Viability Analyses for Vascular Plant Species within Prescott National Forest, Arizona

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Compiled January 2011 with
January 2014 updates
for

Forest Plan Revision
Environmental Impact Statements

Part 1. Description of Ecological Context (Adapted from: Ecological Sustainability Report, Prescott National Forest, Prescott, Arizona, April 2009)

Description of the Planning Unit

Prescott National Forest (PNF) includes mostly mountains and associated grassy valleys of central Arizona that lie between the forested plateaus to the north and the arid desert region to the south. Elevations range between 3,000 feet above sea level along the lower Verde Valley to 7,979 feet at the top of Mount Union, the highest natural feature on the Forest.

Roughly half of the PNF occurs west of the city of Prescott, Arizona, in the Juniper, Santa Maria, Sierra Prieta, and Bradshaw Mountains. The other half of the PNF lies east of Prescott and takes in the terrain of Mingus Mountain, the Black Hills, and Black Mesa.

The rugged topography of the PNF provides important watersheds for both the Verde and Colorado Rivers. Within these watersheds are many important continuously or seasonally flowing stream courses and drainages. A portion of the Verde River has been designated as part of the National Wild and Scenic Rivers System.

Vegetation within PNF is complex and diverse: Sonoran Desert, dominated by saguaro cacti and paloverde trees, occurs to the south of Bradshaw Mountains; and cool mountain forests with conifer and aspen trees occur within as few as 10 miles upslope from the desert . In between, there are a variety of plant and animal habitats including grasslands, hot steppe shrub, chaparral, pinyon-juniper woodlands, and ponderosa pine forests.

There are eight designated wilderness areas comprising more than 104,000 acres, located entirely or partially within the PNF. Portions of the PNF are located less than 90 miles from the Phoenix metropolitan area – a source of regional haze and wind-borne pollutants.

The degree to which the PNF can provide for a diversity of ecosystems and species relative to the surrounding area is known as ‘ecological niche’. The ecological niche of the PNF can be defined by its location within the broader landscape and by examining the various ecological communities and processes that are represented within and outside the boundaries of the planning unit. Using the national ecological hierarchy, ecosystems can be mapped and described as a series of nested units based on similar environmental factors.

Ecoregions are areas of regional extent that share common climatic and vegetation characteristics. Areas within an ecoregion are sub-divided into provinces. *Provinces* are controlled primarily by continental weather patterns such as length of dry season and duration of cold temperatures. Provinces are also characterized by similar soil orders and dominant potential natural vegetation. Figure 2 shows the location of the PNF in relation to the ecological provinces identified for the state of Arizona.

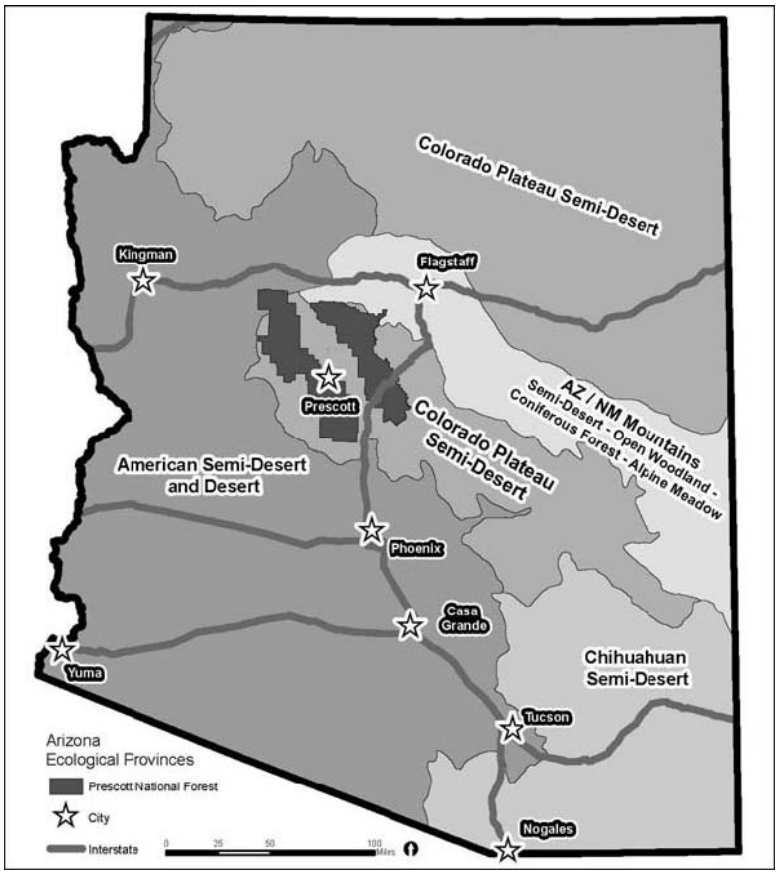

Figure 2. The ecological provinces of Arizona

Areas within a province are sub-divided into sections. *Sections* describe broad areas of similar sub-regional climate, geologic origin, composition, and development, local topography, and drainage networks. Figure 3 identifies the nine ecological sections nested within the four provinces of Arizona. For example, the Colorado Plateau Semi-Desert province includes the Grand Canyon, Painted Desert, Navajo Canyonlands, and Tonto Transition sections. As shown in figure 3, almost all PNF lands (92 percent) are found in the Tonto Transition section of the Colorado Plateau Semi-Desert province. The remaining portion of the PNF (eight percent) is shared between the Mojave Desert and the White Mountains-San Francisco Peaks-Mongollon Rim ecological sections.

This means that the primary niche of the PNF is providing sustainable conditions for the ecological communities and processes that represent the Tonto Transition and secondarily protecting the additional ecosystem diversity within the PNF as represented by the other two ecological sections.

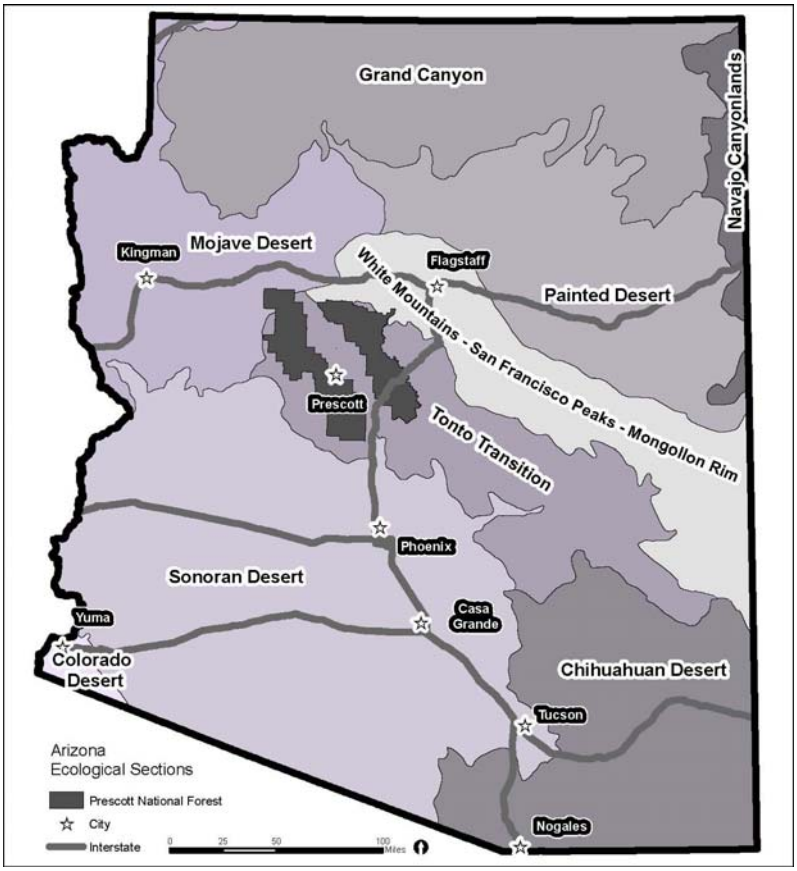

Figure 3. Ecological sections associated with the PNF

Ecological Sections

The following paragraphs characterize the three ecological sections found on the PNF and surrounding landscapes and are summarized in Table 1 below.

