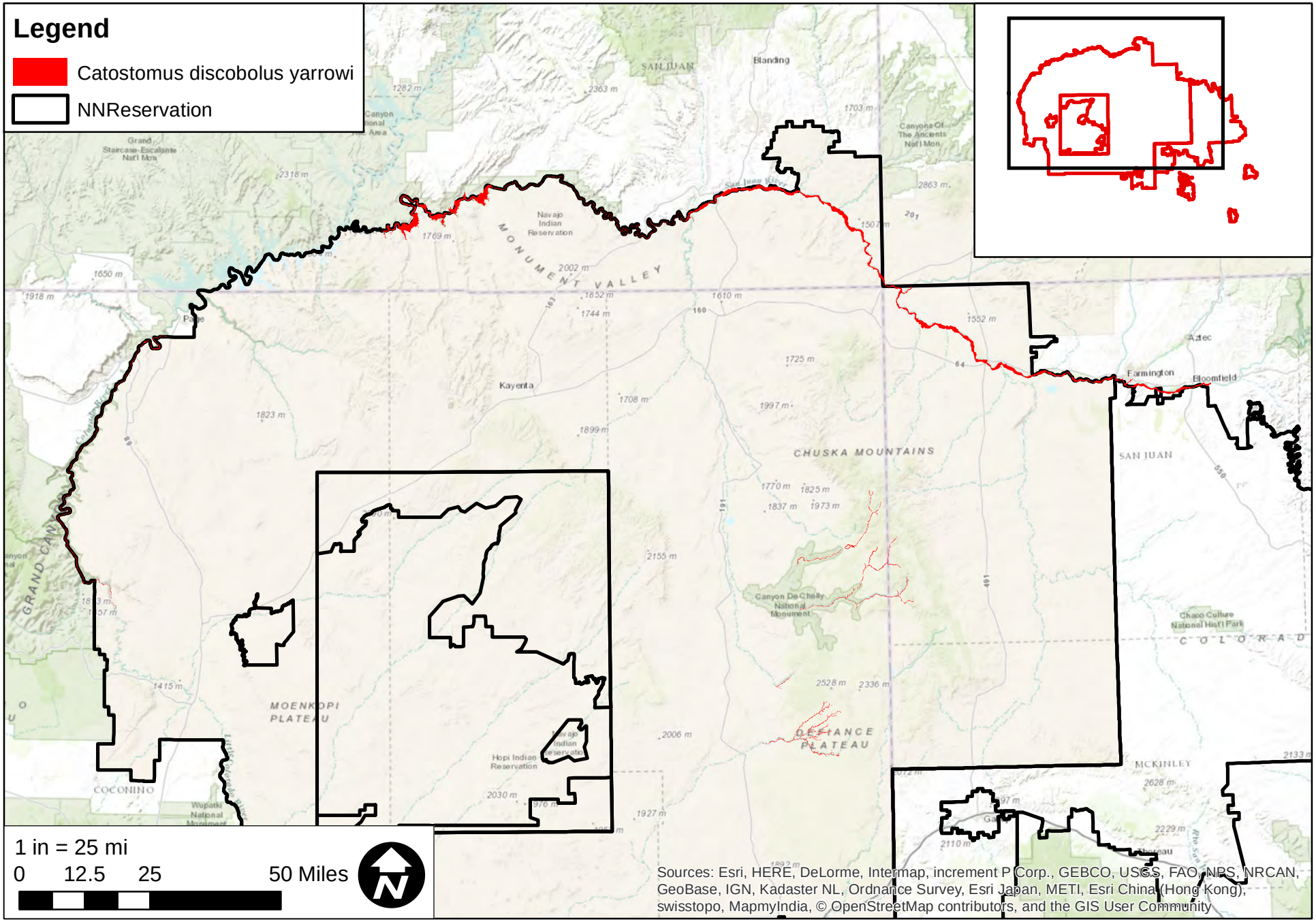

Figure C-9. Potential habitat - Zuni bluehead sucker

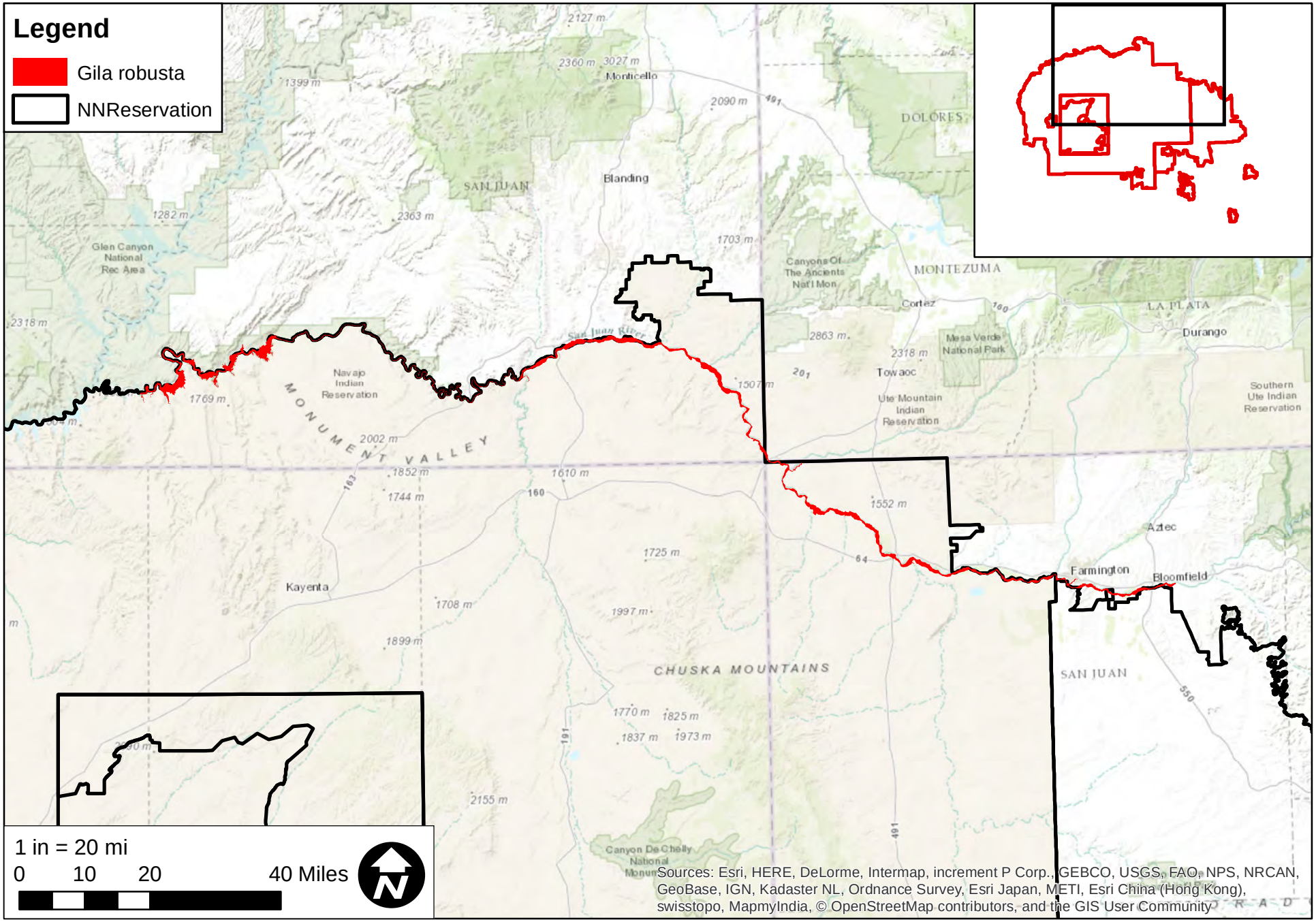

