

## APPENDIX L. VEGETATION ANALYSIS

### Introduction

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The analysis of vegetation on the Navajo Nation was performed by examining broad and detailed land cover classification, vegetation community dynamics, and how these communities may shift and change over time. Such shifts may be from land use, climate change, and natural ecological succession. This appendix was compiled to gather the technical information used in the National Environmental Policy Act (NEPA) or Programmatic Environmental Impact Statement (PEIS) analysis for the Navajo Nation Integrated Weed Management Plan (NNIWMP) and will serve as a supplement to the document. This appendix provides detailed descriptions of the land cover classes used, detailed maps of the described vegetation communities and land cover classes, a spatial analysis on how vegetation may have changed from pre-European settlement, and native species to monitor for that have close botanical relationships to those treated with biological control agents.

### Land Cover Classes

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Land cover for the Navajo Nation was analyzed using the National Land Cover Dataset (NLCD) developed by USGS. This classification system provides a broad classification for major forms of landcover for the entire United States. This classification system was further broken down to evaluate specific vegetation communities using the Southwest Regional GAP (SWReGAP or GAP) analysis, also developed by the USGS (Lowry et al. 2005). The GAP analysis provides detailed vegetation community descriptions for Arizona, Colorado, Nevada, New Mexico, and Utah. Below are listed the major landcover classes from the NLCD dataset. Acreage estimates and associated GAP landcover classes are outlined in **Table L-1**. Table of NLCD landcover and Southwest Regional Gap land cover for the Navajo Nation. Maps are provided for the NLCD land cover dataset and the GAP dataset (**Figure L-1** and **Figure L-2**).

#### **Water**

Open Water – Open water areas are classified based on presence of water year-round with less than 25% cover of vegetation or soils. Open water comprises 0.16% of land cover on the Navajo Nation.

#### **Developed Land**

Developed, Open Space – These are areas with a mixture of constructed materials, but mostly vegetation in the form of short grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes. Developed, Open Space land cover comprises approximately 0.45% of land cover on the Navajo Nation. This land cover classification also includes roads.

Developed, Low Intensity – These include areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% of the total cover. These areas most commonly include single family housing units. Developed, Low Intensity land cover comprises 0.13% of the land cover of the Navajo Nation. Low Intensity areas are commonly homesite lease sites and rural housing areas.

Developed, Medium Intensity – These include areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79% of the total cover. On the Navajo Nation, Developed, Low Intensity areas comprise less than 0.03% of the region. Areas classified as Medium Intensity are often low-density residential areas.

Developed, High Intensity – Highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrials areas. Impervious surfaces account for 80% to 100% of the total cover. Developed, High Intensity areas comprise less than 0.01% of the Navajo Nation and are commonly associated with Community Development Areas.

### **Barren Land**

Barren Land (Rock/Clay/Sand) – Barren land on the Navajo Nation is characterized by barren and sparsely vegetated landscapes, with generally less than 10% plant cover. Barren land composes 0.99% of the Navajo Nation. Canyons and tablelands are included in this classification, which are characterized by steep cliff faces, narrow canyons, and open tablelands of predominantly sedimentary rocks, such as sandstone, shale, and limestone. Sand dunes are also included and are characterized by shifting sandy substrates which form patchy or open grasslands, shrublands, or steppes. Vegetation, if present, is usually very open with scattered trees and shrubs and a sparse herbaceous layer. GAP land cover classes found within the Barren Lands on the Navajo Nation include:

- Barren Lands, Non-specific
- Colorado Plateau Mixed Bedrock Canyon and Tableland
- Inter-Mountain Basins Active and Stabilized Dune
- Inter-Mountain Basins Playa
- Inter-Mountain Basins Shale Badland
- Inter-Mountain Basins Volcanic Rock and Cinder Land
- Inter-Mountain Basins Wash
- North American Warm Desert Bedrock Cliff and Outcrop
- Rocky Mountain Cliff and Canyon

### **Forests**

Deciduous Forest – These are areas dominated by trees greater than 5 meters tall and covering more than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to season change. Due to the arid nature of the Colorado Plateau, deciduous forests only compose around 0.03% of land cover of the Navajo Nation. Deciduous forests in this region are characterized by upland forests dominated by aspen trees (*Populus*

*tremuloides*), with complex shrub and herbaceous understories. Distribution of these forests is limited by water availability, length of growing season, and low temperature. The only GAP land cover classes found within the Deciduous Forests on the Navajo Nation is Rocky Mountain Aspen Forest and Woodland.

Evergreen Forest – Evergreen forests are dominated by trees greater than 5 meters tall and covering more than 20% of total vegetation cover. More than 75% of the trees maintain their leaves all year. Canopy is never without green foliage. On the Navajo Nation, Evergreen forests compose 11.9% of the land cover. Evergreen forests include ponderosa pine (*Pinus ponderosa*) forests and woodlands, alpine and subalpine mixed conifer forests, and pinyon-juniper woodlands. GAP land cover classes found within the Evergreen Forests on the Navajo Nation include:

- Colorado Plateau Pinyon-Juniper Woodland
- Madrean Pine-Oak Forest and Woodland
- Madrean Pinyon-Juniper Woodland
- Rocky Mountain Ponderosa Pine Woodland
- Rocky Mountain Montane Dry Mesic Mixed Conifer Forest and Woodland
- Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland
- Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
- Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland
- Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland
- Southern Rocky Mountain Pinyon-Juniper Woodland

Mixed Forest – These areas dominated by trees greater than 5 meters tall that cover more than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover. This forest type is very uncommon on the Navajo Nation as it only composes around 270 estimated acres of the region. None of the GAP land cover classes on the Navajo Nation are associated with this vegetation type.

### **Shrubland**

Shrub/Scrub – Areas dominated by shrubs; less than 5 meters tall with shrub canopy covering more than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions. Shrub/Scrub comprises 75.8% of the Navajo Nation, making it the largest land cover class that is increasing on the landscape due to the expansion of sagebrush and juniper cover. On the Navajo Nation, Shrub/Scrub typically occurs along plains and foothills between mountain ranges in association with grasslands. GAP land cover classes in the Shrub/Scrublands on the Navajo Nation include:

- Apacherian-Chihuahuan Mesquite Upland Scrub
- Chihuahuan Creosotebush, Mixed Desert, and Thorn Scrub
- Colorado Plateau Blackbrush-Mormon-tea Shrubland
- Colorado Plateau Mixed Low Sagebrush Shrubland
- Colorado Plateau Pinyon-Juniper Shrubland
- Inter-Mountain Basins Big Sagebrush Shrubland

- Inter-Mountain Basins Mat Saltbush Shrubland
- Inter-Mountain Basins Mixed Salt Desert Scrub
- Mogollon Chaparral
- Rocky Mountain Gambel Oak-Mixed Montane Shrubland
- Southern Colorado Plateau Sand Shrubland

### **Herbaceous**

Grassland/Herbaceous - Grasslands are dominated by graminoid or herbaceous vegetation, composed of more than 80% of total vegetation. These areas are not subject to intensive management such as tilling. Grasslands make up 9.7% of land cover on the Navajo Nation. Most grasslands on the Navajo Nation are found in arid areas with well-drained soils and are dominated by perennial bunchgrasses and can be found in associated with open shrub layers.

GAP grassland cover classes on the Navajo Nation include:

- Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe
- Chihuahuan Sandy Plains Semi-Desert Grassland
- Inter-Mountain Basins Juniper Savanna
- Inter-Mountain Basins Montane Sagebrush Steppe
- Inter-Mountain Basins Semi-Desert Grassland
- Inter-Mountain Basins Semi-Desert Shrub Steppe
- Madrean Juniper Savanna
- Rocky Mountain Subalpine Mesic Meadow
- Southern Rocky Mountain Juniper Woodland and Savanna
- Southern Rocky Mountain Montane-Subalpine Grassland

### **Planted/Cultivated**

Pasture/Hay – These are areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation. Pasture/Hay comprises approximately 0.5% of the Navajo Nation and includes many range management units near and along river ways and portions of the NAPI-NIIP agricultural fields.

Cultivated Crops – These are areas used to produce annual crops, such as corn, soybeans, vegetables, tobacco, cotton, and perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled. On the Navajo Nation, Cultivated Crops comprise 0.4% of land cover and primarily describe NAPI/NIIP agricultural lands.

### **Wetlands**

Woody Wetlands – These are areas where forest or shrubland vegetation accounts for more than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water. Woody Wetlands comprise close to 0.26% of the Navajo Nation and are commonly found near drainages and stream terraces within the floodplain. Trees and shrubs dominate such areas, which are subject to annual or episodic flooding, such as cottonwood, willow, and ash trees, are common. Tamarisk and Russian olive are common as well. GAP land cover classes found within Woody Wetlands on the Navajo Nation include:

- Inter-Mountain Basins Greasewood Flat
- Rocky Mountain Lower Montane Riparian Woodland and Shrubland
- Rocky Mountain Subalpine -Montane Riparian Shrubland
- North American Warm Desert Wash
- North American Warm Desert Riparian Woodland and Shrubland

Emergent Herbaceous Wetlands – Herbaceous Wetlands are areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water. Typically, tall grasses and sparse shrubs are found in these areas. Emergent Herbaceous Wetlands comprise close to 0.11% of land cover on the Navajo Nation. GAP land cover classes found in Emergent Herbaceous Wetlands on the Navajo Nation include:

- North American Arid West Emergent Marsh
- Rocky Mountain Alpine-Montane Wet Meadow

**Disturbed**

The NLCD land cover classification does not include a separate category for disturbed lands as they are often documented in any and all land cover classes. However, the GAP data does include a category for its land classes for disturbed areas. This includes areas that may be disturbed from some form of development, such as mining or oil development, or from environmental disturbances, such as fire or invasive weeds.

- Disturbed, Oil Well
- Invasive Annual and Biennial Forbland
- Invasive Annual Grassland
- Invasive Perennial Grassland
- Invasive Southwest Riparian Woodland and Shrubland
- Recently Burned
- Recently Mined or Quarried

**Table L-1.** Table of NLCD landcover and Southwest Regional Gap land cover for the Navajo Nation

NLCD Class	SWReGAP Land Cover	CODE	Acres
Barren	Colorado Plateau Mixed Bedrock Canyon and Tableland	S010	1,798,300.90
Barren	Inter-Mountain Basins Shale Badland	S011	206,549.32
Barren	Inter-Mountain Basins Active and Stabilized Dune	S012	124,485.04
Barren	Barren Lands, Non-specific	N31	60,481.49
Barren	North American Warm Desert Bedrock Cliff and Outcrop	S016	40,923.61
Barren	Rocky Mountain Cliff and Canyon	S006	22,986.99
Barren	Inter-Mountain Basins Volcanic Rock and Cinder Land	S013	8,999.22
Barren	Inter-Mountain Basins Wash	S014	1,772.49
Barren	Inter-Mountain Basins Playa	S015	296.45
Forest	Colorado Plateau Pinyon-Juniper Woodland	S039	3,980,360.06
Forest	Rocky Mountain Ponderosa Pine Woodland	S036	459,760.93
Forest	Rocky Mountain Aspen Forest and Woodland	S023	30,049.37
Forest	Madrean Pinyon-Juniper Woodland	S112	13,824.97
Forest	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	S032	13,222.95
Forest	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	S028	6,947.63