Table 1. Proportion of PNF lands within the ecological sections of central Arizona.

Ecological Section Name	Section	Total Section Acres	Off-PNF Acres	PNF Acres	PNF Percent
Tonto Transition	313C	7,555,169	6,402,655	1,152,514	15.3
White Mountains-San Francisco Peaks-Mogollon Rim	M313A	13,475,096	13,405,710	69,386	0.5
Mojave Desert	322A	33,376,908	33,342,889	34,019	0.1
Grand Totals:		54,407,173	53,151,254	1,255,919	2.3

Tonto Transition Section (describes 92% of PNF)

Geomorphology. The Tonto Transition section is located in the highlands of central Arizona below the Colorado Plateau and above the basins of the Sonoran Desert. Volcanic activity and sedimentary deposition were major geomorphic processes. Lava flows, plugs, dikes, and relatively flat sedimentary deposits resulted. Major landforms are mountains, hills, scarps, and some plains. Major landform features include the Mazatzal Mountains, Black Hills, Aquarius Mountains, Bradshaw Mountains, and the Superstition Mountains. Elevation ranges from 3,000 to 7,400 ft (915 to 2,255 m).

Climate. Precipitation ranges from 10 to 25 in (250 to 635 mm) annually, with more than half of the precipitation falling during the winter. Winters are mild below about 6,800 ft (2,075 m) and cold at higher elevations. The growing season lasts 70 to 170 days.

Vegetation. Vegetation consists of interior chaparral (mix of deciduous and evergreen shrubs) on coarse igneous parent materials and steep slopes. There are pinyon-juniper woodlands on elevations higher than about 4,200 ft (1,280 m); ponderosa pine occurs in frigid and limited mesic soil temperature regimes at higher elevations. Low elevation vegetation consists of semi-arid grasslands and desert shrub-scrub communities.

Disturbances. The natural fire frequency is highly variable, ranging from 2 to 100 years, depending on aspect, elevation, soil moisture, and plant composition. Flash floods and droughts are common.

White Mountain-San Francisco Peaks-Mogollon Rim Section (describes 5% of PNF)

Geomorphology. Located on the Colorado Plateau, this section is in central and eastern-central Arizona and west-central New Mexico. Geomorphic processes active in this section involve recent volcanism, including basaltic lava flows, cinder cone eruptions, and volcanic ash. Major landforms include mountains, plains, plateaus, and hills. Major landform features include the San Francisco Mountains, White Mountains, and Jemez and Mogollon Mountains. Elevation ranges from 6,000 to over 12,600 ft (1,820 to 3,860 m).

Climate. Precipitation ranges from 20 to over 32 in (500 to over 800 mm) annually, with more than half of the precipitation falling during the winter. The growing season ranges from less than 50 to 110 days, and winters are cold.

Vegetation. Plant communities vary over a soil temperature and moisture

gradient with ponderosa pine and Gambel's oaks on the relatively warm and dry sites; white fir and Douglas-fir forests on cool, moist sites; and Engelmann spruce and corkbark fir on the coldest, wettest sites.
Disturbances. Natural fires occurred in ponderosa pine about every 3 to 10 years, but have mostly been prevented during the 20th century. This has led to a higher canopy cover and increased fuel loads, resulting in a less resilient ecosystem and increased hazard of wildfire.

Mohave Desert Section (describes 3% of PNF)

Geomorphology. This area comprises widely separated short ranges in desert plains located in Nevada, Utah, California, and in a small portion of west-northwest Arizona. It contains isolated mountains, plateaus, alluvial fans, playas, basins, and dunes. Elevation ranges from 300 ft below sea level (Death Valley) to 11,000 ft above sea level (-91 to 3,344 m).

Climate. Precipitation ranges from 3 to 10 in (80 to 250 mm). It mostly occurs as scattered high intensity storms of short duration. The growing season lasts 200 to 300 days.

Vegetation. Plant communities include creosote bush, blackbush, greasewood and saltbush on basins, plains, and hills; Joshua tree-dominated communities occur on plains and hills; and basin sagebrush, western juniper and pinyon pine communities occur on mountains.

Disturbances. Areas with less than about 8 in (200 mm) of rainfall rarely support enough vegetation to carry a fire. Fire occurrence in areas receiving more than about 8 in (200 mm) has been influenced by introduced grasses. Fires are variable in frequency and intensity. Flash floods are commonly associated with the irregular occurrence of precipitation events. Table 1 displays the relationship of the PNF to the three ecological sections found in central Arizona. Overall, the sections total nearly 54.4 million acres (column three). The PNF occupies only 2 percent of these three sections as presented in column six.

Potential Natural Vegetation Types (PNVT)

The sustainability of vegetation and soil resources was assessed by evaluating ecosystem characteristics within the above-mentioned ecological sections using potential natural vegetation types (PNVTs). PNVTs are coarse-scale groupings of non-contiguous land that share similar aspect, elevation, vegetation, soil parent material, and historic disturbances such as fire, frost and drought cycles, and insect and disease outbreaks at a landscape scale.

PNVTs represent the vegetation type and characteristics that would occur when natural disturbance regimes and biological processes prevail. It is important not to confuse PNVTs with existing vegetation types. The PNVT classifications weredeveloped from data available in the Terrestrial Ecosystem Survey of the Prescott NF (Robertson et al., 2000) and from information on vegetation dynamics and natural variability compiled by The Nature Conservancy1 and the Landscape Fire and Resource Management Planning Tools Project2 (commonly called LANDFIRE).

Initial identification and classification of PNVTs resulted in 13 categories as reported in the Prescott NF Ecological Sustainability Report (Forest Service, 2009). Additional data gathering and assessment since 2009 resulted in a refinement of the PNVT classification for the Prescott NF. Based on updated midscale vegetation inventory, field visits, data review, and bio-physical model fitting, the number of PNVTs identified on the Prescott NF was adjusted from 13 to 10. Table 2 lists these 10 PNVTs and their proportional area.

Refinements in the identification and classification of PNVTs included:

- The Colorado Plateau Grassland PNVT also known as Colorado Plateau/Great Basin Grassland3 was shortened in name to Great Basin Grassland PNVT to acknowledge the fact that the Prescott NF does not reside on the Colorado Plateau. The Riparian Forest PNVT4 was renamed Riparian Gallery Forest PNVT in recognition of the long and narrow patterns that this PNVT forms along perennial and intermittent streams found on the Prescott NF.
- The Mixed-Conifer with Frequent Fire PNVT (6,600 acres) was combined with the Ponderosa Pine Forest PNVT because they are described by the same biophysical setting model (e.g., vegetation structure and disturbance regime) developed by the Nature Conservancy5. The Ponderosa Pine Forest PNVT was later renamed as Ponderosa Pine-Gambel Oak PNVT.
- The Mixed-Conifer with Aspen PNVT (80 acres) was determined to be a mis-identification and the acres were added to the Ponderosa Pine-Gambel Oak PNVT.