Figure C-10. Potential habitat - Roundtail chub

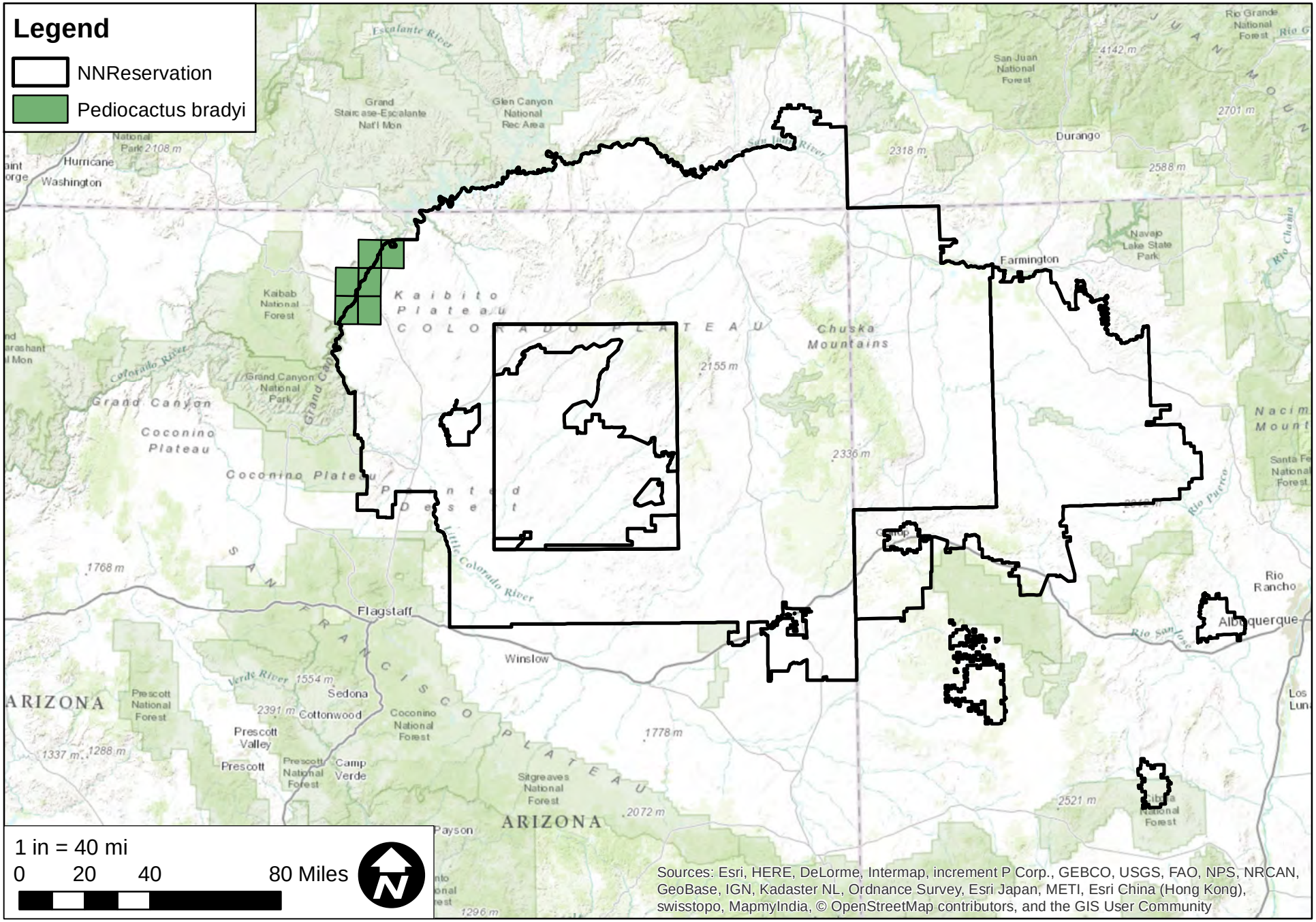

Figure C-11. Potential habitat - Brady pincushion cactus