NLCD Class	SWReGAP Land Cover	CODE	Acres
Forest	Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland	S030	3,828.53
Forest	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	S034	2,357.17
Forest	Southern Rocky Mountain Pinyon-Juniper Woodland	S038	2,195.71
Forest	Madrean Pine-Oak Forest and Woodland	S035	46.04
Forest	Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	S025	19.13
Shrubland	Inter-Mountain Basins Mixed Salt Desert Scrub	S065	1,192,584.90
Shrubland	Colorado Plateau Blackbrush-Mormon-tea Shrubland	S059	1,108,049.82
Shrubland	Southern Colorado Plateau Sand Shrubland	S136	1,047,355.72
Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	S054	612,987.66
Shrubland	Colorado Plateau Pinyon-Juniper Shrubland	S052	45,630.16
Shrubland	Colorado Plateau Mixed Low Sagebrush Shrubland	S056	21,637.72
Shrubland	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	S046	16,788.39
Shrubland	Inter-Mountain Basins Mat Saltbush Shrubland	S045	3,023.69
Shrubland	Mogollon Chaparral	S057	7.78
Shrubland	Apacherian-Chihuahuan Mesquite Upland Scrub	S058	1.33
Shrubland	Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub	S062	1.78
Grassland	Inter-Mountain Basins Semi-Desert Shrub Steppe	S079	2,639,369.73
Grassland	Inter-Mountain Basins Semi-Desert Grassland	S090	2,365,320.36
Grassland	Inter-Mountain Basins Juniper Savanna	S075	300,619.59
Grassland	Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe	S077	2,374.29
Grassland	Madrean Juniper Savanna	S115	756.81
Grassland	Chihuahuan Sandy Plains Semi-Desert Grassland	S113	593.35
Grassland	Southern Rocky Mountain Montane-Subalpine Grassland	S085	325.14
Grassland	Inter-Mountain Basins Montane Sagebrush Steppe	S071	156.34
Grassland	Rocky Mountain Subalpine Mesic Meadow	S083	72.50
Grassland	Southern Rocky Mountain Juniper Woodland and Savanna	S074	3.34
Wetland	Inter-Mountain Basins Greasewood Flat	S096	589,018.35
Wetland	Rocky Mountain Lower Montane Riparian Woodland and Shrubland	S093	22,741.91
Wetland	Rocky Mountain Subalpine-Montane Riparian Shrubland	S091	1,755.81
Wetland	Rocky Mountain Alpine-Montane Wet Meadow	S102	3,309.46
Wetland	North American Warm Desert Wash	S020	342.04
Wetland	North American Arid West Emergent Marsh	S100	269.32
Wetland	North American Warm Desert Riparian Woodland and Shrubland	S097	83.62
Open Water	Open Water	N11	22,932.06
Developed	Developed, Medium - High Intensity	N22	9,801.18
Developed	Developed, Open Space - Low Intensity	N21	8,957.19
Planted	Agriculture	N80	83,591.24
Disturbed	Invasive Southwest Riparian Woodland and Shrubland	D04	44,698.32
Disturbed	Recently Mined or Quarried	D03	37,085.29
Disturbed	Invasive Perennial Grassland	D06	9,244.75
Disturbed	Invasive Annual and Biennial Forbland	D09	4,885.13
Disturbed	Invasive Annual Grassland	D08	1,911.93
Disturbed	Recently Burned	D02	720.34
Disturbed	Disturbed, Oil well	D14	53.37

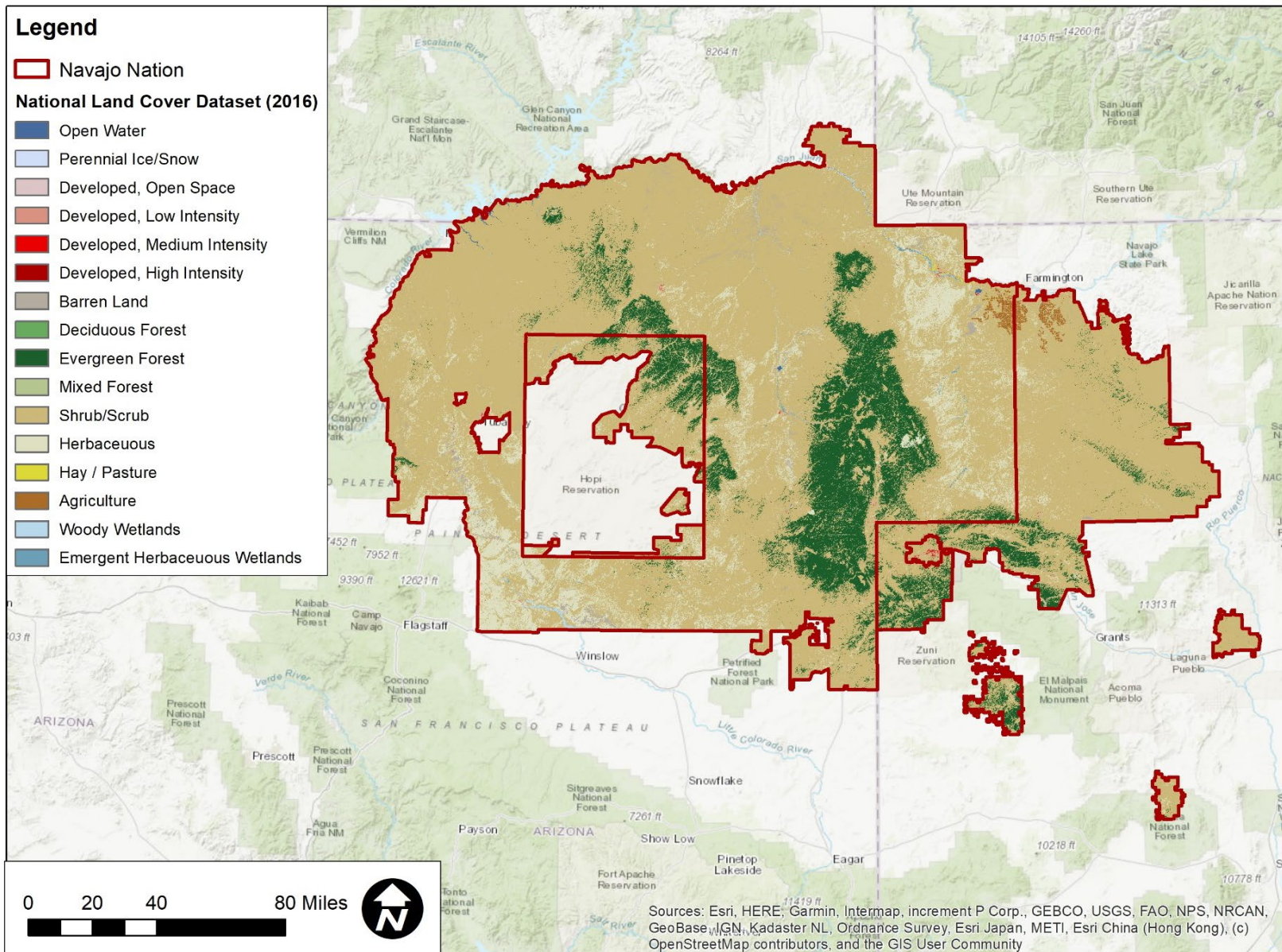


Figure L-1. Land cover classes for the Navajo Nation as determined by the USGS National Land Cover Dataset (Wickham et al. 2014)

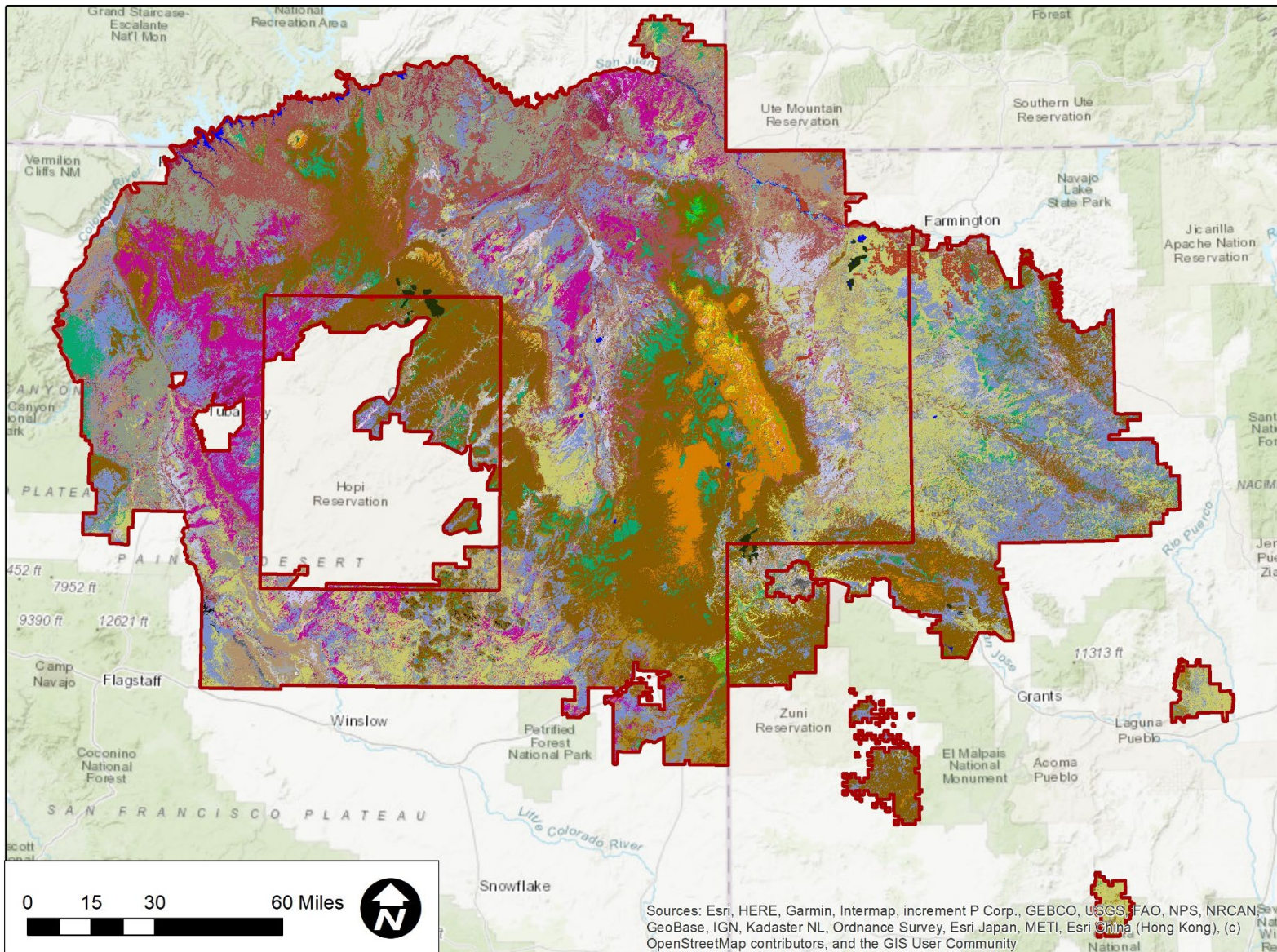


Figure L-2. Land cover classes for the Navajo Nation based on the Southwest Regional GAP Analysis from the USGS (Lowry et al. 2005).





### Comparison of Land Cover

To determine the potential shift in vegetation from pre-European settlement to current day, a comparison of land cover classes was performed. This technique compares Landsat imagery from the LANDFIRE Program. Specifically, it compares the BioPhysical, or historic data (**Figure L-3**) to current existing land cover data (**Figure L-4**). Both datasets are based on the NatureServe ecological systems classification for the terrestrial United States. Historic data includes native vegetation types while the 2016 data includes cover types related to human activity, such as developed, agricultural, and exotic types. The methodology used is based on the riparian vegetation departure analysis developed by Utah State University (MacFarlane et al. 2016). Using this method, land cover classes assigned numeric values based on how similar the current land cover classes is to historic classes with higher values given to native plant cover and lower values given to cover types related to human-based activities (**Table L-2** and **Table L-3**). For this analysis, while overall composition may change or shift based on a variety of factors, the physiognomic groups are generally more consistent across time. Using physiognomy allows for significant differences between land cover groups to be analyzed, which is appropriate for a regional analysis.

**Table L-2.** Vegetation scores based on vegetation physiognomy group for historic land cover data.

Vegetation Group	Land Cover Score
Sparse	40
Shrubland	100
Riparian	100
Open Water	500
Hardwood-Conifer	100
Hardwood	100
Grassland	50
Conifer	100
Barren Rock/Sand/Clay	40

**Table L-3.** Vegetation scores based on vegetation physiognomy groups for 2016 land cover data.

Physical Group	Land Cover Score
Agricultural	1
Developed	2
Developed – High Intensity	2
Developed – Low Intensity	2
Developed – Medium Intensity	2
Developed – Roads	2
Exotic Herbaceous	3
Exotic Tree-Shrub	3
Quarries – Strip Mines – Gravel Pits – Well and Wind Pads	2
Sparsely Vegetated	40
Shrubland	100
Riparian	100
Open Water	500
Conifer-Hardwood	100
Hardwood	100
Grassland	50
Conifer	100