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1 http://azconservation.org/downloads/category/southwest_regional/

2 www.landfire.gov

3 LANDFIRE biopysical setting model #1511350 “Inter-Mountain Basins Semi-Desert Grassland”

4 LANDFIRE biophysical setting model #1511552 “North American Warm Desert Riparian Systems”

5 TNC biophysical setting model “Ponderosa Pine/Bunchgrass”

- The Madrean Encinal Woodland PNVT (5,500 acres) map units were grouped with adjoining PNVT units because of concerns about their identification. Most of the indicator species describing this PNVT, with the exception of the Mexican pines, were observed during field visits to the small and scattered map units assigned to this PNVT. These units were found to be interspersed with Interior Chaparral and Ponderosa Pine-Evergreen Oak PNVTs, suggesting the possibility that multiple fire disturbance regimes existing in close proximity to one another could account for the observed variations in vegetation composition and structure. There is uncertainty in how much the observed vegetation structure may reflect recent land use and/or disturbance history versus the presence of a distinct PNVT. Until additional information is available to address the uncertainty associated with identification of the Madrean Encinal Woodland PNVT, it was decided to manage the vegetation of these map units based on their adjoining PNVT.

Table 2. Potential Natural Vegetation Types (PNVTs) of the Prescott NF

PNVT Name	**Prescott National Forest**	
	Acres	Percent
Semi-Desert Grassland	125,712	10 %
Great Basin Grassland	38,389	3 %
Juniper Grassland	137,274	11 %
Piñon-Juniper Evergreen Shrub	463,296	37 %
Interior Chaparral	315,445	25 %
Ponderosa Pine-Evergreen Oak	63,539	5 %
Ponderosa Pine-Gambel Oak	49,052	4 %
Piñon-Juniper Woodland	36,263	3 %
Desert Communities	5,919	< 1 %
Riparian Gallery Forest	12,439	1 %
Total	**1,247,328**	**100 %**

Potential natural vegetation types within Prescott National Forest and occurrences of vascular plant taxa for which there is a viability concern

Following are descriptions of the number and diversity of vascular plant taxa (species, varieties, and subspecies) of viability concern (VPTVC) within each of the vegetation types listed in Table 2. It should be noted that occurrences of plant species in general are more a function of habitat type (primarily topography, substrate, percent canopy, and proximity to water) than to vegetation types (See Table 5, page 68, for a summary of VPTVC associated with habitat types within PNF).

Semi-Desert Grasslands

Semi-desert grassland is often difficult to define because of human-caused changes over the past two centuries. Much of the semi-desert grassland, such as tobosa grassland, has been converted into scrubland with juniper and mesquite at higher elevations and creosote-cactus scrub at lower elevations. Fortunately, the most important habitat within semi-desert grassland, the Verde Formation, appears to been affected less than habitats with more fertile substrates, at least with respect to the occurrence of VPTVC. A large percentage of the Verde Formation within the PNF supports one or more VPTVC. The small amount of Verde Formation within PNF combined with the large number of VPTVC that occur there highlight the importance of management within the Verde Formation. A more detailed account of the Verde Formation and recommended conservation strategies is provided under Habitats of Special Concern, page 67.

Great Basin and Pinyon Juniper Grasslands

Grasslands within PNF are the most variable of the vegetation types, especially in terms of values of vegetation parameters, including plant cover and diversity. Several VPTVC are represented in PNF grasslands, some of which could be indicators of grassland health as measured in terms of total diversity and abundance of organisms, and annual production of biomass. To date, there is little or no evidence that management efforts to facilitate the viability of VPTVC within grasslands is incompatible with efforts to maintain or increase grazing potential.

Certain substrates and topographies within the grasslands of PNF, notably calcareous alluvial soils and cobbly ridges and hillsides, support the majority of VPTVC.

Pinyon-Juniper Evergreen Shrub and Pinyon-Juniper Woodlands

In general, these habitats support little plant diversity except where they possess rare to infrequent habitat types, such as cliff faces and riparian areas. Several VPTVC occur primarily within both of these habitat types.

Interior Chaparral

Interior chaparral within PNF supports a low diversity of plant species and is not the primary habitat for any VPTVC. To date, there are no occurrences of VPTVC within the habitat, and there are only two taxa for which their occurrence is either likely or possible.

Ponderosa Pine-Evergreen Oak and Ponderosa Pine Gambel Oak Forests

None of these vegetation types support a high diversity or abundance of VPTVC except where there are infrequent habitat types. Most of the VPTVC that occur in PNF forests are associated with riparian areas; moist, north-facing slopes; and rock faces, ledges, and outcroppings.

Desert Communities

There are no VPTVC that are known to occur within the true desert communities of PNF (excluding disclimax grassland).

Riparian Forest

Several VPTVC are associated with riparian forests within PNF, although most records are from where there is a fairly open canopy. Based on the habitat descriptions for records, the occurrences of VPTVC is related more to the presence of perennial water flow and less so to the presence of the riparian forest.

Part 2. Identification of vascular plant taxa for which there is a viability concern

Of the 55 vascular plant taxa (including species, varieties and subspecies) listed as a species of conservation concern (Species of Concern or Interest in the Prescott National Forest Ecological Sustainability Report) within the Prescott National Forest, 24 species are considered to have a viability concern. The remaining 31 taxa do not have an immediate viability concern because they re geographically widespread and common; have not yet been found within Forest boundaries; and/or occur in naturally well-protected habitats or in habitats resistant to grazing, fire, and other potential threats. Specific reasons for excluding these 31 taxa as viability concerns are given in Appendix A. In general, these species should remain on species of conservation concern lists and considered as target species whenever general rare plant surveys are conducted.

In 2014, one additional plant taxa was assessed in response to updates to the Regional Forester's sensitive species list for the National Forests within Arizona and New Mexico, published in the fall of 2013. Information about Greene milkweed (*Ascepias uncialis*) was added to Table 3 below and Appendix A of this report.

Table 3. Vascular plant taxa of conservation concern for Prescott National Forest, from: Prescott National Forest Ecological Sustainability Report 2009 (table updated in 2014)

Taxon	Common name	Immediate viability concern	Justification
Abronia nana	Dwarf sand verbena	No	Widespread and fairly common, collected only once in PNF but at edge of range
Agastache rupestris	Thread-leaf giant-hyssop	No	Locality uncertain in PNF, widespread in AZ, NM
Agave phillipsiana	Phillip's agave	Yes	Geographically limited, few individuals
Agave delamateri	Tonto basin agave	Yes	Geographically limited, few individuals
Allium bigelovii	Bigelow's onion	No	None, widespread in AZ, NM; habitat non-specific
Anulocaulis leiosolenus var. *leiosolenus*	Southwestern ringstem	Yes	Limited habitat and small populations
Apodanthera undulata	Melon-loco	No	Apparently a Chihuahuan Desert species that occurs in PNF at the edge of its range
Arenaria aberrans	Mt. Dellenbaugh sandwort	Yes	Limited range
Asclepias unicialis	Greene milkweed	No	Natural rarity/limited range Not yet found in Yavapai County