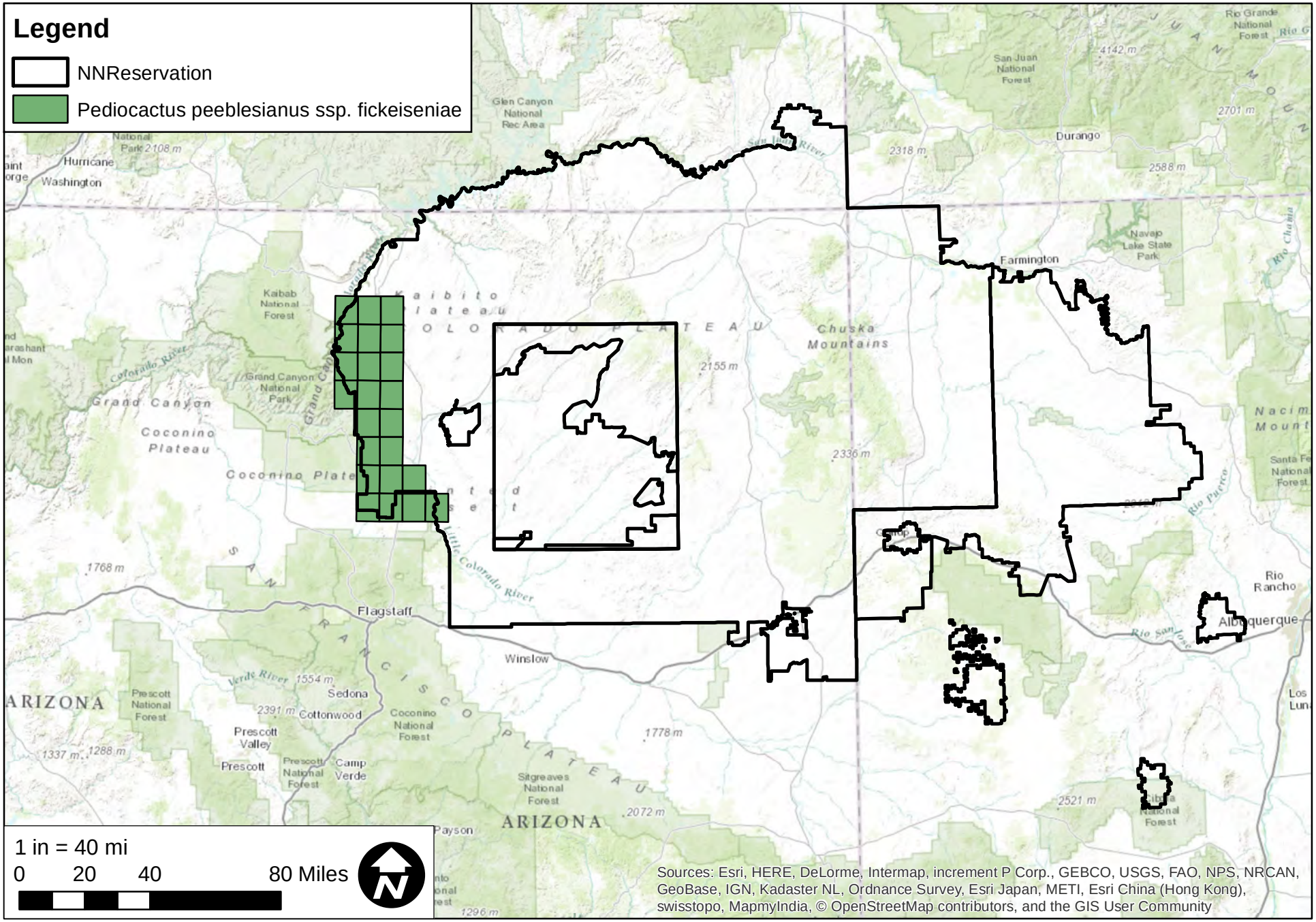

Figure C-12. Potential habitat - Fickeisen Plains cactus

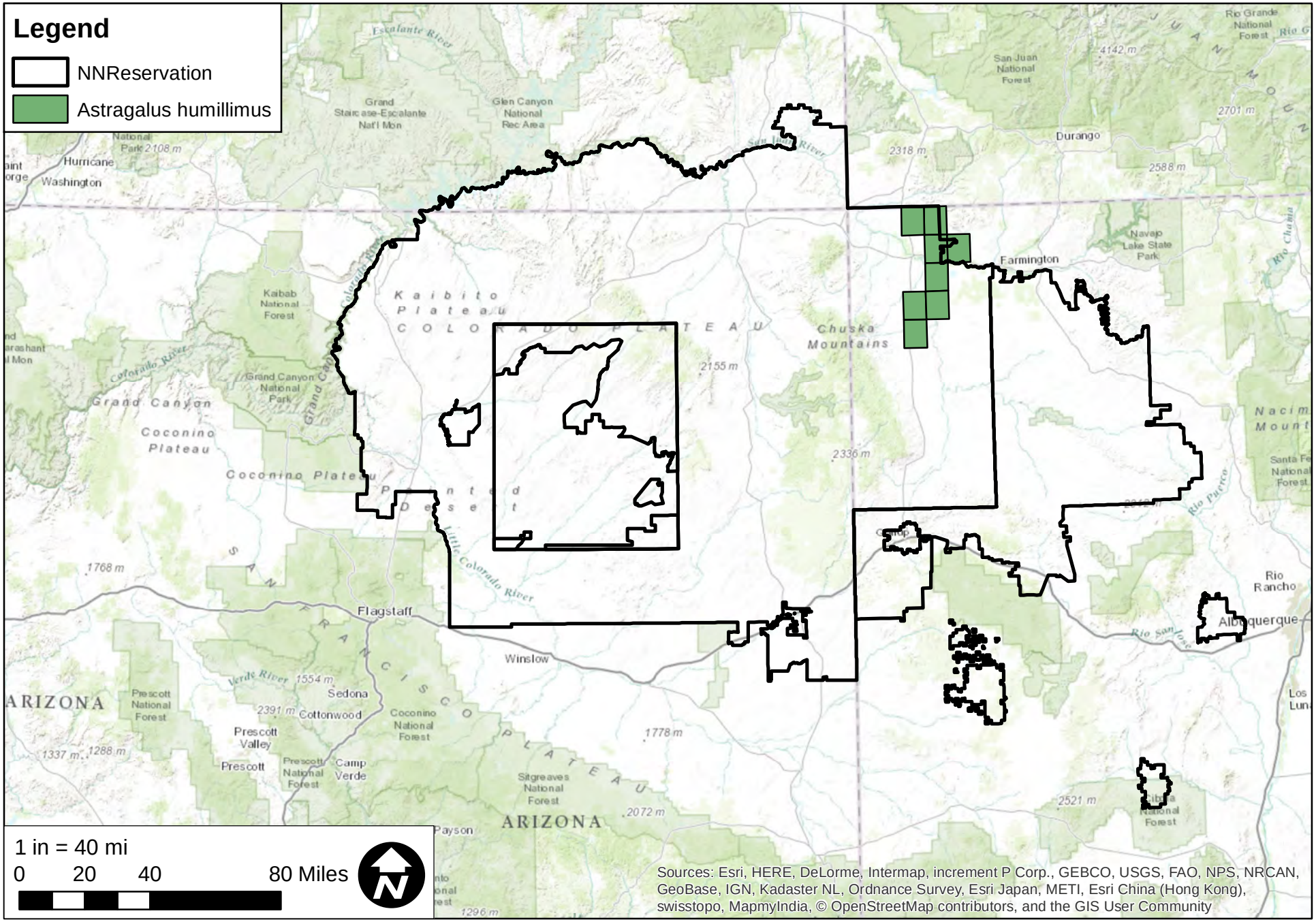