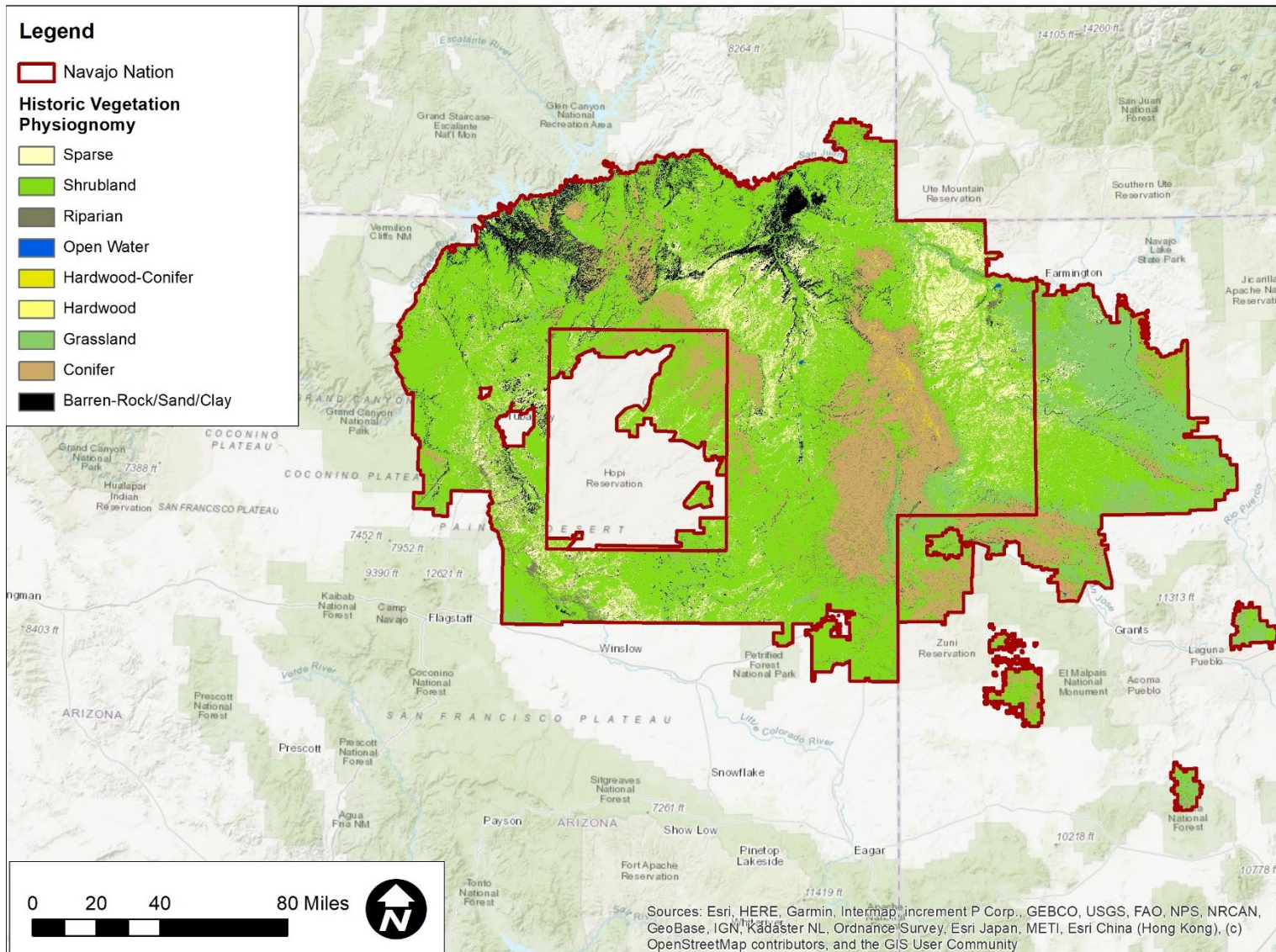


Figure L-3. Historic land cover from pre-European settlement based on LANDFIRE biophysical data analysis.

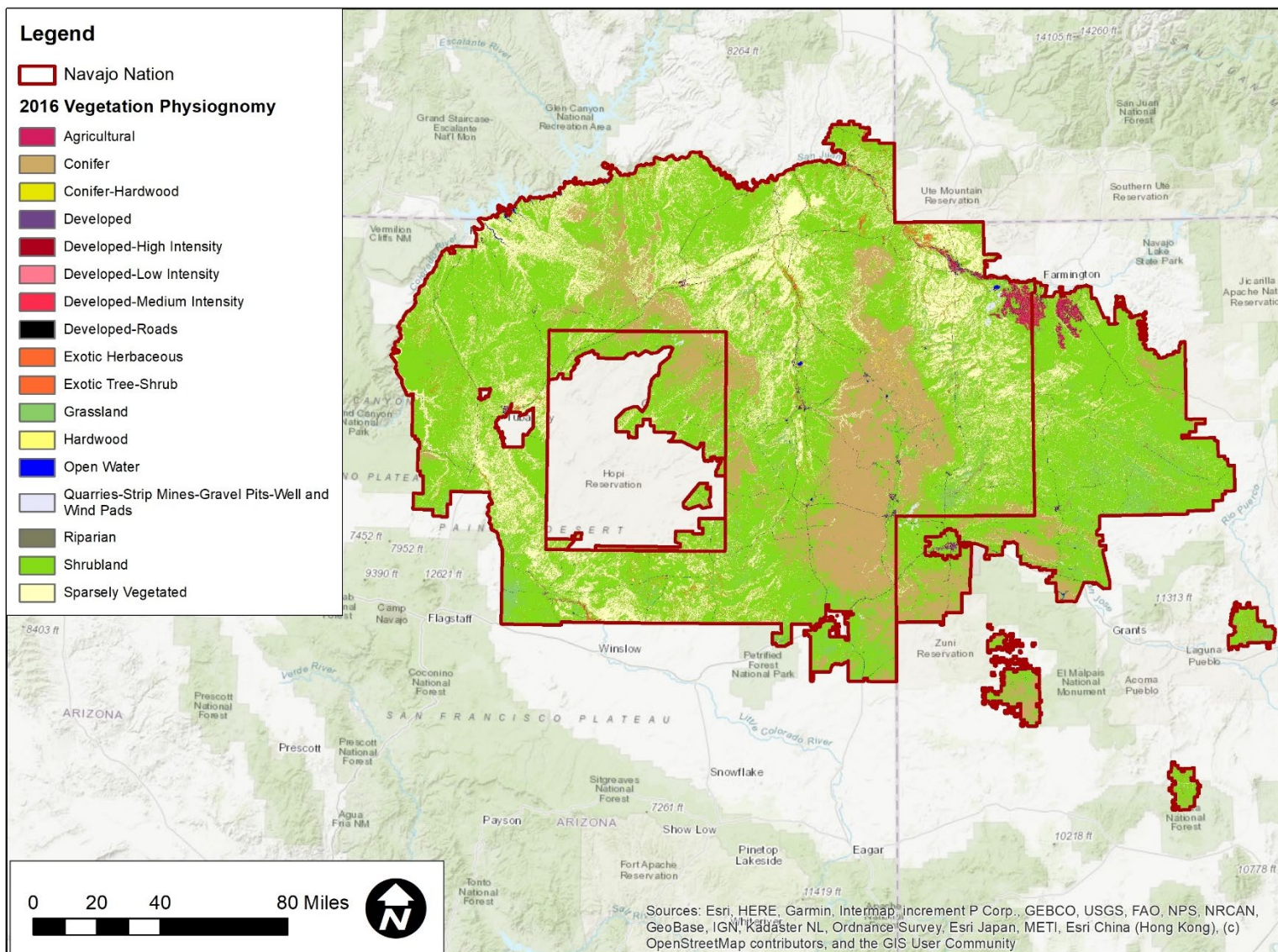


Figure L-4. 2016 land cover data from LANDFIRE based on the National Vegetation Classification for the Navajo Nation.

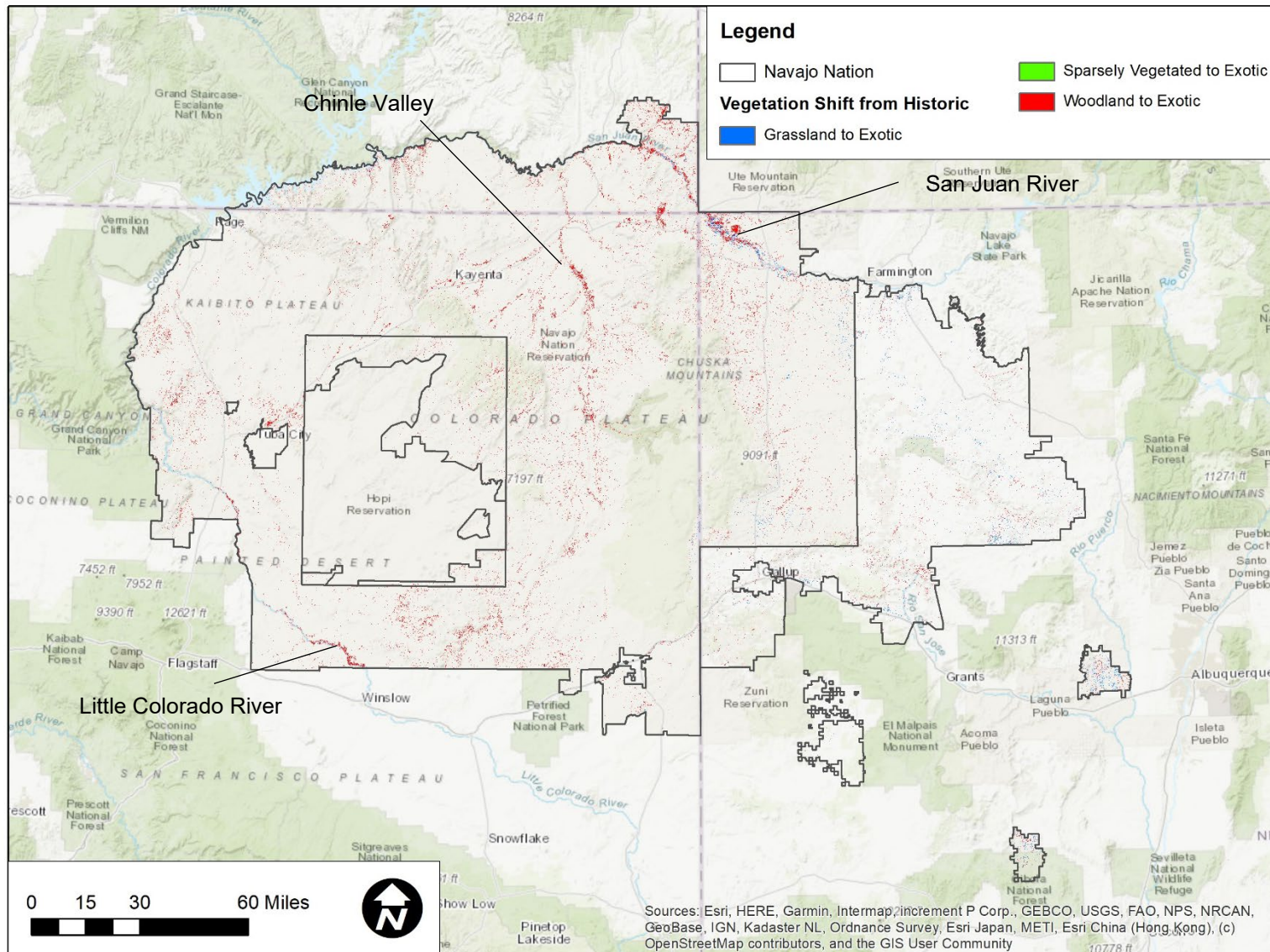
The scored raster datasets are then subtracted from each other to determine the level of change. The resulting changes in the scores indicate how different vegetation groups shifted on the Navajo Nation. Higher scores indicate more significant land cover shifts.

From this analysis, vegetation shifts affected 18.57% of the Navajo Nation (**Table L-4**). Much of this change was the result of grassland conversions either to woodlands (i.e. shrubland, conifers, or hardwoods) or to sparsely vegetated areas. While this analysis is generalized and does not indicate the specific reasons for such shifts, it does indicate that vegetation shifts may not be from direct human alterations on the landscape but from other causes. Such changes could be due to woody plant encroachment, changes in grazing management, desertification, or other causes which may be indirectly related to land use, climate change, or other factors.

**Table L-4.** Results from the vegetation departure analysis based on differences in physiognomic group.

Vegetation Shift	% Change
No Change	81.43
Woodland to Exotics	2.01
Woodland to Developed	0.95
Woodland to Agriculture	0.38
Woodland to Grassland	4.40
Woodland to Sparsely Vegetated	2.93
Grassland to Exotics	1.60
Grassland to Developed	1.45
Grassland to Agriculture	2.79
Grassland to Woodland	73.82
Grassland to Sparsely Vegetated	11.96
Sparsely Vegetated to Exotics	0.01
Sparsely Vegetated to Developed	0.33
Sparsely Vegetated to Agriculture	0.01
Sparsely Vegetated to Woodland	0.04
Sparsely Vegetated to Grassland	0.00

While this analysis does not indicate significant changes from to exotic species, exotic species account for 1.65% of these conversions. Given the size of the Navajo Nation, this represents close to 724 square miles or just over 463,475 acres of weeds that have significantly changed or altered the main vegetation physiognomy of an area (**Figure L-5**). This does not account for smaller populations that have intermixed with native vegetation. But does align with the scale of the weed problem on the Navajo Nation and could provide a general estimate of the size of noxious weed populations in the Region. While shifts occur through out the region, areas with a high concentration of exotic vegetation shifts include along the San Juan River, Chinle Valley, and the lower portion of the Little Colorado River on the Navajo Nation.









**Figure L-5.** Map of areas where vegetation has shifted due to exotic weeds on the Navajo Nation. These shifts were calculated through a vegetation departure analysis comparing pre-European land cover to LANDFIRE land cover from 2016. Areas with a large number of exotic vegetation shifts include the San Juan River, Chinle Valley, and the Little Colorado River.