Table 3. Vascular plant taxa of conservation concern for Prescott National Forest, from: Prescott National Forest Ecological Sustainability Report 2009 (table updated in 2014)			
Taxon	**Common name**	**Immediate viability concern**	**Justification**
Astragalus troglodytus	Creeping milk-vetch	Yes	Limited distribution, sporadic occurrence
Astragalus calycosus var. scaposus	King's milk-vetch	No	Many collections from AZ, NM, UT; common over large range
Carex ultra	Cochise sedge	No	Has not been found on Forest
Cleome lutea var. jonesii	Jones' spider-flower	No	Widespread in AZ, somewhat weedy in nature
Cupressus arizonicus (pygmy)	Arizona cypress pygmy form	No	Occurs within habitat that is not threatened by human or natural disturbances
Cystopteris utahensis	Utah bladder fern	Yes	Widespread over several states but considered rare
Desmodium metcalfei	Metcalfe's ticktrefoil	Yes	Limited range and distribution
Draba asprella var. stelligera	Rough whitlow-grass	No	Has not been found on the Forest but needs taxonomic verification
Echinocereus yavapaiensis	Yavapai claret-cup	No	Occurs primarily in protected habitats; common and abundant within its limited range.
Ephedra fasciculata	Nevada Mormon-tea	No	Widespread and common
Erigeron saxatilis	Cliff Fleabane	No	Occurs primarily in protected habitats
Erigeron anchana	Mogollon fleabane	No	Has not been found on Forest
Eriogonum corymbosum var. glutinosum	Wild buckwheat	No	Has not been found on Forest
Eriogonum ripleyi	Ripley's wild-buckwheat	Yes	Limited range and habitat
Eriogonum ericifolium (*E. ericifolium* var. *ericifolium*)	Heathleaf wild buckwheat	Yes	Limited range and habitat
Eriogonum pulchrum (*E. ericifolium* var. *pulchrum*)	Yavapai wild buckwheat	No	Has not been found on Forest
Eriogonum arizonicum	Arizona wild-buckwheat	Yes	Limited range and distribution and populations on somewhat restricted soil types
Eriogonum heermannii var. floccosum	Heermann's woolly wild-buckwheat	No	Occurs on protected habitat or at least where there are probably no conservation options
Fremontodendron californicum	California flannelbush	No	Although rare within PNF, wide ranging elsewhere; occurs in chaparral and is fire-tolerant
Hedeoma diffusum	Flagstaff pennyroyal	Yes	Limited range, populations in PNF may represent a new species

Table 3. Vascular plant taxa of conservation concern for Prescott National Forest, from: Prescott National Forest Ecological Sustainability Report 2009 (table updated in 2014)			
Taxon	**Common name**	**Immediate viability concern**	**Justification**
Heuchera novamexicana	New Mexico alum-root	Yes	Widespread in NM but very limited in AZ
Heuchera eastwoodiae	Eastwood alum-root	Yes	Limited range and habitat
Lepidium montanum var. *glabrum*	Mountain pepperweed	No	Has not been found on Forest
Leptodactylon caespitosum (var. or sp. nov.)	Matted prickly-phlox	No	Occurs primarily in protected habitats
Lesquerella arizonica (*Physaria arizonica*)	Arizona bladderpod	No	Has not been found on Forest
Lesquerella cinerea (*Physaria cinerea*)	Basin bladder-pod	Yes	Limited range and habitat
Lesquerella pinetorum (*Physaria pinetorum*)	White Mountain bladderpod	Yes	Widespread in AZ, NM but not common
Lotus mearnsii var. *mearnsii*	Mearns lotus	Yes	Limited range and habitat
Lupinus latifolius ssp. *leucanthus*	Broadleaf lupine	Yes	Llimited distribution and habitat, current habitat fragile
Margaranthus solanaceus	Netted globecherry	No	Although rare within PNF, wide ranging especially in SE AZ
Mertensia macdougalii	Macdougal's bluebells	Yes	Limited distribution, many collections but often from same locality
Nicotiana quadrivalvis var. *bigelovii*	Native tobacco	No	Not known to occur on Forest land, widespread in CA, OR
Pediomelum mephiticum (PNF populations = *P. verdiensis*)	Skunk-top scurfpea	Yes	Limited range and habitat, PNF populations being described as a new species
Penstemon oliganthus	Apache beardtongue	No	Fairly widespread with many localities, 1 locality within PNF but at SW edge of range
Penstemon nudiflorus	Flagstaff beardtongue	No	Limited distribution but common within its range, especially within PNF
Perityle congesta	Compacted rock daisy	No	Has not been found on Forest
Phacelia rupestris	Rock scorpionweed	No	Rare in AZ but widespread in NM, TX, and Mexico
Phlox amabilis	Arizona phlox	Yes	Limited range and distribution
Polygala rusbyi	Hualapai milkwort	Yes	Limited range and distribution
Puccinellia parishii	Parish's alkali grass	No	Has not been found on Forest
Salvia dorrii ssp. *mearnsii*	Mearns sage	Yes	Limited range and distribution
Sporobolus interruptus	Black dropseed	Yes	Limited distribution, possible importance as grazing indicator
Stachys rothrockii	Rothrock's hedge-nettle	No	Has not been found on Forest

Table 3. Vascular plant taxa of conservation concern for Prescott National Forest, from: Prescott National Forest Ecological Sustainability Report 2009 (table updated in 2014)			
Taxon	**Common name**	**Immediate viability concern**	**Justification**
Talinum validulum	Western flame-flower	No	Occurs primarily in habitats little effected by grazing, fire, and other potential threats
Thelypodiopsis ambigua var. *ambigua*	Long Valley tumblemustard	No	Has not been found on Forest
Thelypteris puberula	Showy maidenfern	No	Not known to occur within PNF
Triteleia lemmoniae	Oak creek triteleia	Yes	Limited range and distribution

3. Life history, distribution and abundance, habitats, and potential threats for species for which there is a viability concern

Agave delamateri

Species overview

Populations of this species are largely clonal and thought to have originally been cultivated by pre-European cultures (Hodgson 1999). This brings into question its taxonomic validity and suggests that populations in the United States represent gametes brought from other regions (probably Mexico). The cultural significance of the species, therefore, may exceed its biological significance.

Life history

Agave delamateri is a long-lived perennial with a basal rosette of semi-succulent leaves. Stems generally take ten or more years to flower and then the central shoot dies. Clonal offshoots from the stem, however, continue to mature and produce additional offshoots. A single clone, therefore, lives indefinitely until it is killed by disease or some other natural or human-caused occurrence. Seeds for the species are unknown and, with without sexual reproduction, the species is almost certainly an evolutionary dead end. Gene flow, however, may occur between individuals of this species and *A. chrysantha*, which suggests that pollen of the former is viable (Hodgson 1999). In general, the nectar of agave flowers is an important food source for bats.

Distribution and abundance

The species is endemic to Coconino, Gila, Maricopa, Pinal and Yavapai counties, Arizona with 101 occurrences listed in Seinet and two localities from additional sources. The total distribution range for *Agave delamateri* is 180 km. In Coconino County there are four localities (two of which are clones with same locality data) in the southern portion ranging only 5 km; in Gila County there are 51 occurrences in the west-central portion, ranging 50 km; in Maricopa County there are three occurrences in the northern portion, ranging only 1km; and in Yavapai County there are 36 occurrences in the eastern portion, ranging 60 km. The remaining four collections do not have locality data.

Five locations are listed for PNF ranging 61km, with two locations within a meter of each other.

Habitat

Individuals of the species occur along drainages and ridges; with substrates including granite, red-brown silt, sandstone, limestone, and basalt rocks. Elevation ranges between 370m (1200ft) and 1601m (5250ft) with a mean elevation of 981m (3220ft). Vegetation types include high desert, desert grasslands, desert scrub, Juniper grassland, piñon-juniper woodland, and riparian areas.