Figure C-13. Potential habitat - Mancos milkvetch

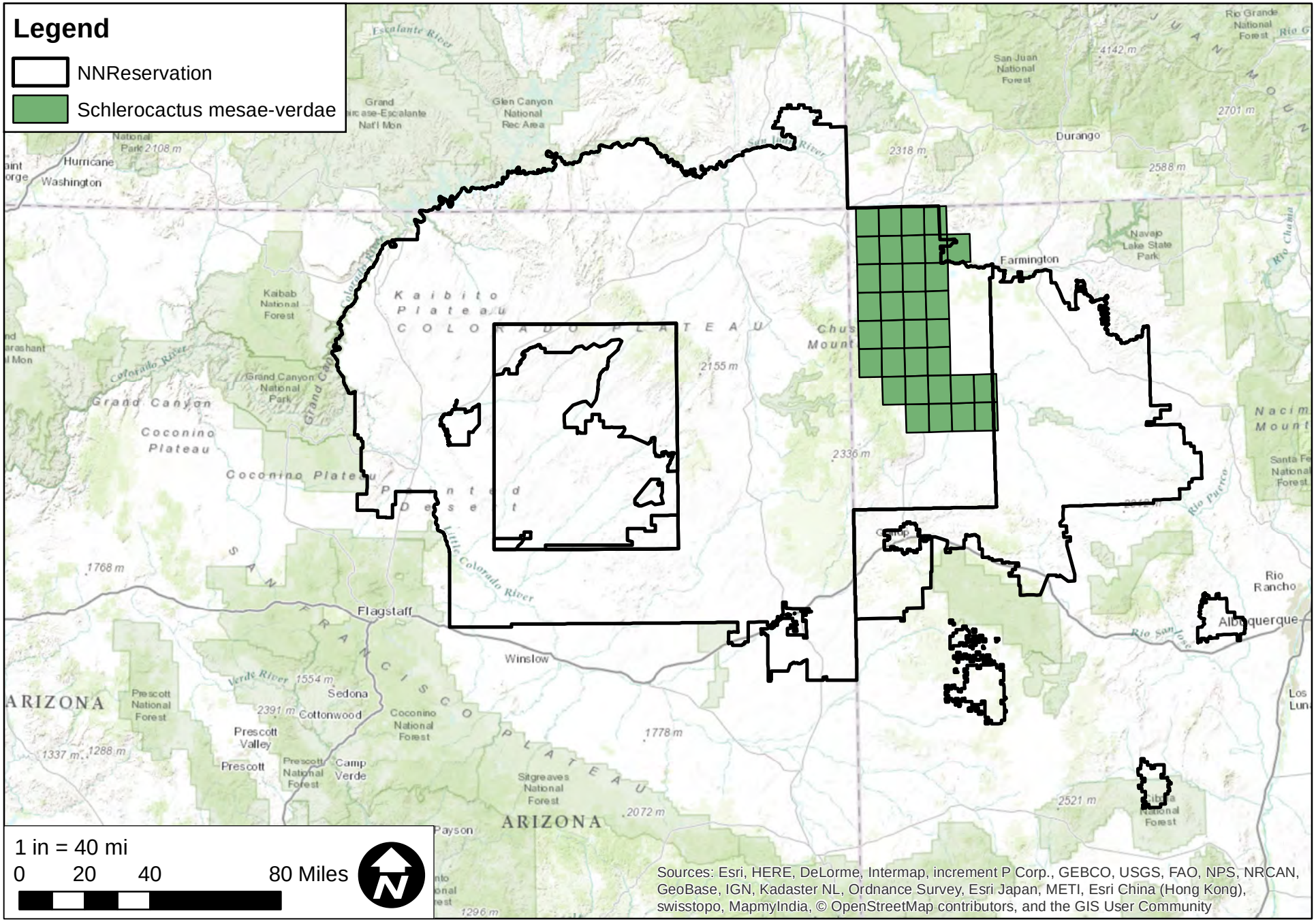

Figure C-14. Potential habitat - Mesa Verde Cactus