### Priority Noxious Weed Species Descriptions




The following are description and characteristics of the noxious weeds found within the project area that have been prioritized for management and control on the Navajo Nation. As defined in the weed management plan, weeds are exotic, invasive, aggressive, competitive, and persistent. Locations for known weed infestations are from recent BIA weed mapping efforts and the SWEMP. Names include common name, scientific name, USDA Plants Code, and Navajo name, if available.

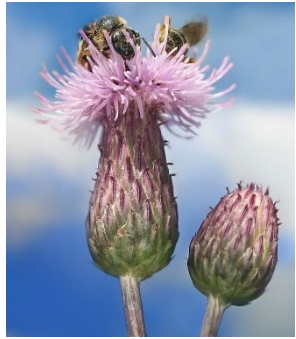


#### Category A Species




Name	Origin	Description	Concerns	Photo
<b>Leafy Spurge</b> <i>(Euphorbia esula)</i> EUES Chi'il abci tsoh	Eurasia	Perennial forb with greenish-yellow flower bracts. Flowers in May and June. Leaves are simple and opposite with a blue-grey hue. Plant can reach a maximum height of 4 ft.	Can reproduce by seeds and root buds. Roots can grow up to 30 ft from plants and seeds, which are forcefully expelled, can land up to 15 ft. from the original plant. Plant produces latex, which can cause lesions around the eyes and mouth of cattle (USFS 2005). Invades grasslands and can invade riparian areas, shrublands, and savannas. No populations documented but known near Mormon Lake in Flagstaff.	 John Randall, The Nature Conservancy
<b>African Rue</b> <i>(Peganum harmala)</i> PEHA	North Africa Mediterranean	Small, bright green succulent perennial forb with a bushy growth. Plants die back to the root in the winter and grows in late March and early April.	Contains four poisonous alkaloids toxic to cattle, sheep, and horses. Toxins can cause a loss of appetite, trembling, and loss of coordination. Severe poisoning can cause hemorrhaging in the heart and liver. The seeds are the most toxic part, while leaves are less so (USFS 2005). Invades disturbed or barren areas with moist soils. Populations found near Navajo Bridge at business site leases in Western Navajo.	 National Park Service




Name	Origin	Description	Concerns	Photo
<p><b>Tree of Heaven</b> (<i>Ailanthus altissima</i>) AIAL T'iis Nattóí</p>	<p>China</p>	<p>Deciduous tree can grow up to 90 feet tall with gray bark. Branches have a large pitch and heart-shaped leaf scars. Discerned from similar native trees by the leaves, which have a circular gland on each leaflet near the petiole. Flowers are small greenish clusters becoming straw-colored to reddish brown fruits in a pod-like structure.</p>	<p>Can reproduce from seed or roots which form extensive networks in dense colonies that out-compete native trees. Produces chemicals that prevent other trees from establishing. Roots can damage sewers and foundations of nearby structures (PCA 2009). Invades disturbed areas and can grow in forest openings and common areas. Does not establish well in wetlands or shaded areas. Populations in Shiprock.</p>	 <p>Russ Kleinman, NMSU</p>
<p><b>Fountaingrass</b> (<i>Pennisetum setaceum</i>) PESE3</p>	<p>Northeastern Africa and western Asia</p>	<p>An attractive perennial grass grows in dense clumps with erect stems up to 4 ft high. Florets grow in bushy clusters of pink or purple and appear bristly in inflorescences 6-15 in. long.</p>	<p>Highly aggressive and fire-adapted. Outcompetes native plants after burns. Seeds are long-lived and disperse easily by wind or water, allowing them to travel great distances (USFS 2005).</p>	 <p>Eric Guinter, 2005</p>
<p><b>Squarrose knapweed</b> (<i>Centaurea virgata</i>) CEVI</p>	<p>Western Asia</p>	<p>Long-lived perennial forb grows to 12-18 inches tall with small pink to purple flowers. Remain a rosette for several years under poor conditions before growing into a flowering stem. Grows in a bushy habit, with deep taproot. Leaves alternate and covered in short to medium grayish hairs. Upper leaves are entire and linear while lower leaves are 4-8 in. long and deeply pinnately lobed.</p>	<p>Invades rangelands with shallow soils and is adapted to harsh climates. Flowerheads have burs that allow them to cling easily to passing animals, vehicles, and clothing. Favors opens disturbed sites (USFS 2005)</p>	 <p>Gerald-Carr 2013</p>
<p><b>Blue mustard</b> (<i>Chorispora tenella</i>) CHTE2</p>	<p>Eurasia</p>	<p>Winter annual grows in late fall to early winter. Plants overwinter as a rosette and resumes growth in the spring. Flowers grow in pink to purple flowers with petals that extend outwards and twist. Plants have a distinct musky odor. Leaves are sinuate to dentate and plants are covered in glandular hairs.</p>	<p>Plants spread via seeds on disturbed sites. If eaten by cattle, can produce an off flavor in milk. In agricultural fields, blue mustard can reduce yields of several grain crops (Lyons et al. 2006). Detected just outside of Chinle, AZ</p>	 <p>EnviroPlan Partners 2018</p>







Name	Origin	Description	Concerns	Photo
<p><b>Ravenna grass</b> <i>(Saccharum ravennae)</i></p> <p>SARA3</p>	<p>Mediterranean</p>	<p>Perennial bunch grass with long-flowering cane-like stalks that can reach over 12 ft in tall and a basal area several feet in diameter. Flowers in summer with large plume like inflorescence. Distinguished from pampas grass by the dense villous hairs that grow along the lower leaf blades (Thomsen and Meyer 2007)</p>	<p>Planted often as an ornamental, can easily escape due to its lightweight seeds that disperse in wind and water. Establishes quickly in disturbed areas and is highly competitive in riparian areas. Can form dense monocultures, growing out from beneath established vegetation. Established stands can increase fire risk along riparian zones and anchor soils normally subject to shifting (PDCNR 2013). Populations detected on the Hopi Reservation and in Grand Canyon National Park.</p>	 <p><i>Daderot</i></p>
<p><b>Yellow starthistle</b> <i>(Centaurea solstitialis)</i></p> <p>CESO3</p> <p>C'it Bilat'a dootlizhigí</p>	<p>Europe</p>	<p>Annual forb that grows 2-3 feet tall with wiry stems. Roots can grow at least 3 ft into a deep taproot. Flower heads are spiny and grow singly at the stem tips with narrow yellow petals. Plants starts as a low rosette with white hairs. Leaves and stems are gray to bluish green with fine white cottony hairs.</p>	<p>Horses grazing large quantities are susceptible to “chewing disease,” a neurological disorder preventing the horse from swallowing. There is no cure of chewing disease and it is fatal (USFS 2005). Populations have been detected along roadsides on BIA-27 north of Ganado Lake and on I-40 outside of Window Rock.</p>	 <p><i>Peggy Greb, USDA</i></p>
<p><b>Bull thistle</b> <i>(Cirsium vulgare)</i></p> <p>CIVU</p>	<p>Eurasia</p>	<p>Typically, biennial but can be perennial and grow up to 7 ft. in height. Leaves deeply lobed with coarse prickly hairs on top and woolly hairs underneath. Leaves have sharp spines on the midrib and tips, resembling a spear. Flowers in pink-magenta heads at the end of each stem, with spiny bracts surrounding each seed head (DiTomaso et al. 2013).</p>	<p>Invades disturbed sites along slash piles, old log desks, and roadsides. Regeneration solely from short lived seeds. However, each flower can produce between 100 – 300 seeds per flower. Can outcompete native vegetation and reduce site productivity and stocking rates (USFS 2005). Has been detected in numerous locations on the Navajo Nation, mostly along roads and highways.</p>	

Name	Origin	Description	Concerns	Photo
<p><b>Canada thistle</b> <i>(Cirsium arvense)</i></p> <p>CIAR4</p> <p>Azéé hakani yázhí</p>	<p>Southeastern Europe and eastern Mediterranean</p>	<p>Colony-forming perennial thistle grows up to 3 to 5 ft tall. Has an extensive creeping root system that can reach depths of 5 to 15 ft. Leaves spiny lobed, alternate, and oblong or lance shaped. Plants are dioecious and flowers are white to purple in clusters of 1 to 5 per branch. Flowerheads are glabrous with white woolly hairs. Can produce 1,000-5,000 seeds per stem (DiTomaso et al. 2013)</p>	<p>Underground roots can produce new plants, which makes eradication difficult. Can reduce forage consumption in rangelands and crop yields on agricultural lands (USFS 2005). Competes aggressively with native plants and is a host plant for several agricultural insects and diseases (DiTomaso et al. 2013). Has been detected on some rangelands and along roads near Window Rock and Leupp.</p>	 <p>Richard Bartz, 2007</p>
<p><b>Dalmatian toadflax</b> <i>(Linaria dalmatica)</i></p> <p>LIDA</p>	<p>Eastern Europe</p>	<p>Ornamental perennial forb grows up to 3 ft tall. Stems rough and woody at the base, and waxy and smooth at the top. Leaves waxy and bluish-green, ovate to heart-shaped with smooth margins. Leaves alternate and clasping at the upper portion of the stem. Has deep taproots with adventitious buds that form new plants. Flowers resemble yellow to orange snapdragons (DiTomaso et al. 2013)</p>	<p>Plants reproduce from both seed and underground root stalks. One plant can produce up to on half million seeds, as well as lateral roots up to 10 feet from the plant (King County 2011). Can crowd out native plants and reduce forage of rangelands. Commonly occurs along roadsides in the southwestern United States and has been detected in Western and Fort Defiance Agency jurisdictions.</p>	 <p>Renee Benally, BIA</p>
<p><b>Musk thistle</b> <i>(Carduus nutans)</i></p> <p>CANU4</p> <p>Azee'okani'whooshi Azee'okani'denini</p>	<p>Eurasia</p>	<p>Biennial forb can grow up to 5 ft. tall. Prickly leaves and stems with prickly wings. Forms deep taproots and germinates in the winter to early spring, forming a rosette and developing flowering stems in the spring and summer the next year. Purple to pink flowers form in summer in hemispherical thistles, that nod on long stalks. Reproduces only by seed (DiTomaso et al. 2013)</p>	<p>In one growing season, a single plant can produce over 100,000 seeds. Can increase from a single plant to a large infestation within 2 to 3 years. Seeds remain viable for around 15 years, requiring intensive monitoring of infested and treated sites (USFS 2017). Can crowded out native species and valuable forage plants and spines discourage animals from entering infested areas. Found throughout the Navajo Nation along roadsides, farm fields, and rangelands.</p>	



Name	Origin	Description	Concerns	Photo
<p><b>Perennial pepperweed</b> <i>(Lepidum latifolium)</i></p> <p>LELA2</p> <p>Os si tsóh</p>	<p>Eurasia</p>	<p>Long-lived perennial forb can grow from 2 to 4 ft tall from seeds or roots. Prefers moist or seasonally wet sites. Leaves are alternate and can be wider at the base and narrower along the stems, margins entire to slightly toothed. Flowers form in small white clusters at end of the stems.</p>	<p>Grows in a variety of areas, including floodplains, pastures, riparian areas, and near residential structures. Forms dense thickets that crowd out other plants. Seeds and plant fragments can spread easily and make dispersion difficult to control. Has been detected in Marble Canyon and at NAPI-NIIP lands (DiTomaso et al. 2013).</p>	 <p>Joseph DiTomaso</p>
<p><b>Scotch thistle</b> <i>(Onopordum acanthium)</i></p> <p>ONAC</p> <p>Zéé hókanííł béeí Whosh Waa'</p>	<p>Europe</p>	<p>Broad spiny stems with vertical rib. Large spiny leaves with dense hairs. Violet to reddish flowers in spherical to hemispherical shape. Plants grow in tall erect. Reproduces solely by seed (DiTomaso et al. 2013).</p>	<p>Plants can create an impenetrable thicket, with seeds viable for 6 years. Grows in disturbed areas along roadsides and in waste areas (USFS 2017). Produces large numbers of seeds that contain a water-soluble germination inhibitor that can delay maturation (DiTomaso et al. 2013). Found throughout the Navajo Nation along roadsides and in some riparian washes and farms.</p>	 <p>CSU Extension</p>
<p><b>Spotted knapweed</b> <i>(Centaurea maculosa, C. stoebe)</i></p> <p>CESTM</p> <p>Ch'it Bilat'a dootl'izhigí</p>	<p>Central Europe</p>	<p>Biennial or short-lived perennial forb growing 1 to 3 feet tall with a long, sturdy taproot. Forms basal rosettes in winter and early spring and then develops erect, highly branched flowering stems in late spring to summer. Leaves are alternate, pinnately lobed and dotted with resin ducts. Each flowerhead forms 30 -40 disk flowers with white, pink, or purple flowers. Phyllaries have dark colored tips, giving them a spotted appearance (DiTomaso et al. 2013).</p>	<p>Forms monocultures that reduce native plant populations. Can inhibit growth of other nearby plants (USFS 2005). Can reproduce both vegetatively and from seed. Seeds can remain dormant in soils for 8 years and can germinate without sun exposure. Can hybridize with diffuse knapweed (DiTomaso et al. 2013). Population common along roads and near the Shonto Boarding School.</p>	 <p>BIA</p>