Known and potential threats

There is no mention of threats for the species in Seinet. Agaves in general, however, are favorite food for javelina. Fire may be a threat in areas where vegetation is relatively dense. Given that the plants are probably subject to herbivory and the lack of seed production, the few individuals that occur within the Forest will probably be extirpated, if not through herbivory, then through attrition. How long these clones will survive in the wild is highly speculative and may range between a few years to a few centuries.

Recommended conservation strategies

1. Surveys for new individuals

Surveys within the general area of occurrence in the Forest would help determine a better estimate of individuals. Because new individuals may be found, this may be an important step prior to any further conservation or monitoring efforts.

2. Propagation from offshoots

Propagation from offshoots would be simple and ramets could be planted at various easily monitored sites. Since individuals often produce a large number of offshoots, there would probably be little damage to the longevity of the plant if some were taken for purposes of propagation. Clones could be established in test plots and public gardens in order to insure the genetic survival of the species. Although transplanting rare species is not generally recommended, this species may be an exception owing to its suspected history as a cultivar.

3. Javelina deterrents

Because deterring javelina may not be practicable, individuals of *Agave delamateri* within the Forest should first be monitored in order to determine whether there indeed is a problem. The purpose of fencing off individuals would be to deter herbivores such as javelina. Since there are only a few individuals known within the Forest, the amount of fence would not be extensive. Because of the cultural significance of the species, it may be possible to commandeer volunteers from, for example, the Highlands Center. The fence recommended by the Arizona Game and Fish Department is an electric one and, therefore, probably not practical for several reasons on Forest lands. Anti-javelina pellets are also available from nurseries.

4. Fire management

In the unlikely event that monitoring suggests fire may damage individuals, then it may be useful to remove some of the vegetation in the vicinity of the agave plants. Since these agaves generally occur in areas of sparse vegetation, efforts would probably be minimal.

Recommended monitoring

After surveys have been done to determine whether additional clones exist within the Forest, occasional monitoring of individuals (every 5-10 years) would help determine the rate of attrition within the Forest and, therefore, aid in conservation efforts. Initial baseline data that would be helpful would include locations and number of individuals; stage of maturation (presence or absence of flowering stalks); presence or absence of seeds (presently unknown); evidence of herbivory, disease, die-off caused by drought or fire; evidence of off-road vehicle travel or other human disturbances.

References

Hodgson, W. 1999. Agavaceae, agave family, part one. Journal of the Arizona-Nevada Academy of Science 32(1):1-21.

Agave phillipsiana

Species overview

Like *Agave delamateri*, populations of this species are largely, if not entirely clonal, and were probably brought into the region as cultivars (Hodgson 2001). Thus, many of the processes associated with the evolution and geographic distribution of natural populations are lacking in *A. phillipsiana* as well.

Life history

Agave phillipsiana is a long-lived perennial with a basal rosette of semi-succulent leaves. Stems generally take ten or more years to flower and then the central shoot dies. Clonal offshoots from the stem, however, continue to mature and produce additional offshoots. A single clone, therefore, lives indefinitely until it is killed by disease or some other natural or human-caused occurrence. Flowers open in September. Capsules and seeds were unknown when the species was published (Hodgson 2001).

Distribution and abundance

The species is endemic to Yavapai, Coconino, and Gila County, Arizona with 38 occurrences listed in Seinet. The total distribution range for *Agave phillipsiana* is 314 km. In Coconino County, there are 15 localities in the northwest portion ranging 56 km; in Yavapai County, 21 localities in the northeast to the south-central portion of ranging 89 km, and in Gila County, two localities in the west-central portion ranging 21 km. Individuals per site vary from one to few with probably fewer than 100 individuals known for the species.

Within the PNF, clones of this species occur primarily south of Wilhoit along the Hassayampa River and its tributaries. Twelve occurrences are spread over a distance of less than five km with some within 100 meters of one another. Clones of *A. delamateri* have been confused with those of *A. phillipsiana* and sightings south of Wilhoit listed as *A. delamateri* are probably for those of *A. phillipsiana*.

Habitats

Individuals of the species occur on slopes, hilltops, and ridgelines; with substrates including granitic grus, and limestone or Basalt rocks. In elevation, they range between 700m (2290ft) and 1500m (4920ft) with a mean of 1120m (3650ft). Vegetation types include desert scrub, desert grassland, open piñon pine grassland, and Juniper grassland.

Known and potential threats

There is no mention of threats for the species in Seinet. Agaves in general, however, are favorite food for javelina. Fire may be a threat in areas where vegetation is relatively dense. Given that the plants are probably subject to herbivory and the lack of seed production, the few individuals that occur within the Forest will probably be extirpated, if not through herbivory, then through attrition.

Recommended conservation strategies

1. Surveys for new individuals

Surveys within the general area of occurrence in the Forest would help determine a better estimate of individuals. Because new individuals may be found, this may be an important step prior to any further conservation or monitoring efforts.

2. Propagation from offshoots

Propagation from offshoots would be simple and ramets could be planted at various easily monitored sites. Since individuals often produce a large number of offshoots, there would probably be little damage to the longevity of the plant if some were taken for purposes of propagation. Clones could be established in test plots and public gardens in order to insure the genetic survival of the species. Although transplanting rare species is not generally recommended, this species may be an exception owing to its suspected history as a cultivar.

3. Javelina deterrents

Because deterring javelina may not be practicable, individuals of *Agave phillipsiana* within the Forest could first be monitored in order to determine whether there indeed is a problem. The purpose of fencing off individuals would be to deter herbivores such as javelina. Since there are only a few individuals known within the Forest, the amount of fence would not be extensive. Because of the cultural significance of the species, it may be possible to commandeer volunteers from, for example, the Highlands Center. The fence recommended by the Arizona Game and Fish Department is an electric one and, therefore, probably not practical for several reasons on Forest lands. Anti-javalina pellets are also available from nurseries.

4. Fire management

In the unlikely event that monitoring suggests fire may damage individuals, then it may be useful to remove some of the vegetation in the vicinity of the agave

plants. Since these agaves generally occur in areas of sparse vegetation, efforts would probably be minimal.

Recommended monitoring

After surveys have been done to determine whether additional clones exist within the Forest, occasional monitoring of individuals (every 5-10 years) would help determine the rate of attrition within the Forest and, therefore, aid in conservation efforts. Initial baseline data that would be helpful would include locations and number of individuals; stage of maturation (presence or absence of flowering stalks); presence or absence of seeds (presently unknown); evidence of herbivory, disease, die-off caused by drought or fire; evidence of off-road vehicle travel or other human disturbances.

References

Hodgson, W. C. 2001. Novelties in American Agave (Agavaceae). Novon,11 (4) 410-416.

Anulocaulis leiosolenus var. leiosolenus

Species overview

This is a taxonomically unique species and, although is one of the species that occurs on the Verde Formation, it is also known from a variety of other soils. It is a tall herb with large basal leaves and a few smaller stem leaves. The branches of the inflorescence are long and thin, bearing scattered large delicate white to pink flowers with long pink-purple stamens.

Life history

Anulocaulis leiosolenus var. *leiosolenus* is probably a long-lived perennial herb from a large vertical tuberous taproot. The flowers emerge between late spring and early fall and, like many species within the family, are closed during mid-day.

Distribution and abundance

Populations of the taxon occur in Coconino, Mohave, and Yavapai counties, Arizona, westward into Nevada and eastward into New Mexico, Texas, and Chihuahua (Brian 2000). There are only twelve occurrences listed in Seinet. In Coconino County there are five occurrences in the west-central portion, ranging 109km, there is one occurrence on the east-central border of Mohave and Coconino counties, and in Yavapai County there are five occurrences in the east-central portion, ranging 39km, Two occurrences are recorded for PNF near road 136 near Lucky Canyon, 6km SW of Camp Verde (Seinet, Envirosystems Management, Inc. 2003).