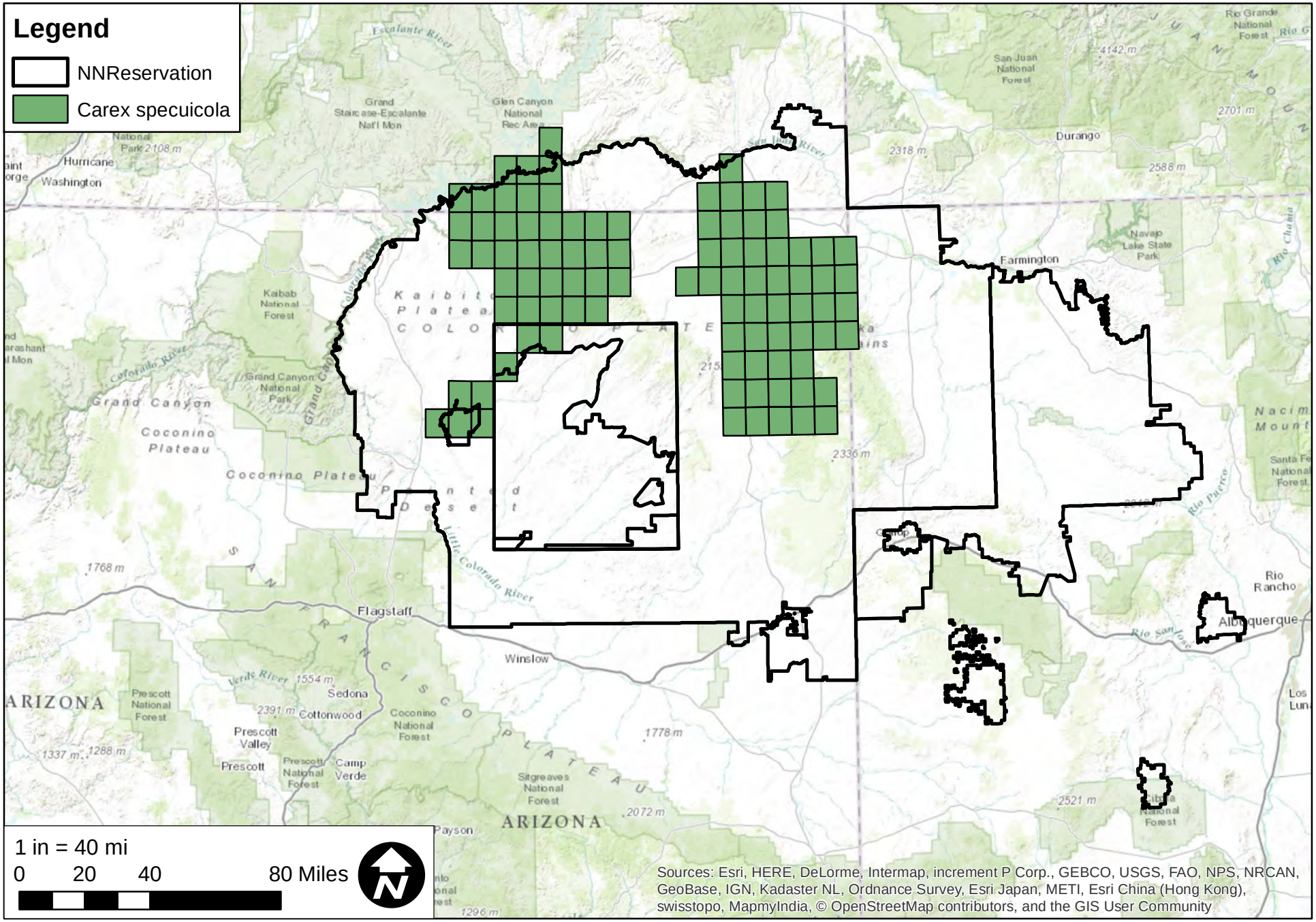

Figure C-15. Potential habitat - Navajo sedge

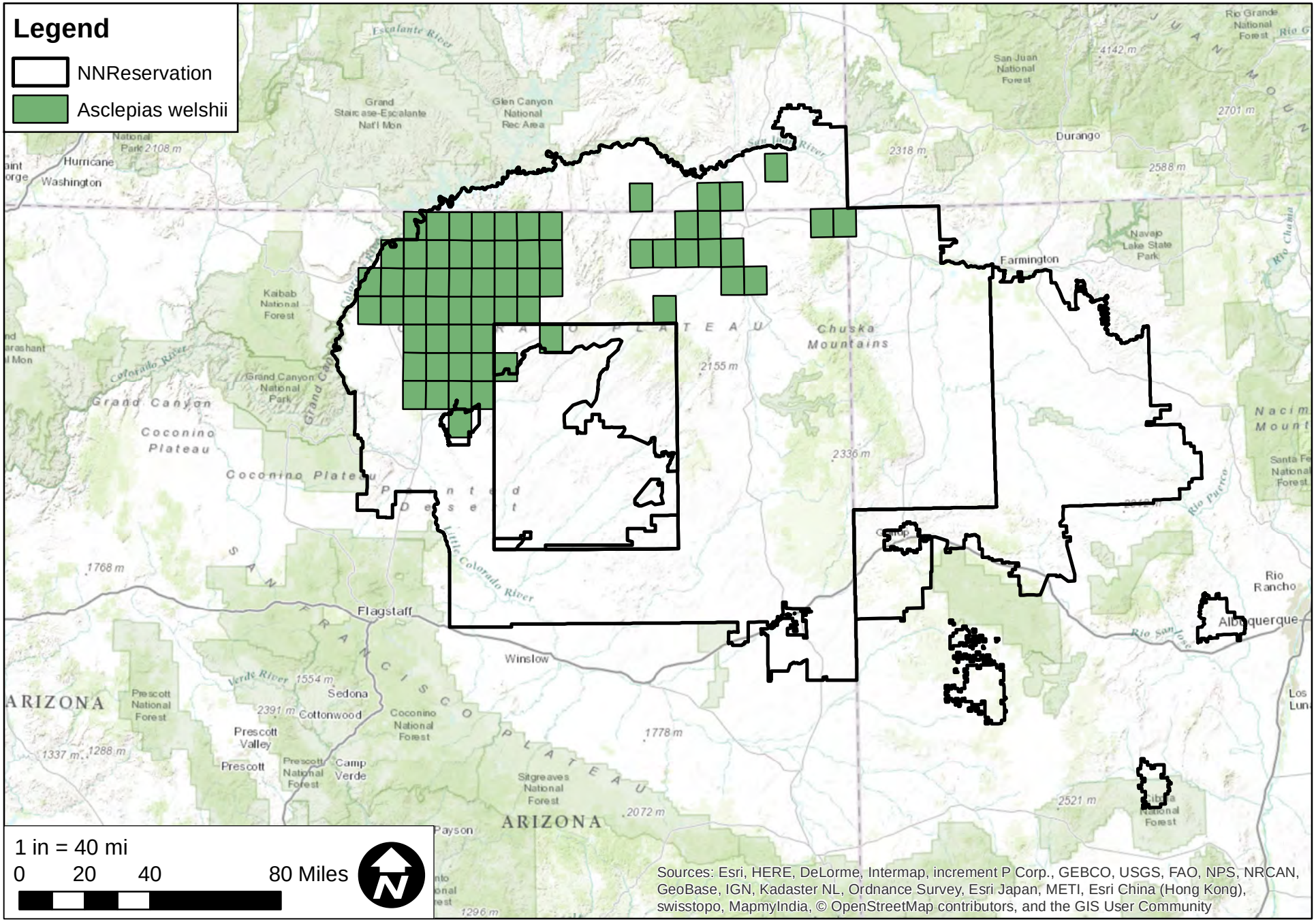

Figure C-16. Potential habitat - Welsh's milkweed