Name	Origin	Description	Concerns	Photo
<p><b>Tall whitetop</b> (<i>Cardaria draba</i>) (<i>Lepidium draba</i>)</p> <p>CADR</p> <p>Os si tsóh</p>	<p>Russia/Eurasia</p>	<p>Deep-rooted perennial that grows up to 2 ft tall with deep roots, growing 12-30 ft deep. Can produce 50 sheets in a square yard. Leaves alternate, gray green in color, and vary in shape. Lower blade surface is covered in short white hairs. Basal leaves are short-stalked and upper leaves are clasping. Numerous small, white fragrant flowers in spring to summer. Prolific seed production. (DiTomaso et al. 2013)</p>	<p>One plant can spread 12 feet in its first year. Plants are toxic to cattle. Can reproduce by seed or root segments. One plant can produce 1,200 to 4,800 seeds, which are short lived. Extensive and fast-growing root system are the main method of spread (DiTomaso et al. 2013). Found in alkaline, disturbed soils and is highly competitive once established (USFS 2005). Has been detected on the Navajo Nation along roadsides and washes in the eastern Chuska mountains.</p>	 <p>Steve Dewey, USU</p>
<p><b>Sahara mustard</b> (<i>Brassica tournefortii</i>)</p> <p>BRTO</p> <p>Oostse'</p>	<p>Mediterranean</p>	<p>Erect winter annual that forms a basal rosette with a span of around 3 feet and a height of 2 ft. Basal leaves are deeply pinnate-lobed and lower stems have dense, stiff white hairs. Produces small yellow flowers that produce long linear fruits. Mature fruits open from the base to release the seeds. Reproduce solely by seed (DiTomaso et al. 2013)</p>	<p>Fast-growing and drought tolerant, these plants grow best in disturbed and sandy soils. Flowers are self-pollinating and create thousands of seeds. Dried plants can break off and form tumbleweeds, increasing seed spread. Can increase fire risk, lower biodiversity, and lower forage value of rangelands (USFS 2017c).</p>	 <p>Mike Lewis, UCR</p>
<p><b>Uruguyan pampas grass</b> (<i>Cortaderia selloana</i>)</p> <p>COSE4</p>	<p>South America, mainly in low elevation subtropical grasslands and riparian areas.</p>	<p>Fast-growing bunch grass forms densely tufted bunches with long basal leaves and tall-showy plumelike inflorescences, which are 1 – 3 ft long. Leaves sharply serrated. Inflorescences have fountain-like appearance. Forms dense fibrous roots that grow in shallow, short lateral rhizomes. Plants are dioecious and can only develop seeds if male or female plants are within pollination range. (DiTomaso et al. 2013).</p>	<p>A single plant can produce millions of seeds that can travel via wind for several miles. Can grow along roadsides, steep cliffs, streambanks, and open disturbed areas. Tolerant of intense sunlight, drought, and frost and can live for over a decade. Displaces native species, lowering biodiversity and reducing habitat quality. Leaves are extremely sharp and can harm wildlife, livestock, and humans (DiTomaso et al. 2013)</p>	 <p>Joseph DiTomaso, UCD</p>




Name	Origin	Description	Concerns	Photo
<p><b>Yellow nutsedge</b> <i>(Cyperus esculentus)</i></p> <p>CYES</p> <p>Tłohi'gai</p>	<p>Europe</p>	<p>Warm season perennial grass growing between 6 to 30 in tall. Leaves originate from the base of the stem and are grass-like, smooth, and glossy. Stems are triangular. Flowers are umbrella shaped spikelets with long, leaf-like bracts that are yellowish. Roots form prolific hard, round brown to black tubers that facilitate vegetative spread (CDA 2015)</p>	<p>Reproduces by seed and tubers, which make it difficult to control. Tubers develop rapidly and can persist in the soil for years, forming dense colonies and crowding out native vegetation. Can be damaging to crops with onions, potatoes, beans, and corn. Can grow in a variety of soils, and prefers wet or moist soils, but is drought-tolerant once established (CDA 2015).</p>	 <p>Patrick Alexander</p>
<p><b>Sulphur cinquefoil</b> <i>(Potentilla recta L.)</i></p> <p>PORE5</p> <p>Azee tsoxíí Chil di tsoxíí</p>	<p>Mediterranean and Eurasia</p>	<p>Perennial forb grows up to 3 ft tall. Flowers pale yellow with 5 heart-shaped petals and 5 enclosing green sepals. Leaves are palmate with serrate margins with narrow oblanceolate leaflets. Stems, underside of leaves, petioles, and calyx have long perpendicular hairs. Discern from natives by green underside and appressed hairs on the stem. Produces numerous seeds that can last for up to 4 years in soil (CDA 2019)</p>	<p>Can reproduce by seed or new root shoots. Commonly invades grasslands and shrub-dominated areas, especially disturbed sites or waste areas. Plants are unpalatable and avoided by animals due to high tannin content. Can quickly dominate grazing areas and out-compete native forage grasses (CDA 2019)</p>	 <p>Robert Flogaus-Faust 2006</p>
<p><b>Common Mediterranean grass</b> <i>(Schismus barbatus)</i></p> <p>SCBA</p>	<p>Africa and Mediterranean</p>	<p>Cool season annual grass grows erect to semi-prostrate up to 8 in tall. Forms large dense mats. Fine, narrow leaf blades with small dense panicles. Flowers appear in spring and are self-pollinating. Spikelets are small and lack awns with 3-8 florets per spikelet. Plants reproduce only by seed. (DiTomaso et al. 2013)</p>	<p>Found on dry slopes, bajadas, desert mesas, river bottoms, or valley bottoms and locally abundant in mountain ranges between 100 and 4,000 ft in elevation. Forms dense mats during years of favorable winter precipitation, outcompeting native species. Is a primary species fueling desert wildfires in the Mojave Desert and threatens species diversity in ecosystems that have not evolved to more frequent fire intervals (USFS 2005)</p>	 <p>Max Licher</p>

Name	Origin	Description	Concerns	Photo
<p><b>Tamarisk</b> (<i>Tamarix</i> spp.)</p> <p>TAMAR</p> <p>K'eilichii'its'óóz</p>	Eurasia	Trees originally planted as ornamentals and for erosion control. Has deciduous tiny scale- or awl-like leaves, although athel varieties are evergreen. Deep, efficient root system with high evapotranspiration rates during warm seasons. Flowers are in racemes with simple, but occasionally compound panicle-like flowers. Different species can be identified by the nectar base at the flower. Flowers are small and white to dark pink. (DiTomaso et al. 2013)	Category A species are found in more isolated populations but can hybridize with similar species. Hybridization is not well understood but can increase spread and utilization of uninhabitable ecosystems. Deep roots extract salts from deeper soils and excrete it from the leaves, increasing salinity of surface soils. Can replace more desirable native species and displace native wildlife species, including the endangered Southwestern willow flycatcher.	 <p>Russ Kleinman &amp; Rich Felger</p>

**Category B Species**




Name	Origin	Description	Concerns	Photo
<p><b>Camelthorn</b> (<i>Alhagi camelorum</i>, <i>A. maurorum</i>)</p> <p>ALMA12</p> <p>Ch'ilhoshí</p>	Eurasia	Aggressive perennial shrub with thick rhizomes that grow out 36 ft or more from the parent plant. Plants have greenish, ridged, hairless stems that are highly branched with thorny branches. Leaves alternate, sparse, and simple, thick, and leathery, and oval shaped. Flowers appear in summer and are two to six magenta pea-like flowers on short stalks. Fruits are reddish-brown pods with beaked tip in late summer.	Extensive root systems make this species difficult to eradicate. Seed also facilitate spread as they can be dispersed by water, animals, and winds, but reproduction is mostly vegetative. Can grow through pavement and thorns can flatten tires (USFS 2005). On the Navajo Nation, it grows quickly along roadsides, washes, and streams, and near communities. Heavy infestations documented near Shiprock, Tuba City, Chinle Wash, the San Juan River Basin, and along the Little Colorado River.	 <p>Susan Holiday</p>
<p><b>Halogeton</b> (<i>Halogeton glomeratus</i>)</p> <p>HAGL</p> <p>Chil'bit'ááh t'ó</p>	Eurasia	Erect winter and summer annual with small fleshy leaves. Stems are tinged reddish or purple and leaves are alternative, sessile, dull green to bluish-green, and end in a needle-like spike. Flowers are numbers and dense on the leaf axils and lack petals. Reproduces mostly by seed. (DiTomaso et al. 2013)	Not extremely competitive but invades disturbed and overgrazed areas. Produces oxalates that are toxic to livestock (NRCS 2002). Found in heavy populations along roads and disturbed areas such as on Black Mesa near coal mine operations. Is widespread on the Navajo Nation.	 <p>Renee Benally, BIA</p>




Name	Origin	Description	Concerns	Photo
<p><b>Siberian elm</b> <i>(Ulmus pumila)</i></p> <p>ULPU</p> <p>Naasts'ósí bit'iis</p>	<p>China, Siberia, Manchuria, and Korea</p>	<p>Fast growing trees, from 50 to 70 ft tall. Leaves alternate, oblong in shape with serrate margins. Flowers greenish and clustered in short pedicels that appear before leaves in March and April. Bark light gray brown with irregular furrows. Fruits are samaras with a dry, compressed nutlet.</p>	<p>Widely grown in the southwestern United States as a shade tree, it can outcompete native species in riparian zones and other sensitive areas. Winged seeds can travel long distances by wind or vehicles. Tree produce abundant seeds that make it difficult to control (USFS 2005). In isolated populations on the Navajo Nation along roadsides, homesite leases, and business site lease areas.</p>	 <p>Russ Kleinman</p>
<p><b>Tamarisk/Saltcedar</b> <i>(Tamarix ramosissima)</i></p> <p>TARA</p> <p>K'eilichii'its'óóz</p>	<p>Eurasia</p>	<p>Trees can grow to 20 ft tall with deciduous awl-like twig leaves that overlap with acute tips. Foliage is usually bluish-green with small flowers. Flowers are small and white to dark pink. Prolific seeders and able to reproduce vegetatively. (DiTomaso et al. 2013)</p>	<p>Outcompetes native riparian trees by forming deep root systems that access underground water not available to other species. Species can increase fire risk in riparian system by increasing flammable fuels (USFS 2005). Widespread on the Navajo Nation in riparian areas and washes where it alters stream flow, decreased habitat quality, and increased fire risk. Some populations have been impacted by the tamarisk leaf beetle (<i>Diorhabda</i> spp.), which defoliates large stands and increases fuel loads. Common along washes, roadsides, homesite leases, and business site lease areas.</p>	 <p>Steve Dewey, USU</p>
<p><b>Diffuse knapweed</b> <i>(Centaurea diffusa)</i></p> <p>CEDI3</p> <p>Ch'il lat'á dei nínigí</p>	<p>Mediterranean</p>	<p>Biennial or short-lived perennial forb forming 1 to 2 ft tall with a long single taproot. Leaves alternate and covered in short interwoven gray hairs. Upper leaves are entire and linear and lower leaves are longer and deeply pinnate-lobed. Flowers heads are spiny with comb-like phyllaries and white, pink, or pale purple flowers. Plants reproduce by seed only. (DiTomaso et al. 2013)</p>	<p>Seeds can remain viable for 12 years. Dead plants break off at ground level and form tumbleweeds that spread seeds. Can increase erosion and sedimentation while decreasing habitat and forage quality. Produces chemical compounds that inhibit growth of other species (USFS 2005). Can also hybridize with spotted knapweed. Widespread on Navajo Nation and found along roadsides, mining areas, and community areas.</p>	 <p>Matt Lavin</p>