Habitats

In Arizona, individuals occur on east-facing slopes; with substrates including calcareous clays and shales, gypsum, talus, limestone, zoraster granite, gray-white volcanic tuft, and vishnu schist. Elevation ranges between 390m (1300ft) and 1500m (4920ft) with a mean elevation of 947m (3110ft). Vegetation types include desert scrub and desert riparian, and *Aristida purpurea* grassland.

Known and potential threats

Because of it uniqueness, the species tends to be overcollected by botanists. This threat is exacerbated by the fact that there are often only a few individual per population. Species in the family are generally subject to herbivory. Because of its delicate nature, individuals of this taxon are particularly susceptible to herbivory and physical damage from human activities.
Since, at least within PNF, it is known only to occur in the Verde Formation, threats to this habitat apply to this species (See discussion under habitats, p. 59).

Recommended conservation strategies

Like other taxa that occur primarily on the Verde Formation, conservation of habitat is of primary concern to the viability of the populations. For a more detailed account of the Verde Formation (p. 59)

1. Surveys for new individuals

Surveys within areas where the Verde formation occurs in the Forest would help ascertain the presence of any additional populations. Surveys for individuals of this taxon can be conducted concurrently with those for other taxa that occur within similar habitat.

2. Prevention of off-road vehicle traffic

Impediments to off-road use in areas where individuals of the taxon occurs are of primary importance. Closing two-tracks and minor Forest roads with large boulders and/or other vehicle-proof structures at access points may be effective in this regard. Signs suggesting alternate and legal ORV areas in the vicinity may be useful.

4. Grazing management

Although restricting cattle grazing may benefit populations of the taxon, wasted efforts in this regard may be avoided if populations are first monitored in order to ascertain if grazing is indeed a negative influence. In addition, if cattle are eating the plants, then other animals are probably eating them as well. If elk, for example, are impacting the site, then stronger fencing may need to be erected.

4. Fire management

Although historically habitats within the Verde Formation are not subject to fire, in years where non-native weeds, such as *Bromus rubens* (cheatgrass), are abundant, fire may be a problem. During such years, removal of weeds near individuals of *Anulocaulis* may be preventative.

Recommended monitoring

Baseline data that recorded the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. The interval of monitoring may also depend on baseline data. For example, if individuals of *Anulocaulis* appear to be healthy with no impacts, then monitoring could probably done less frequently.

References

Brian, Nancy J. 2000. A field guide to the special status plants of Grand Canyon national Park. Science Center, Grand Canyon National Park, Arizona.

Envirosystems Management, Inc. 2003. Rare plant and noxious weed survey on the Verde Ranger District, Prescott National Forest.

Flora of North America Editorial Committee. 2003. Flora of North America. 4:29-30

Arenaria aberrans

Species overview

This species belongs to a somewhat taxonomically ambiguous group and, therefore, data should be regarded as tenuous until adequate diagnostic characters become available. In Kearney and Peebles (1960) the species is separated from its relatives by the bluntness of its sepals.

Life history

Very little is known about the life history of this perennial herb. The flowers are rather showy (ca. 1cm broad) and are open during the day from May to July (Kearney & Peebles 1960).

Distribution and abundance

The species is endemic to Apache, Coconino, Gila Mohave, and Yavapai counties with 25 occurrences listed in Seinet and four localities listed from additional sources. The total distribution range for *Arenaria* aberrans is 414km. In Apache County there is one occurrence in the south-central portion; in central Coconino County there are seven occurrences, ranging 85km, in central-west Gila County there is a single occurrence; in central Yavapai County there are 13 occurrences, ranging 99km; and in Mohave County there are two occurrences, ranging 151km. The remaining five collections do not have locality data. Six locations are found in PNF ranging 47km, with three locations are within 1km of each other.

Habitats

Populations of the species tend to occur on south, north and northeast-facing slopes; with substrates including granite, Quaternary alluvial, basaltic soil, rich organic soil, and sandy soils. Elevation ranges between 1694m (5557ft) and 2772m (7325ft) with a mean elevation of 2232m (7325ft). Vegetation types include chaparral, oak woodland, sagebrush community, and pine forest.

Known and potential threats

Most populations are recorded from habitats where fire is common but the effects of fire on the species are unknown. Being primarily herbaceous, plants are probably grazed by cattle.

Recommended conservation strategies

1. Identification criteria

Because the species appears morphological similar to its closest relatives, such as *A. eastwoodiae*, which also occur within the Forest, good diagnostic descriptions, including photographs would enable personnel to more easily identify the species.

2. Surveys for new individuals

Surveys for the species within in the Forest would help ascertain the presence of any additional populations. Because taxonomic identification is difficult, populations within the Forest presently thought to be *Arenaria aberrans* should be verified, then specific habitat criteria from those populations could be used to identify other potential areas of occurrence.

3. Fire management

Habitats where *Arenaria aberrans* occurs are subject to fire but the effects of fire on the species are undocumented. Initial and repeat monitoring may provide some insight into whether fire management would enhance the viability of this species.

4. Grazing management

Although the habitat for this species suggests that grazing probably does not impart a negative influence on populations, impacts of grazing should be tested through initial monitoring efforts.

5. Prevention of off-road vehicle traffic

As with grazing, this species occurs within habitats where off-road travel would not generally affect plants.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire,

and other factors would be useful in determining better regime of conservation strategies. The interval of monitoring may also depend on baseline data. For example, if individuals of *Arenaria aberrans* appear to be healthy with no impacts, then monitoring could probably done less frequently.

References

Arizona Game and Fish Department. 2004. Plant abstract for *Arenaria aberrans*. Phoenix, Arizona.

Kearney, Thomas H., and Robert H. Peebles. 1960. Arizona Flora. University of California Press, Berkeley, California.

Astragalus troglodytus

Species overview

A low herbaceous perennial with a loose rosette of basal leaves ca. 10cm long. It is a distinct species that is easily identified by its lack of an elongated stem, simple hairs, large (to 12mm) red-purple flowers, and the one-celled, nearly spherical fruits that occur in a cluster at the end of the fruiting stalk (Arizona Game and Fish Department 2004).

Life history

Individuals occur in local populations that are often widespread from one another. It is unknown whether this is a short-lived or long-lived perennial. Flowers develop from April to August.

Distribution and abundance

Astagalus troglodytus is endemic to Coconino and Yavapai Counties, Arizona, ranging only 140km; 48 occurrences are listed in Seinet and four localities listed from additional sources. In Yavapai County, there are ten occurrences in the central and east-central portions, ranging 133km; in southern Coconino County there are 42 occurrences, ranging 70km. Three locations are recorded from PNF within 1km of each other.

Habitats

Individuals of the species tend to occur on flats and southeast-facing slopes; with substrates including basalt rocks, gravel, other volcanic materials,

rocky malapai soil, clay, sand, and loam. Elevation ranges between 1280m (4200ft) and 2400m (8198ft) with a mean elevation of 1889m (6199ft). Vegetation types include *Bouteloua gracilis* grassland, pine forests, piñon-juniper forests, and chaparral.

Known and potential threats

There are probably few, if any threats to populations of this species. Because of its low habit, it is probably not heavily grazed and belongs to a genus that is generally not palatable to cattle. Fire may have some effects on populations but individuals often occur in rocky substrate where fires are not prevalent.