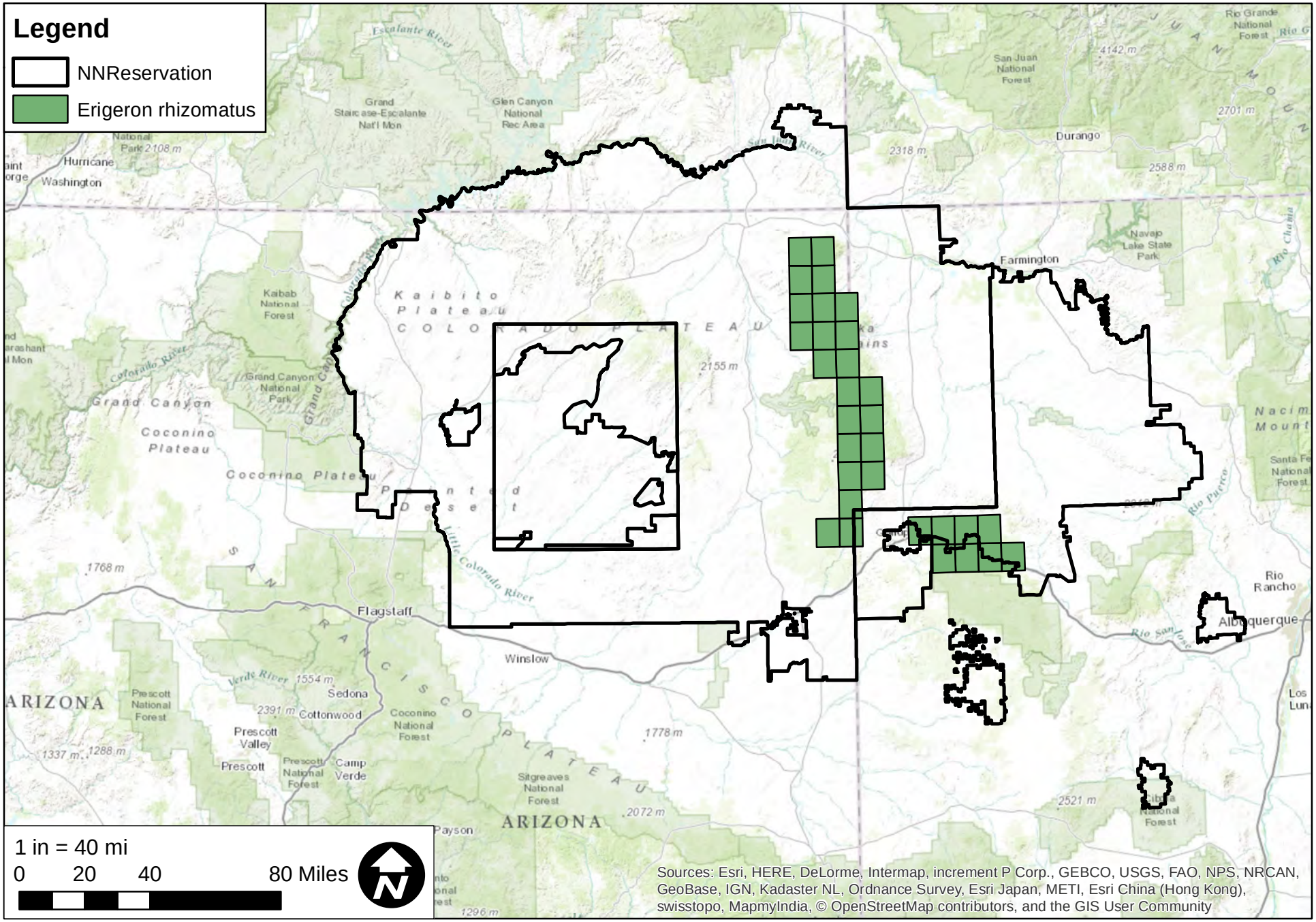

Figure C-17. Potential habitat - Zuni/Rhizome fleabane

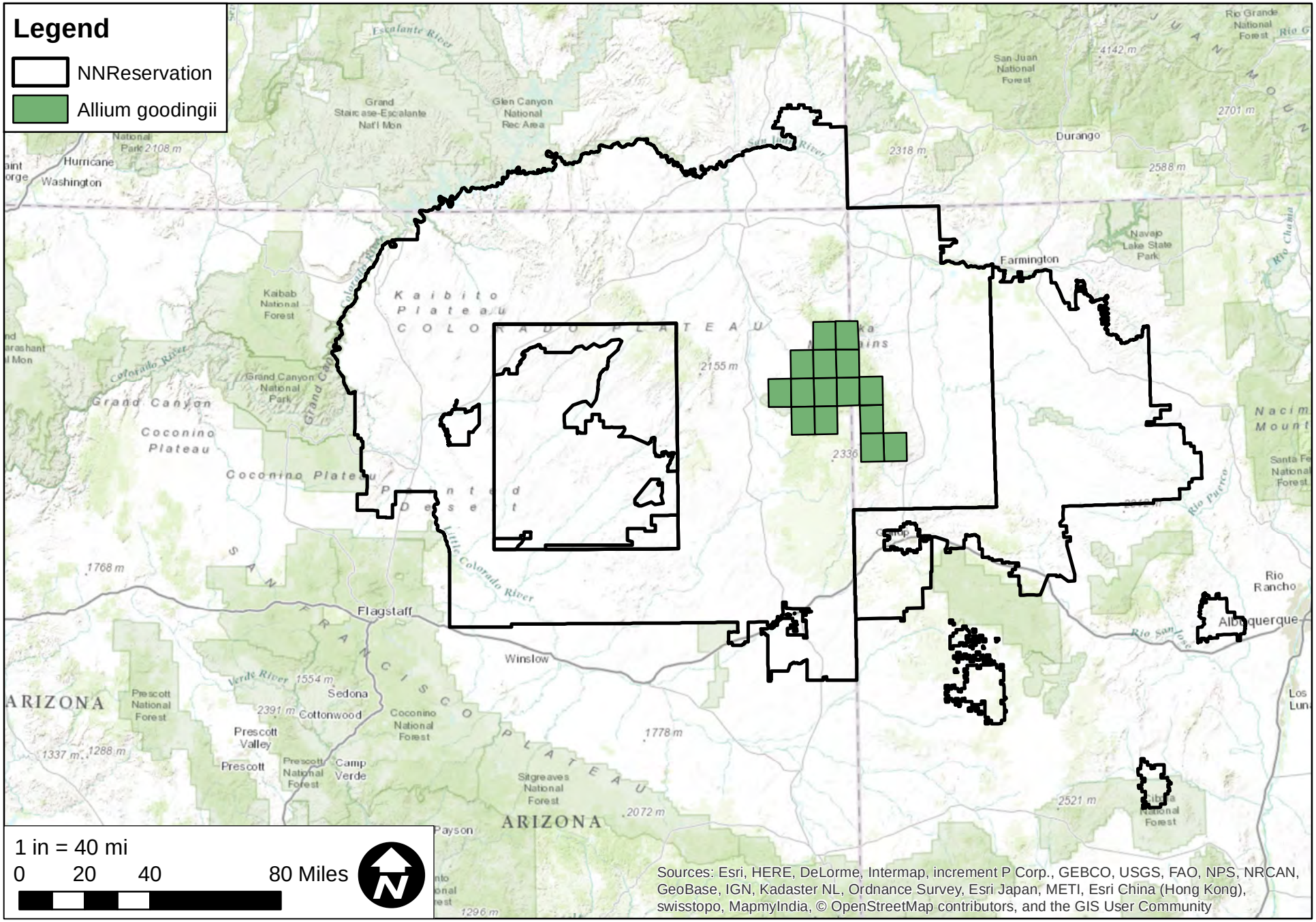