Name	Origin	Description	Concerns	Photo
<p><b>Russian knapweed</b> <i>(Acroptilon repens)</i></p> <p>ACRE3</p> <p>Ch'ildích'l'ilibáhí</p>	<p>Central Asia</p>	<p>Deep-rooted perennial forb grows to 3 ft tall. Stems erect, branched, and covered with gray hairs. Leaves alternate and entire. Basal leaves are mostly oblong and longer than stem leaves, which are narrower. Old flower stems can persist for extended periods after senescence, forming thatch. Flowerheads hemispherical, in clusters, color white to lavender-blue. (DiTomaso et al. 2013)</p>	<p>Plants develop adventitious roots that enable the species to colonize areas quickly. Produces compounds that suppress the growth of native plants, allowing it to form dense monocultures. In two years, roots can grow 10 ft deep and 10 to 12 feet in diameter (USFS 2005). Found throughout the Navajo Nation on farms, rangeland, near waterways, and along roadsides.</p>	 <p>Patrick Alexander</p>
<p><b>Russian olive</b> <i>(Elaeagnus angustifolia)</i></p> <p>ELAN</p> <p>Tsin łibáhá</p>	<p>Asia</p>	<p>Large shrub to medium-sized tree with silvery foliage. Leaves alternate, simply, narrowly lanceolate to elliptical with smooth margins. Upper surface of leaf is grey-green and underside is silvery grey and covered in scales. Flowers are umbel-like clusters with small highly fragrant flowers. Plants mainly reproduce by seed.</p>	<p>Originally used as windbreaks and for erosion control, it was planted extensively throughout the southwestern United States. Invades riparian areas where it replaces native trees (USFS 2005). Has invaded several major washes and riparian areas on the Navajo Nation, including Long Canyon, Shonto Wash, Colorado Pueblo Wash, Fruitland, and streams and tributaries around Shiprock.</p>	 <p>John Randall, The Nature Conservancy</p>
<p><b>Johnsongrass</b> <i>(Sorghum halepense)</i></p> <p>SOHA</p> <p>Akál</p>	<p>Mediterranean</p>	<p>Erect perennial grass that grows to 2 - 8 ft tall. Base of stalks are reddish pink, leaves are 0.5 – in wide and 6 to 20 in long. Blades are flat with a distinctive white midvein. Inflorescence is a large open panicle, reddish to purple in color. Plants also have thick, fibrous rhizomes. (CDA 2009)</p>	<p>Spreads rapidly through seeds and rhizomes. Poses problems on disturbed sites and agricultural lands where it can hybridize with crops, such as sorghum. Leaves can produce a toxin that is poisonous to livestock if ingested (CDA 2009)</p>	 <p>Harry Rose, 2005</p>









**Category C Species**

Name	Origin	Description	Concerns	Photo
<p><b>Cheatgrass</b> <i>(Bromus tectorum)</i></p> <p>BRTE</p> <p>Shíyínáldzidí</p>	<p>Europe</p>	<p>Erect winter and spring annual grass growing around 2 ft tall, that typically droop to one side. Leaves covered in short, soft hairs. Florets have long awns. Flowers in spring and then become reddish purple.</p>	<p>Prolific seeder that increases in density with bare soil for germination. Increases fire frequency in areas where it invades, often in forests, near residential sites, and in open fields (USFS 2005). A widespread problem in southwestern United States with populations throughout the Navajo Nation. Known to invade rangelands and hiking and horse trails</p>	 <p><i>EnviroPlan Partners, 2017</i></p>
<p><b>Field bindweed</b> <i>(Convolvulus arvensis)</i></p> <p>COAR4</p> <p>Ch'il nat'oi ɫigáí</p>	<p>Eurasia</p>	<p>Hardy perennial creeping vine. Leaves are ovate to heart-shaped and green. Flowers are bell or trumpet-shaped and white to pink in color. Plants reproduce vegetatively and by seeds.</p>	<p>Spreads quickly with extensive rhizomes and rootstocks. Seeds have long dormancy period, lasting up to 60 years. Drought-tolerant and can outcompete native and desirable vegetation. Roots can penetrate fabric, plastic, and other barriers (UC IPM 2011). Widespread on the Navajo Nation, affecting rangeland, farmlands, and roadsides.</p>	 <p><i>EnviroPlan Partners 2017</i></p>
<p><b>Jointed goatgrass</b> <i>(Aegilops cylindrica)</i></p> <p>AECY</p> <p>Cl'oh athe ni'lí</p>	<p>Eurasia</p>	<p>Tall winter annual grass grows up to 20 in tall. Foilage looks like to winter wheat but blades, auricles, ligules, and leaf sheaths have evenly spaced fine hairs along the margins. Seedheads have spikelets arranged alternately along a zigzag rachis with seeds 1 to 5 in long. Seed heads turn red to purple at maturity. Seed break apart at joints. (DiTomaso et al. 2013)</p>	<p>Causes serious problems in agricultural fields, especially for grains, as it is very similar visually and genetically to winter wheat. Can hybridize with winter wheat and reduce overall crop yields (USFS 2017a). Has high silica content which accumulates into thatch that suppresses other species. Tough seedheads have long barbed awns that can injure livestock and survive field burns. (DiTomaso et al. 2013)</p>	 <p><i>Patrick Alexander</i></p>

Name	Origin	Description	Concerns	Photo
<p><b>Puncturevine</b> <i>(Tribulus terrestris)</i></p> <p>TRTE</p> <p>Ch'ilhoshiq Naakaibihosh</p>	<p>Southern Europe</p>	<p>Broadleaf summer annual that forms ground covering dense mats 2 to 3 ft in diameter. Green to reddish-brown stems that spread radially. Leaves are evenly pinnate-compound with 3 to 7 pairs of leaflets per leaf. Small solitary yellow flowers that develop 5-sided burs with two stout spines. Reproduces only by seed. (DiTomaso et al. 2013)</p>	<p>Burs can stick to passing animals, tires, and people. A prolific seeder, a single plant can produce thousands of seeds that persist for up to 20 years. Has a deep taproot, allowing it to outcompete other plants for water and nutrients. Harmful to animals both from injury and from toxins. Toxins are harmful to sheep and cattle (DiTomaso et al. 2013). Widespread on the Navajo Nation along roadsides, fields, disturbed sites, and near watering holes and windmills.</p>	 <p>Steve Dewey, USU</p>
<p><b>Rescuegrass</b> <i>(Bromus catharticus)</i></p> <p>BRCA6</p>	<p>South America</p>	<p>Cool-season annual bunchgrass that grow up to 3 ft tall. Openly branched seed heads with nodding appearance. Seed heads have many flattened flower spikelets, yellow in color. Stems robust, glabrous, and unbranched.</p>	<p>Used as forage in the southern U.S. but considered weedy in the U.S. and Mexico. Well adapted to warm climates and resistant to extreme cold. Found along roadsides, ditch banks, lawns, gardens, and small grained winter drops. Outcompete native vegetation, particularly in riparian areas. Seeds have barbed awns that adhere to clothing and animal fur and can be carried by wind, water, (Halvorson and Guertin 2003)</p>	 <p>Patrick Alexander</p>
<p><b>Ripgut brome</b> <i>(Bromus diandrus)</i></p> <p>BRDI3</p> <p>T'oh da a gighí</p>	<p>Eurasia and Africa</p>	<p>Cool season annual grass with sharp florets and straight awns. Leaves and leaf sheaths are covered in short, soft hairs. Florets have long awns with open, loose, nodding panicles.</p>	<p>Found along roadsides, field borders, disturbed areas, and native rangelands. Threat to wildlife where it replaces native bunchgrasses. Seeds have barbed awns that adhere to clothing and fur. Currently detected east of Chinle near Canyon de Chelly</p>	 <p>Joseph DiTomaso, UCD</p>

Name	Origin	Description	Concerns	Photo
<p><b>Smooth brome</b> (<i>Bromus inermis</i>)  BRIN2  Bijih t'óh</p>	<p>Eurasia</p>	<p>Sod-forming perennial cool-season grass that spreads by rhizomes. Can vary in height from 2 to 4 ft. Leaves frequently marked by a transverse wrinkle resembling a “W” a few inches from the tip. Flower heads are purplish-brown and produce semi-compact panicles that spread out with maturity. Flat compressed seeds are awn-less and 1/3 in long.</p>	<p>Plants spread by rhizomes and are best adapted to cooler climates but are drought tolerant and cold resistant. Can be used for forage and hay production but can become highly invasive, outcompeting more desirable native plants. Populations have been detected in the Chuska Mountains north of Long Lake and along Highway 134.</p>	 <p>Christian Fischer, 2011</p>
<p><b>Bald brome</b> (<i>Bromus racemosus</i>)  BRRA2</p>	<p>Eurasia</p>	<p>Annual grass with upright stem in clusters or tufts. Seeds are awn-less. Florets attached to main stem instead of axis of inflorescence.</p>	<p>Grows in agricultural fields, pastures, and disturbed areas. Can be grazed by livestock when young but dries up as it matures. Increases fire risk. Has been detected in Canyon de Chelly.</p>	 <p>Rutger Barendse, Saxifraga</p>
<p><b>Red Brome</b> (<i>Bromus rubens</i>)  BRRU2  Bi'zé yilwo' lichí'í</p>	<p>Mediterranean</p>	<p>Short-lived cool season annual grass with sharp florets and straight awns. Leaves and leaf sheaths covered in short, soft hairs. Red brome is shorter than cheatgrass, growing 1.5 ft tall with narrower leaf blades. Panicles are compact and dense and dark red. Becomes dark red when dried and mature.</p>	<p>Prefers open spaces in shrub and grassland communities. Creates fine fuels that decompose slowly and increase fire risk, intensity, and spread. Sharp awns injure wildlife and livestock, reduce available forage, recreational opportunity, wildlife diversity and habitat, and land values. Seed can adhere to clothing and fur and as well as wind, water (USFS 2017b). Detected on the Utah side of Lake Powell, near Antelope Pass, along Highway 160 outside Tuba City, and in western part of Canyon de Chelly.</p>	 <p>Ken Gishi, NRCS</p>

Name	Origin	Description	Concerns	Photo
<p><b>Spreading wallflower</b>  <i>(Erysimum repandum)</i></p> <p>ERRE4</p> <p>Bist'á azéé tsoh</p>	<p>Eurasia</p>	<p>Winter annual forb with stout stems 1-2 ft tall, square in cross-section. Grows in a single stem, with narrow linear leaves along the stems that wither when flowering. Flowers are an elongated cluster with four green sepals and four yellow petals. Petals are clawed with a white patch at the base. Fruits are green narrow pod about 3 in long and spreading. Deep stout taproot.</p>	<p>Commonly found among winter annual crops, along roadsides, and in disturbed sites (Hilty 2012). Some varieties can be herbicide resistant. Detected in Canyon de Chelly.</p>	 <p>Patrick Alexander</p>
<p><b>Horehound</b>  <i>(Marrubium vulgare)</i></p> <p>MAVU</p>	<p>Eurasia</p>	<p>Cool season perennial forb about 2 ft tall. Stems are densely hairy, thick, and square in cross-section. Leaves are aromatic, opposite, ovate to nearly round with round toothed margins. Upper and lower leaf surfaces are hairy. Flowers white to deep magenta grown in head-like whorls. Reproduces only by seed.</p>	<p>Colonizes fields and other open/disturbed areas. Establishes in infertile soils and often a primary colonizer on in eroded areas. Considered naturalized in much of the U.S. Can outcompete native vegetation and form dense stands in annual grasslands. Populations near Ganado, east of Lukachukai on BIA-13, and east of South Sheba Crater.</p>	 <p>Amy Smith Muisse, NMSU</p>
<p><b>California burclover</b>  <i>(Medicago polymorpha)</i></p> <p>MEPO3</p> <p>T'oh azee</p>	<p>Southern Europe</p>	<p>Forb grows as an annual or perennial in disturbed sites. Plants grow to 2 ft tall and likely prostrate. Leaves divide into 3 leaflets with reddish hue and serrated edges. Flowers small bright yellow clusters. Fruits tightly coiled pods with two to three rows of prickles.</p>	<p>While it can be used as forage, the prickly fruits can get caught in wool and animal fur. Tendency to spread quickly in poor and disturbed soils where it can outcompete native vegetation (UC IPM 2014). Detected in Canyon de Chelly in Canyon del Muerto.</p>	 <p>Forest &amp; Kim Starr, 2006</p>