Recommended conservation strategies

1. Surveys for new individuals

Surveys for the species within in the Forest would help ascertain the presence of any additional populations. Because the habitat for *Astragalus troglodytus* is widespread, surveys specific to the species should be done in the general vicinity of the known populations within the Forest.

2. Fire management

Habitats where *Astragalus troglodytus* occurs are subject to fire but the effects of fire on the species is undocumented. Initial and repeat monitoring may provide some insight into whether fire management would enhance the viability of this species.

5. Prevention of off-road vehicle traffic

Since habit for the species is often in level area with few trees and shrubs, off-road travel could impact individuals. Initial monitoring efforts may shed light on whether off-road vehicle travel has a negative impact on the viability of the species. If there are signs of off-road vehicle damage, then closing minor Forest roads or restricting nearby woodcutting activities may reduce effects.

4. Grazing management

Although species of this genus are not generally palatable to cattle, impacts of grazing should be considered during initial monitoring efforts.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weed infestation, fire, and other factors would be useful in determining better regime of conservation strategies. Although the interval of monitoring may depend on baseline data, every three to five years would probably suffice for this species.

References

Arizona Game and Fish Department. 2004. Plant abstract for *Astragalus troglodytus*. Pheonix, Arizona.

Cystopteris utahensis

Species overview

A fairly distinctive fern, which was recently described (1991), is distinguished from its relatives by having elongate triangular leaves to 45cm long that are minutely glandular; dark brown somewhat lattice-like rhizome scales; and green or straw-colored petioles (Flora of North America Editorial Committee 1993).

Life history

A delicate perennial herb spreading by rhizomes. The leaves die back in winter or during times of drought.

Distribution and abundance

A fairly wide-ranging species occurring in Utah (Grand, Kane, Utah and Washington counties), Arizona, Colorado (Moffat Co., Dinosaur National Monument), and disjunct in western Texas, and New Mexico (Arizona Game and Fish Department 2005). There are 44 records of the species in Seinet with a range of 630km. In Arizona there are 33 localities ranging 369km; in north-central Apache County there are seven occurrences ranging 30km; in central and southern Coconino County there are 25 localities; and in northwest Yavapai County, there is one occurrence. The one occurrence in Yavapai County is from the northwest end of Juniper Mountain Wilderness Area and is the only site known for PNF.

Habitats

Individuals of the species tend to occur on west and north-facing slopes, ledges, crevices, cliff bases, seeps and rocky washes; with substrates including limestone, sandstone, dacite, talus deposits, limestone, chert, and silt. Elevation ranges between 1300m (4265ft) and 2615m (8580ft) with a mean elevation of 1975m (6422ft). Vegetation types include oak-Juniper woodlands, riparian areas, hanging garden communities, spruce and fir forest in seeps, and *Bouteloua grassland*.

Known and potential threats

There are no known threats for this species. The population in PNF occurs in rock crevices at the base of a limestone cliff where grazing would be limited.

Recommended conservation strategies

1. Identification criteria

Because the species appears morphological similar to other ferns that occur within the Forest, good diagnostic descriptions, including photographs would enable personnel to more easily identify the species.

2. Surveys for new individuals

Surveys for the species within in the Forest would help ascertain the presence of any additional populations. Because the habitat for *Cystopteris utahensis* is widespread, surveys specific to the species should be done in the general vicinity of the known population within the Forest.

3. Fire management

Habitats where *Cystopteris utahensis* occurs are probably not frequented by fire. Monitoring, however, may provide some insight into whether fire management would enhance the viability of this species.

4. Grazing management

Although the habitat for this species suggests that grazing probably does not impart a negative influence on populations, impacts of grazing should be tested through initial monitoring efforts.

5. Prevention of off-road vehicle traffic

As with grazing, this species occurs within habitats where off-road travel would not generally affect plants.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. Although the interval of monitoring may depend on baseline data, every three to five years would probably suffice for this species.

References

Arizona Game and Fish Department. 2005. Plant abstract for *Cystopteris utahensis.* Phoenix, Arizona.

Flora of North America Editorial Committee. 1993. Flora of North America. 2:267

Desmodium metcalfei

Species overview

A fairly distinctive herbaceous perennial with thin weak stems, small pink-purple flowers, and fruits that stick to socks and other means of dispersion. The leaves are trifoliate and mostly without hairs.

Life history

This low (generally less than 10cm tall) perennial often occurs in patches in the shade of riparian areas. The flowers emerge between August and October.

Distribution and abundance

The species has a wide range from Arizona to New Mexico and south into Sinaloa, Mexico, ranging over 1300km. There are16 occurrences listed in Seinet (15 in Arizona). In Arizona, it ranges over 450km; in Cochise County there are three occurrences in the central to south portion, ranging 113km; in south

Coconino County, there is one locality; in Gila County there are five localities in the central and northern portions, ranging 135km, in southwest Pima County there is one locality; in Santa Cruz County there are three localities in the central and southwest portions, ranging 35km, and in southern Yavapai County there is one locality. There is one collection in Seinet that does not have locality data. The one occurrence in Yavapai County is southeast of Crown King in the Bradshaw Mountains and is also the only location known in PNF.

Habitats

Populations of the species tend to occur along washes; with substrates including limestone, granite, and limy shale. Elevation ranges between 822m (2700ft) and 2438m (8000ft) with a mean elevation of 1630m (5350ft). Vegetation types include ponderosa forest, riparian areas, grasslands, mixed evergreen/oak/riparian area, and mesquite washes.

Known and potential threats

Although there are no known threats to the species, very little is known about the autoecology of its populations. *Desmodium* is often considered a weed because of the fruits that cling to clothing.

Recommended conservation strategies

1. Surveys for new individuals

Surveys for the species within in the Forest would help ascertain the presence of any additional populations. Because the habitat for *Desmodium metcalfei* is widespread, surveys specific to the species should be done in the general vicinity of the known population within the Forest.

2. Fire management

Habitats where *Desmodium metcalfei* occurs are subject to fire but the effects of fire on the species is undocumented. Initial and repeat monitoring may provide some insight into whether fire management would enhance the viability of this species.

3. Grazing management

Although riparian habitats often incur heavy grazing, which could have a negative impact on populations, impacts of grazing should be tested through initial monitoring efforts. If grazing does negatively affect the viability of the species, then removing cattle from the drainage may be an option.

4. Prevention of off-road vehicle traffic

As with grazing, this species occurs within habitats where off-road travel may affect plants. Blocking access for motor vehicles to the drainage(s) where populations of *Desmodium metcalfei* occur may facilitate the viability of the species.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. The interval of monitoring may also depend on baseline data. For example, if individuals of *Desmodium metcalfei* appear to be healthy with no impacts, then monitoring could probably done less frequently. Considering the exceptionally wide range of the species, preserving populations on the Forest may not greatly facilitate the viability of the species as a whole.

References

Bleakly, David. 2009. New Mexico Rare Plant Taxon Report for Desmodium metcalfei. New Mexico Rare Plant Technical Council, New Mexico.

Eriogonum arizonicum

Species overview

Eriogonum arizonicum is not an official species of concern for the State of Arizona. It is a small perennial herb and, except for being confused with a more rare species, *E. capillare*, it is fairly distinctive.

Life history

Its small stature would suggest that individuals are short-lived. Flowers emerge March through June and again in August through November, depending

on rains. Although it is a perennial, individuals may flower their first year (Flora of North America Editorial Committee 2005).