Figure C-18. Potential habitat - Gooding's onion

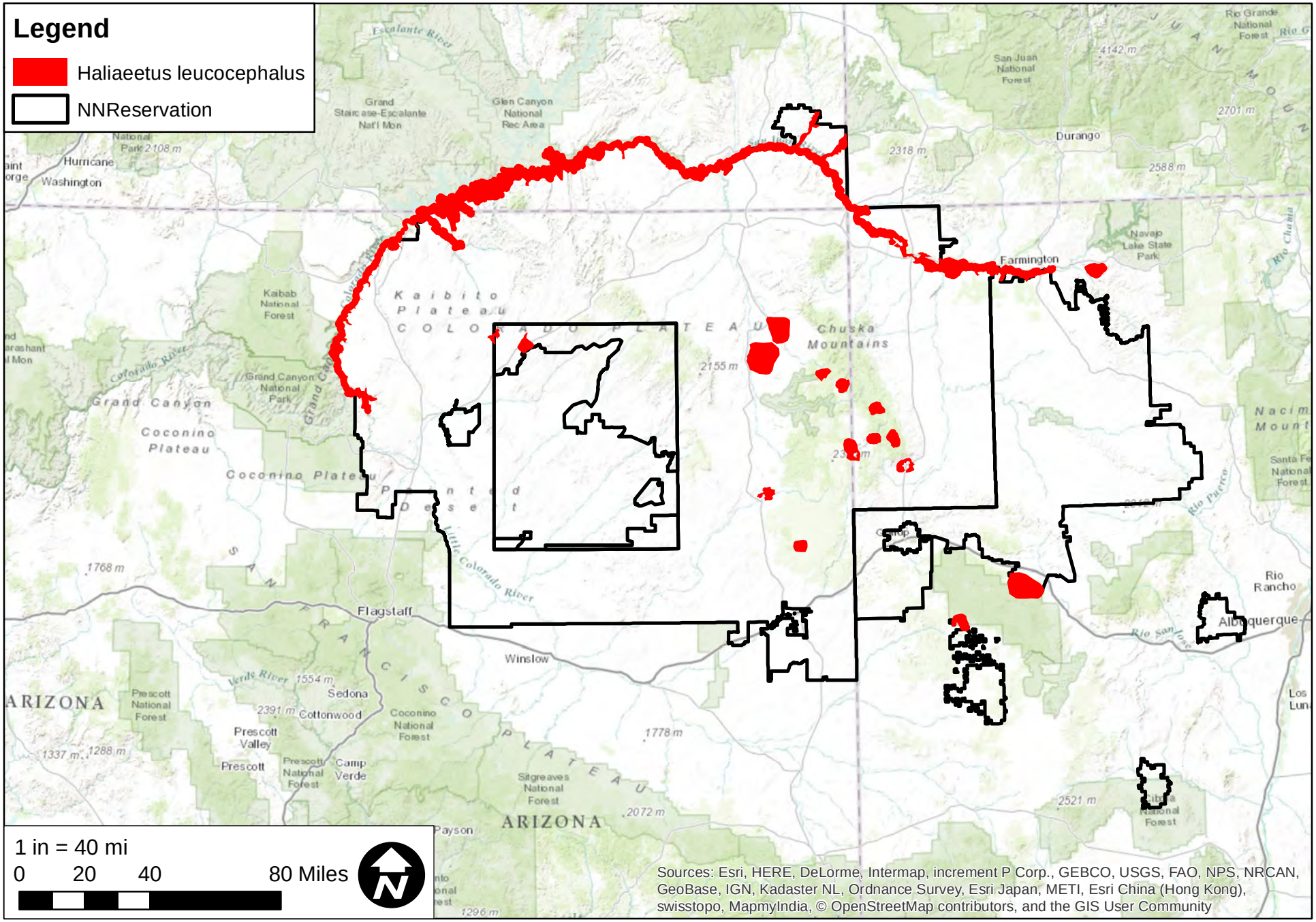

Figure C-19. Potential habitat - Bald eagle (MBTA)