Name	Origin	Description	Concerns	Photo
<p><b>Russian thistle</b> (<i>Salsola kali</i>, <i>S. collina</i>, <i>S. paulsenii</i>, <i>S. tragus</i>)</p> <p>SATR12</p> <p>Chi'ildeeníni</p>	<p>Eurasia</p>	<p>Warm-season annual forb growing between 0.5 to 4 ft tall. Densely branched, with globe-shaped habit and a deep taproot. Plants appear bluish-green with reduced, stiff, prickly upper stem leaves. Flowers are small and inconspicuous without petals and solitary on leaf axils.</p>	<p>Common in disturbed grasslands and desert communities, roadsides, railroad ROWs, trails, along streams and lakes, dry plains, agricultural fields, abandoned fields, waste lands, and overgrazed rangeland. When mature, can become tumbleweeds, spreading seeds across the landscape, persisting for years, collecting along waterways and fence lines, and creating a fire hazard. Ignited tumbleweeds carry fire across fire breaks to unburned areas. Produces oxalates and are toxic to livestock.</p>	 <p>National Park Service</p>
<p><b>Field brome</b> (<i>Bromus arvensis</i>)</p> <p>BRAR5</p>	<p>Eurasia</p>	<p>Winter annual grass that produces a dense, low leafy growth in the fall. Tillers profusely and produces seed heads in late spring and early summer. Seed stalks are 2 -3 ft tall. Extensive fibrous root system with short top growth. (NRCS 2002a)</p>	<p>Commonly planted as a winter cover crop, but can become invasive, displacing more desirable vegetation. Does well on medium textured soils that are moderately to well-drained. Sometimes identified as Japanese brome.</p>	 <p>Daderot</p>
<p><b>Kochia</b> (<i>Bassia scoparia</i>, <i>Kochia scoparia</i>)</p> <p>BASC5</p> <p>Ch'il nilt'qlí</p>	<p>Eurasia</p>	<p>Annual forb grows up to 7 ft tall. Foilage gray-green and covered in soft hairs. Leaves are mostly alternate, flat, linear-lanceolate turning reddish-brown as it matures. Has a deep taproot with several branched fibrous lateral roots. Flowers are inconspicuous and fruits have five thicken lobes and short horizontal wings.</p>	<p>Drought tolerant. Common in grasslands, pastures, prairies, roadsides, floodplains, riparian areas, and agricultural fields. Reduces crop yields, contaminates crops, and outcompetes native vegetation by releasing allelopathic chemicals into soils. If consumed in large quantities, can be toxic to livestock. Produces thousands of seeds and can become tumbleweeds, spreading seeds across the landscape.</p>	 <p>EnviroPlan Partners, 2016</p>

## Federal and Tribally Listed Species Descriptions

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### Federally Listed Species

**Brady Pincushion Cactus** (*Pediocactus bradyi*) is a small, semiglobose cactus, ranging from 2.5 to 5 cm in diameter. Suitable habitat consists 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 3,340 – 5,200 ft. in elevation. The species is known only from Coconino County, within the vicinity of the Marble Canyon rim. On the Navajo Nation it is found south of Lee's Ferry on the east side of the Colorado River, south to the vicinity of Sheep Springs Wash. There is potential for the species to exist from Lee's Ferry south and west to the Echo Cliffs, along tributary canyons of the Colorado River, south to Shinumu Wash (NNDFW 2020). Listed as Group 2 by NNDFW

**Mancos Milkvetch** (*Astragalus humillimus*) is a small, mat forming, perennial shrub with persistent spiny leaf stalks. It is best surveyed during the flowering period from April to early May but can be identified by an expert year-round. The species forms highly localized populations from 4 – 20 acres in size, typically found on large, nearly flat sheets of exfoliating whitish-tan colored sandstone, in small depressions and sand filled cracks on or near ledges and mesa tops. It can be found on the Navajo Nation 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. There is potential for the species to exist throughout the Four Corners area on all slickrock formations consisting of Point Lookout and Cliffhouse Sandstone, and possibly other related features (NNDFW 2020). Listed as Group 2 by NNDFW.

**Fickeisen Plains Cactus** (*Pediocactus pebblesianus ssp. fickeiseniae*) is a spherical, usually solitary cactus with stems ranging from 2.5-6.0 cm tall. It is best surveyed from late March to late April. Suitable habitat consists of soils overlain by Kaibab limestone in Navajoan desert or Great Plains grassland, as well as canyon rims and flat terraces along washes, typically with limestone chips scattered across the surface. Populations are known to occur between 4,000 and 6,000 ft. in elevation. This species is known from Arizona in Coconino County from House Rock Valley and Gray Mountain to the Little Colorado and Colorado Rivers. On the Navajo Nation, this cactus can be found between Gray Mountain and Bitter Springs at elevations between 4,000 and 6,000 ft. There is potential for the species to occur between Marble Canyon and Gray Mountain (NNDFW 2020). Listed as Group 3 by NNDFW.

**Mesa Verde Cactus** (*Schlerocactus mesae-verdae*) consists of mostly solitary stems, though it can be found in clusters; stems are oval to depressed-globose, 3 – 11 cm long, and up to 10 cm in diameter. It can only be surveyed during the flowering and fruiting period from April through May. Suitable habitat can be surveyed year-round and consists of salt-desert scrub communities, typically in the Fruitland and Mancos shale formations, but also in the Menefee Formation overlaying Mancos shale. It is most frequently found on the tops of hills or benches and along slopes, from 4,900 to 5,500 ft. in elevation. Appropriate Mesa Verde cactus habitat must have an

underlying layer of clay soils that can be overlain with either igneous or sedimentary gravel. On the Navajo Nation, it is found from the Colorado border south to near Naschitti, New Mexico. There is potential for the species to exist on the Navajo Nation only within its known distribution to the north, south, and west. The eastern limits are still unclear (NNDFW 2020). Listed as Group 2 by NNDFW.

**Rhizome Fleabane** (*Erigeron rhizomatus*) is an herbaceous perennial herb with creeping rhizomes, 25 – 45 cm tall. It is distinguished from other fleabane species by its rhizomatous habit, nearly hairless leaves and very few hairs on the stems and leaves. It is best surveyed during its flowering period between May and June but can be identified by an expert through July and possibly August. Suitable habitat can be identified year-round and consists of fine textured clay hillsides of mid to high elevation between ca. 7,000 and 8,300 ft. in elevation. It is known from clays derived from the Chinle Formation in the Zuni and Chuska Mountains, and to similar clays of the Baca Formation in the Datil and Sawtooth ranges in New Mexico. On the Navajo Nation, it has been recorded 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 pinion-juniper associations between Lupton in Apache County, Arizona and Prewitt in McKinley County, New Mexico (NNDFW 2020). Listed as Group 2 by NNDFW.

**Navajo Sedge** (*Carex specuicola*) is a perennial grass-like plant with a dried persistent leaf base. Positive identification of the plant is only possible during the flowering/fruitletting season, from late June through September; however, suitable habitat can be identified year-round. This sedge is typically found in seeps and hanging gardens on vertical sandstone cliffs and alcoves, from 4,600 ft. to 7,200 ft. in elevation. On the Navajo Reservation it has been 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. It is also known from Chinle Creek in San Juan County, Utah. Within the Navajo Nation, there is potential for the species to occur in northern Arizona and southeastern Utah, especially in hanging gardens of the San Juan River drainage and Lake Powell (NNDFW 2020). Listed as Group 3 by NNDFW.

**Welsh's Milkweed** (*Asclepias welshii*) is an herbaceous perennial herb with large oval soft woolly leaves and globular clusters of cream-colored flowers that are rose-hued in the middle. It is best surveyed from June through September. Suitable habitat consists of active sand dunes derived from Navajo sandstone in sagebrush, juniper, and ponderosa pine communities. On the Navajo Nation, the species can be found in Coconino County, north of Tuba City and south of Monument Valley in Navajo County and Apache County. There is potential for the species to exist on all active sand dunes between Page and Tuba City, east to the Chinle Creek drainage (NNDFW 2020). Listed as Group 3 by NNDFW.

## Navajo Listed Species

This section solely describes species listed by the Navajo Nation Department of Fish and Wildlife. Several species in Groups 1 and 2 are federally listed and described above.

### Group 2

**Cutler's Milk-vetch** (*Astragalus cutleri*) is a short-lived perennial, often flowering as an annual, growing 10-35 cm tall. Because this is primarily an annual plant, it can only be located during its flowering/fruitlet period, which is April through early June. Its habitat consists of warm desert shrub communities on sandy, seleniferous soils with level to moderate slopes on the Shinarump and Chinle Formations, from ca. 3,800 ft. in elevation. Within the Navajo Nation, it is found in Copper and Nokia Canyons; however, there is potential for the species to occur in canyons adjacent to Copper and Nokia Canyons, where there is suitable habitat (NNDFW 2020).

### Group 3

**Goodding's Onion** (*Allium gooddingii*) is an herbaceous perennial with an elongate bulb terminating in a thick iris-like rhizome. It is best surveyed from mid-July through August. Its habitat generally consists of spruce-fir forests and mixed conifer forests in the Chuska Mountains and also under Gambel oak thickets interspersed with aspen, dogwood, and Douglas fir. It is most often found in moist, shady canyon bottoms and north-facing slopes, often along streams, from 6,400 – 9,400 ft. in elevation. On the Navajo Nation, it is found in Canyon de Chelly, the Chuska Mountains in Apache County, Arizona and McKinley County and San Juan Counties in New Mexico. There is potential for the species to occur throughout the Chuska Mountains and the Defiance Plateau (NNDFW 2020). Species does have federal protection in U.S. Forest Service lands through a Cooperative Agreement but does not have federal protection for other lands per ESA.

**Aztec Gilia** (*Aliciella formosa*) is an herbaceous perennial distinguished by entire leaves and woody bases on older plants. It must be surveyed during the flowering/fruitlet period from late April to June. It is endemic to soils of the Nacimiento Formation in salt-desert scrub communities ranging from 5,000 to 6,400 ft. in elevation. On the Navajo Nation, it has been recorded in Kutz Canyon south of Bloomfield, New Mexico. There is potential for the species to exist south of Farmington and Bloomfield where the Nacimiento Formation occurs (NNDFW 2020).

**Alcove Death Camas** (*Zigadenus vaginatus*) is a stout perennial that sprouts from rhizomes. It is best surveyed from mid-July through August. Suitable habitat can be identified year-round. Habitat consists of hanging gardens, seeps, and alcoves, primarily on Navajo Sandstone. It is endemic to the Colorado Plateau in southern Utah and northern Arizona. On the Navajo Nation, it is known from 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 (NNDFW 2020).



**Marble Canyon Milkvetch** (*Astragalus cremnophylax* var. *hevroni*) is a dwarf, evergreen, perennial herb, which forms a mat less than 1.5 cm high. It is best surveyed from April to May but can be identified year-round by an experienced botanist. Suitable habitat can be identified year-round. 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 at ca. 5,000 ft. in elevation. The species is only known from the rim of Marble Canyon near Shinumo Wash. Specifically, it is known from the east rim of Marble Canyon from the Little Colorado River Gorge to Navajo Bridge (NNDFW 2020)

**Cronquist Milkvetch** (*Astragalus cronquistii*) is a perennial plant that sprouts from a taproot and underground root crown. It must be surveyed from May to June, when seedpods are present. Suitable habitat can be identified year-round. Habitat consists of salt desert shrub and blackbrush communities on sandy or gravelly soils derived from the Cutler and Morrison Formations or Mancos Shale, from 4,750 to 5,800 ft. in elevation. On the Navajo Nation, it is reported from south of Bluff, Aneth, and near the Utah border with Colorado. There is potential for the species to occur on the Navajo Nation in southeastern Utah (NNDFW 2020).

**Naturita Milkvetch** (*Astragalus naturitensis*) is a low-growing perennial best surveyed from late April through May when seed pods are present. Habitat consists of sand filled pockets on sandstone slickrock and rimrock pavement along canyons in the pinyon-juniper zone. Known populations occur between 5,000—7,000 ft. in elevation. 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 Utah. Within the Navajo Nation there is suitable habitat for the species north of I-40 in McKinley County to the Hogback in San Juan County (NNDFW 2020).

**Acoma Fleabane** (*Erigeron acomanus*) is a mat-forming perennial which sprouts from a taproot. It is best surveyed from June to August, though suitable habitat can be identified year-round. Suitable habitat consists of sandy slopes beneath sandstone cliffs of the Entrada Sandstone Formation in pinion-juniper woodland communities. Populations are known from ca. 7,000 ft. in elevation. On the Navajo Nation, it is documented north of Thoreau and north of Prewitt; however, there is potential for the species to exist north of I-40 in McKinley County (NNDFW 2020).

**Round Dunebroom** (*Errazurizia rotundata*) is a low, woody shrub reaching up to 30 cm in height. It is best surveyed from mid-April through September. 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 the semi-arid environment of the Great Basin Desert scrub. On the Navajo Nation, populations are known from sandy pockets between outcroppings of Moenave Sandstone, between 4,600 and 5,200 ft. in elevation. On the Navajo Nation this species has been found between Moenave and Willow Springs; however, suitable habitat exists between Gap, Arizona and Petrified Forest National Monument (NNDFW 2020).

**Navajo Penstemon** (*Penstemon navajoa*) is a short-lived perennial herb that grows between 20 and 45 cm tall. It is best surveyed from early July to early August, to ensure positive identification. Habitat consists of rocky, open places in ponderosa pine, aspen, and Douglas-fir communities ranging from 7,000 to 10,300 ft. in elevation. This plant is known only from the upper slopes of Navajo Mountain and upper Dark Canyon in San Juan County, Utah. There is potential for the species to occur on the upper slopes of Navajo Mountain and, potentially, on the upper elevations of Skeleton Mesa (NNDFW 2020).

**Alcove Rock Daisy** (*Perityle specuicola*) is a perennial herb reaching 50 – 70 cm in height. Identification of this plant is only possible from late July through September. Habitat consists of hanging garden communities between 3,690 and 4,000 ft. in elevation. 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 (NNDFW 2020).