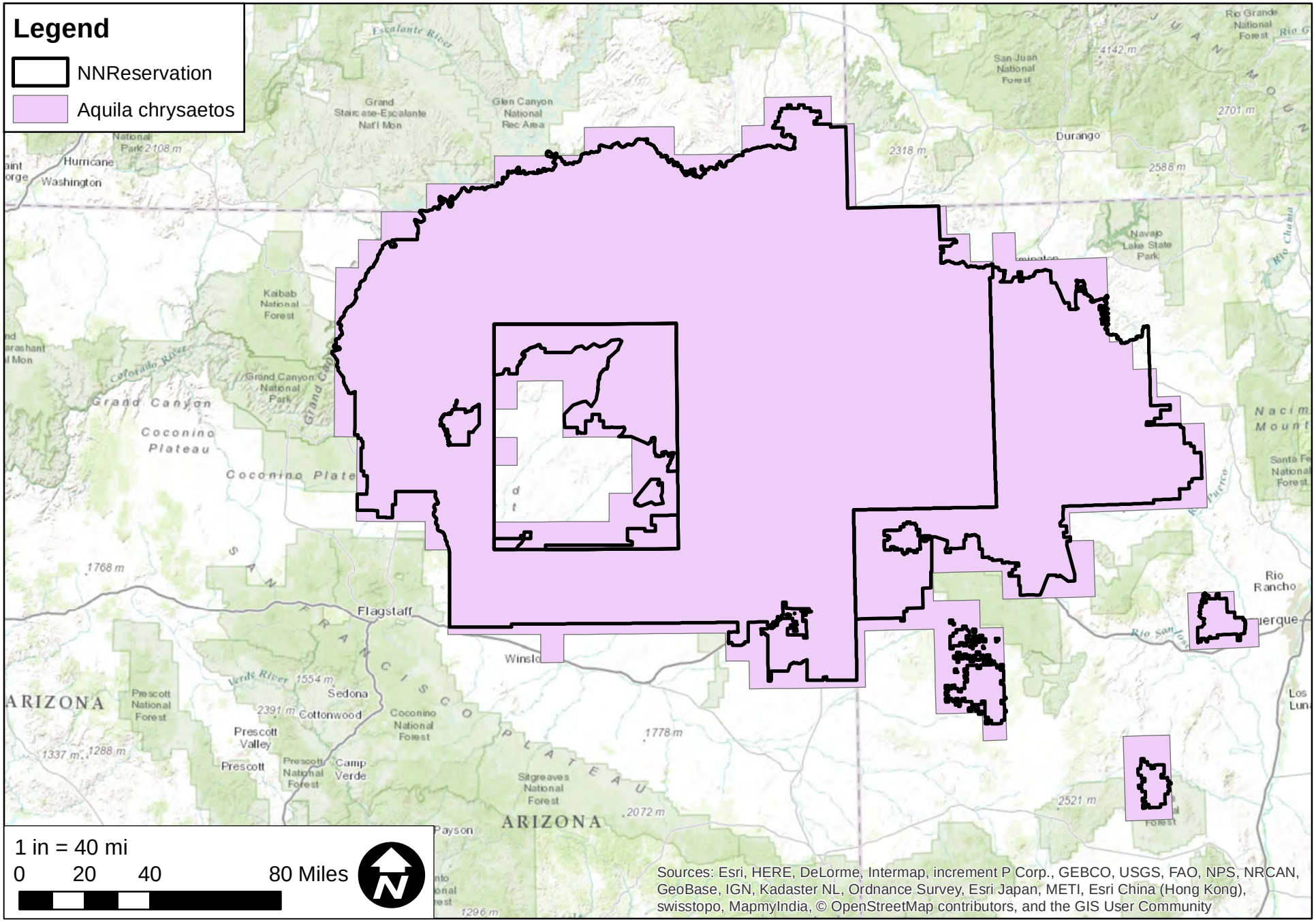

Figure C-20. Potential habitat - Golden eagle (MBTA)

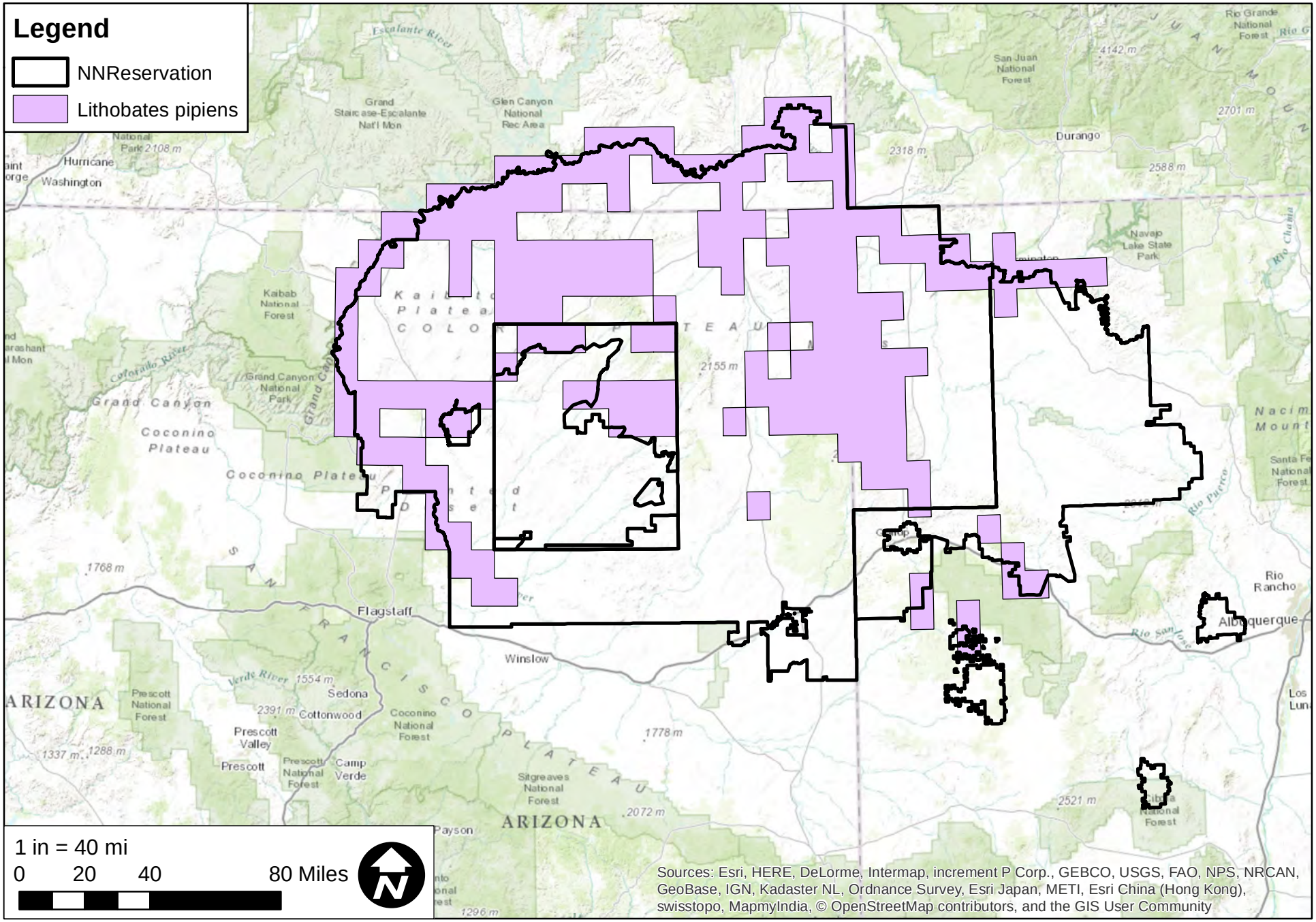

Figure C-21. Potential habitat - Northern leopard frog