**Navajo Bladderpod** (*Lesquerella navajoensis*) is a cushion-forming herbaceous perennial which grows from a thick taproot. Surveys for this plant should take place during the flowering period from May to early June. 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 pinion-juniper communities. On the Navajo Nation, it is found in New Mexico on mesa rims northwest of Thoreau and Continental Divide, in the Chuska Mountains at Todilto Park; in Arizona it is known 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 (NNDFW 2020).

**Alcove Bog-orchid** (*Platanthera zothecina*) is a perennial orchid with erect stems 15 to 60 cm tall. It must be surveyed during the flowering period, between July and August, for positive identification. Suitable habitat consists of seeps, hanging gardens, and moist stream areas within desert shrub, pinion-juniper, and ponderosa pine/mixed conifer communities. Known populations occur between 4,000 and 7,200 ft. in elevation. Within the Navajo Nation, the plant has been documented in the headwaters of Oljeto Wash, Tsegi Canyon watershed, hanging gardens surrounding Navajo Mountain, and Chinle Wash drainages. There is potential for the species to occur in appropriate habitat within the Navajo Nation in northern Arizona and San Juan County, Utah (NNDFW 2020).

**Brack's Hardwall Cactus** (*Sclerocactus cloverae* ssp. *Brackii*) Cactus growing in solitary cylindrical stems 3-8 cm tall and 2-7 cm in diameter. Central spines are straw-colored to grown in clusters of 4-5 with the lower spine hooked. Flowers are purple 2.5 -3.5 cm long and 1.5 to 3

cm in diameter, appearing in late May. Grows in desert scrub and scattered juniper communities in the sandy clay hills of the Nacimiento Formation at 5,000 – 6,000 ft. On the Navajo Nation, it occurs south of the San Juan River. Also known as Clover's cactus.

#### Group 4

**San Juan Milkweed** (*Asclepias sanjuanensis*) is a perennial herb, 4-8 cm tall, which forms a woody taproot. It is distinguished from other milkweeds in its range by its greenish white petals. It is best surveyed from April through June. Habitat consists of primarily sandy or sandy loam soils in pinion-juniper woodlands and Great Basin grassland communities. Known populations occur from 5,000 to 6,200 ft. in elevation, often in disturbed sites. On the Navajo Nation, it is recorded from east of Highway 491 south of the San Juan River, and just south of the San Juan County line. There is potential for the species to occur on the Navajo Nation within suitable habitat throughout San Juan and McKinley Counties in New Mexico (NNDFW 2020).

**Heil's Milkvetch** (*Astragalus heilii*) is a tufted, low perennial best surveyed from mid-May through June. The species' habitat consists of rocky ledges of the Mesa Verde Group in pinion-juniper communities at ca. 7,200 ft. On the Navajo Nation, it is only documented from its type locality near Borrego Pass (NNDFW 2020).

**Navajo Saltbush** (*Atriplex garrettii* var. *navajoensis*) is a deciduous shrub growing up to 1.5 m in height. It is best surveyed from August through November. The species' habitat consists of salt desert shrub communities between 3,000 and 4,000ft. in elevation. It grows on Moenkopi Shale, often overlain with a Kaibab Limestone. On the Navajo Nation, it is located on the east side of Marble Canyon from Lee's Backbone to Jackass Canyon; however, there is potential for the species to 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 (NNDFW 2020).

**Atwood's Camissonia** (*Camissonia atwoodii*) is a winter annual herb that sprouts from a taproot. Surveys must occur during the flowering months from September to November for positive identification. 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. The species is endemic to the Last Chance drainage in Kane County, Utah. It has not been reported on the Navajo Nation; however, there is appropriate habitat along shores and drainages of Lake Powell (NNDFW 2020).

**Rydberg's Thistle** (*Cirsium rydbergii*) is a perennial herb ranging from 100 cm to 300 cm in height. It is best surveyed during the flowering and fruiting season from late spring through September and October. Suitable habitat consists of hanging gardens, seeps, and sometimes stream banks below hanging gardens, between 3,300- 6,500 ft. in elevation. On the Navajo Nation, the species occurs in southern San Juan County, Utah and in Coconino and Apache Counties in Arizona (NNDFW 2020).

**Utah Bladder-fern** (*Cystopteris utahensis*) is a fern consisting of creeping stems. The best time to survey is from June through August; however, the plant can be identified anytime there are fertile fronds. Habitat consists of seeps, cracks, and ledges on cliffs formed from calcareous substrates including sandstone, limestone, and dacite. Populations are known from 4,200 to 8,800 ft. in elevation. On the Navajo Nation, it is only found within Canyon de Chelly National Monument (NNDFW 2020).

**Sivinski's Fleabane** (*Erigeron sivinskii*) is a perennial herb that sprouts from a thick taproot. For positive identification of this species, surveys must occur during the flowering and fruiting period from May through June. Habitat consists of steep, barren, shale slopes of the Chinle Formation, in pinion-juniper woodland and Great Basin desert scrub communities. Known populations occur from 6,100 to 7,400 ft. in elevation. 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, there is potential for the species to exist north of I-40 in New Mexico and in the Chuska Mountains (NNDFW 2020).

**Sarah's Buckwheat** (*Eriogonum lachnogynum var. sarahiae*) is a perennial herb reaching 10 cm in height which grows in dense clusters and mounds. It is best surveyed from May through July. Suitable habitat consists of windswept mesa tops in pinion – juniper communities between 5,900- 7,500 ft. in elevation. This species is endemic to the Owl Rock Member of the Chinle Formation, topped by Todilto limestone. Only a few plants have been recorded on the Navajo Nation in the vicinity of Red Valley, north of Red Lake. There is potential for the species to exist in the Chuska Mountains between Lupton, Arizona and Prewitt, New Mexico (NNDFW 2020).

**Bluff Phacelia** (*Phacelia indecora*) is a 3-14 cm tall annual with spreading stems. It must be surveyed in May or June for positive identification. Suitable habitat consists of salt desert communities between 3,600 ft. and 4,500 ft. in elevation. This species is endemic to San Juan County, Utah, and has not been documented on the Navajo Nation; however, there is potential for it to occur within the San Juan River drainage (NNDFW 2020).

**Cave Primrose** (*Primula specuicola*) is a perennial herb that forms basal rosettes and grows to a height of 30 cm. It is best surveyed during the flowering season from March through April but can be identified by an expert year-round. 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. In the Grand Canyon it is known from seeps in Kaibab and Redwall limestone. On the Navajo Nation, it has been documented in the Chinle Wash area and in canyons surrounding Navajo Mountain. There is potential for the species to occur in any of the hanging gardens in the Chinle Wash drainage and in canyons north and south of Navajo Mountain (NNDFW 2020).

**Marble Canyon Dalea** (*Psoralea arborescens* var. *pubescens*) is a shrub ranging from 40 – 100 cm tall with small indigo flowers, linear leaflets, and distinctive seed pods with large round discrete blister glands. It is best surveyed during the flowering and fruiting season in May and June. Suitable habitat consists of mixed desert shrub communities growing on soils derived from the Moenkopi Formation between 3,400 – and 4,900 ft. in elevation. On the Navajo Nation, it has been recorded in the Navajo Springs area south of Navajo Bridge. Within the Navajo Nation, there is potential for the species to occur from Lees' Backbone to Bitter Springs (NNDFW 2020).

**Parish's Alkali Grass** (*Puccinella parishii*) is a many-stemmed annual grass growing 5 – 28 cm tall. For positive identification, this species must be surveyed from mid-April to early June. Suitable habitat includes alkali seeps, springs, and seasonally wet areas such as washes. Populations are known to occur between 5,000 and 7,200 ft. in elevation. Within the Navajo Nation, this species has been documented in Utah in San Juan County northeast of Beclabito and in the vicinity of Two Grey Hills. There is potential for the species to exist anywhere on the Navajo Nation in alkali seeps, springs, or seasonally wet areas (NNDFW 2020).

**Arizona Rose Sage** (*Salvia pachyphylla* ssp. *eremopictus*) is a many-branched spreading shrub growing 35-50 cm tall with showy, bright violet flowers. It is best surveyed in the flowering period from mid-July to October but can be identified by an experienced individual year-round. Habitat consists of desert shrub lands and pinion-juniper communities on basalt or soils derived from the Chinle Formation, between 5,500 and 6,500 ft. in elevation. On the Navajo Nation, it is often found along the base of volcanic plugs, mesa tops, and slopes. It has been found north of Dilkon in Navajo County. There is potential for the species to 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 (NNDFW 2020).

**Welsh's American-aster** (*Symphyotrichum welshii*) is an herbaceous perennial growing 30 – 100 cm tall. It is best surveyed during the flowering period from August to October. Suitable habitat consists of wet meadows, seeps, springs, and hanging gardens between 4,300 and 8,000 ft. in elevation. On the Navajo Nation, it is only known from one population in the Tsegi watershed in northern Navajo County. Within the Navajo Nation there is potential for it to occur in northern Coconino and Navajo Counties (NNDFW 2020).

## Native Species Related to Candidate Noxious Weed Species for Biocontrol

This section outlines native species that occur on the Navajo Nation that may be closely related to those proposed for control through biological agents. This analysis was done by identifying species in the same genus as the exotic species based on county occurrence data provided by the USDA NRCS PLANTS Database (<https://plants.sc.egov.usda.gov/java/>). Under the IWMP, agencies should survey for these related native species prior to implementing biological control treatments.

**Leafy Spurge**                      *Euphorbia esula*  
**Family**                              *Euphorbiaceae*  
**Genus**                                *Euphorbia*

### NATIVE RELATED SPECIES

Common Name	Scientific	T&E	County
Marble Canyon spurge	<i>Euphorbia aaron-rossii</i>		Coconino
Snow on the prairie	<i>Euphorbia bicolor</i>		NM State presence
Blackseed spurge	<i>Euphorbia bilobata</i>		Cibola
Horned spurge	<i>Euphorbia brachycera</i>		All
Mountain spurge	<i>Euphorbia chamaesula</i>		Coconino, Navajo, Apache
Chinese caps	<i>Euphorbia crenulata</i>		AZ State
Hairy-fruit spurge	<i>Euphorbia cuphosperma</i>		Apache
Toothed spurge	<i>Euphorbia dentata</i>		Coconino, Apache
Beetle spurge	<i>Euphorbia eriantha</i>		NM State presence
Squareseed spurge	<i>Euphorbia exstipulata</i>		Coconino, Cibola, Sandoval
Huachaca Mountain spurge	<i>Euphorbia macropus</i>	x	Sandoval
Snow on the mountain	<i>Euphorbia marginata</i>		San Juan (NM)
Woodland spurge	<i>Euphorbia palmeria</i>		Coconino
Mojave spurge	<i>Euphorbia schizoloba</i>		Coconino, Navajo
Warty spurge	<i>Euphorbia spathulata</i>	x	Apache, McKinley, San Juan (NM & UT)

**Yellow starthistle**                *Centaurea solstitialis*  
**Family**                              *Asteraceae*  
**Genus**                                *Centaurea*

### NATIVE RELATED SPECIES

Common Name	Scientific	T&E	County
American star-thistle	<i>Centaurea americana</i>		Navajo, Apache

**Dalmatian toadflax**      *Linaria dalmatica*  
 Family                      *Scrophulariaceae*  
 Genus                        *Linaria*

**NATIVE RELATED SPECIES**

Common Name	Scientific	T&E	County
None identified			

**Spotted knapweed**      *Centaurea maculosa*  
 Family                      *Asteraceae*  
 Genus                        *Centaurea*

**NATIVE RELATED SPECIES**

Common Name	Scientific	T&E	County
American star-thistle	<i>Centaurea americana</i>		Navajo, Apache

**Diffuse knapweed**      *Centaurea diffusa*  
 Family                      *Asteraceae*  
 Genus                        *Centaurea*

**NATIVE RELATED SPECIES**

Common Name	Scientific	T&E	County
American star-thistle	<i>Centaurea americana</i>		Navajo, Apache

**Russian knapweed**      *Acroptilon repens*  
 Family                      *Asteraceae*  
 Genus                        *Acroptilon*

**NATIVE RELATED SPECIES**

Common Name	Scientific	T&E	County
None identified			

**Field bindweed**      *Convolvulus arvensis*  
 Family                      *Convolvulaceae*  
 Genus                        *Convolvulus*

**NATIVE RELATED SPECIES**

Common Name	Scientific	T&E	County
Texas bindweed	<i>Convolvulus equitans</i>		Coconino, Navajo, Apache, San Juan (NM)

**Puncturevine**                    *Tribulus terrestris*  
**Family**                         *Zygophyllaceae*  
**Genus**                         *Tribulus*

**NATIVE RELATED SPECIES**

Common Name	Scientific	T&E	County
<i>None identified</i>			



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