Distribution and abundance

Endemic to Arizona, *Eriogonum arizonicum* has a range of 369km in Coconino, Gila, Maricopa, Mohave, Pima, Pinal, and Yavapai counties. There are 49 occurrences listed in Seinet and six localities listed from additional sources. In west-central Coconino County there is a single occurrence; in central Gila County there are two occurrences within a range of 1km; in northeast Maricopa County, there are twelve localities, ranging 74km; in southeast Mohave County there are five occurrences ranging 15km, in east-central Pima County there is one occurrence; in east-central Pinal County there are nine occurrences from the northern to the southeastern portion, ranging 114km, and in Yavapai County there are ten occurrences in the central and eastern portions, ranging 104km. There are nine collections from Seinet that do not have adequate locality data. Within PNF there are five occurrences ranging 81km, with the closest two locations within 8km of each other.

Habitats

Populations of the species tend to occur on north, west and east-facing slopes, along washes, and above underground springs; with substrates including gravel, sand, cobble, basaltic hills, limestone, volcanic tuff, and agglomerate. Vegetation tends to be short and sparse. Elevation ranges between 390m (1300ft) and 3600m (11000ft) with a mean elevation of 1874m (6150ft). Vegetation types include southern desert scrub, chaparral, riparian, and roadsides.

Known and potential threats

The primary threat to individuals of the species is probably off-road traffic, since populations are often in areas where vegetation cover is low. For the same reason, fire is probably not a concern since there would be little fuel to carry it. Areas where the species occurs do not appear to be heavily grazed.

Recommended conservation strategies

1. Prevention of off-road vehicle traffic

Impediments to off-road use in areas where individuals of the species occurs may prove necessary depending on data gathered during initial monitoring efforts. The closing two-tracks and minor Forest roads with large boulders and/or other vehicle-proof structures at access points may be effective in this regard. For roadside populations, such management may be counter-productive, since individuals of *Eriogonum arizonicum* would probably not have been there in the first place if were not for the road. After initial observations of a population in question, it may be surmised whether the road or the plant population occurred first.

2. Fire management

Since habitats where *Eriogonum arizonicum* occur are generally not subject to fire, it may be expedient to consider fire management only after any effects of fire are documented by monitoring of populations.

3. Grazing management

As with fire, since habitats where *Eriogonum arizonicum* occur are generally not subject heavy grazing, it may also be expedient to consider range management only after any effects of cattle grazing are documented by monitoring of populations.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. Although the interval of monitoring may depend on baseline data, every three to five years would probably suffice for this species.

References

Flora of North America Editorial Committee. 2005. Flora of North America. 5:392

Eriogonum ericifolium

Species overview

A distinctive perennial herb that looks like a stunted heather. Until recently, the species was thought to include *E. ericifolium* var. *pulchrum* but the

authority has recently elevated the latter to its own species, *E. pulchrum*. In any case, the two taxa are very distinct from one another, the leaves of *E. ericifolium* being glabrous on the upper surface and those of *E. pulchrum* short floccose. There are no populations of *E. pulchrum* known from PNF.

Life history

Individuals occur in sometimes dense and very localized populations. Flowers emerge between August and November. The leaves remain green throughout the winter. In terms of number and distribution of populations, this may be the rarest species that occurs on the Forest.

Distribution and abundance

The species is endemic to Mohave, and Yavapai counties, Arizona, with 12 occurrences listed in Seinet and 13 localities listed from additional sources. The total distribution rang for *Eriogonum ericifolium* is 219km with, one locality is located in the northern portion of Mohave County, and the remaining 22 localities are located in the eastern portion of Yavapai County ranging 31km. One location is found in PNF, in the White Hills, SE of Cottonwood.

Habitats

Individuals of the species tend to occur on north, west and south-facing slopes, along washes, and in shallow pockets of sandy soil; with substrates including gravel, sand, basalt, limestone, sandstone, chert, silt, and calcareous substrate. Elevation ranges between 1067m (3500ft) and 1770m (5807ft) with a mean elevation of 1418m (4635ft). Vegetation types include high desert, and piñon Juniper woodlands. In PNF, the population occurs on the Verde Formation.

Known and potential threats

There are no known threats and few potential threats for the species. Since, at least within PNF, it is known only to occur in the Verde Formation, threats to this habitat apply to this species (See discussion under habitats).

Recommended conservation strategies

Like other taxa that occur primarily on the Verde Formation, conservation of habitat is of primary concern to the viability of the populations. Fortunately, since populations include large numbers of individuals, occasional mortality of a few individuals would probably not be as important as it would be for certain other taxa, such as *Anulocaulis leiosolenus*.

1. Surveys for new individuals

Surveys within areas where the Verde formation occurs in the Forest would help ascertain the presence of any additional populations. Surveys for individuals of this taxon can be conducted concurrently with those for other taxa that occur within similar habitat, primarily the Verde Formation.

2. Prevention of off-road vehicle traffic

Impediments to off-road use in areas where individuals of the taxon occurs are of primary importance. Closing two-tracks and minor Forest roads with large boulders and/or other vehicle-proof structures at access points may be effective in this regard. Signs suggesting alternate and legal ORV areas in the vicinity may be useful.

4. Grazing management

Although restricting cattle grazing may benefit populations of the species, wasted efforts in this regard may be avoided if populations are first monitored in order to ascertain if grazing is indeed a negative influence. In addition, if cattle are eating the plants, then other animals are probably eating them as well. If elk, for example, are impacting the site, then stronger fencing may need to be erected.

4. Fire management

Although historically habitats within the Verde Formation are not subject to fire, in years where non-native weeds, such as *Bromus rubens* (cheatgrass), are abundant, fire may be a problem. During such years, removal of weeds near individuals of *Eriogonum ericifolium* may be preventative.

Recommended monitoring

Baseline data that recorded the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. The interval of monitoring may also depend on baseline data. For example, if individuals of *Eriogonum ericifolium* appear to be healthy with no impacts, then monitoring could probably done less frequently.

References

Flora of North America Editorial Committee. 2005. Flora of North America. 5:254-255,

Eriogonum ripleyi

Species overview

Eriogonum ripleyi is a distinctive perennial herb or subshrub with the appearance of a bonsai conifer. Similar in habit to *E. ericifolium* but the upper surfaces of the leaves in *E. ripleyi* are short and densely hairy. Populations are generally rare and widespread, even within its most frequent habitat, the Verde Formation. Individuals of the species are often locally abundant.

Life history

Although individuals of *Eriogonum ripleyi* appear to be long-lived, there is no supporting data to this effect in the literature. The somewhat showy clusters of flowers emerge between March and June. The leaves remain green throughout the winter.

Distribution and abundance

The species is endemic to Maricopa, Mohave, and Yavapai counties Arizona, with 29 occurrences listed in Seinet and 15 localities listed from additional sources. The total distribution range for *Eriogonum ripleyi* is 321km; in north-central Maricopa County there are seven occurrences, ranging 10km; in northern Mohave County there is one occurrence (type locality); and in northwest and east-central Yavapai County there are 28 localities, ranging 160km. The remaining eight collections from Seinet have insufficient locality data. Six occurrences for the species are spread over PNF ranging 41 km, with five within 1km or each other.

Habitats

Individuals of the *Eriogonum ripleyi* tend to occur on south-facing slopes; with substrates including white chalky carbonate, gravel silt, gypsum, tertiary lake beds (Verde Formation), volcanic tuff, ash, and sandstone. Elevation ranges

between 616m (2000ft) and 1848m (6062ft) with a mean elevation of 1232m (4041ft). Vegetation types include piñon-juniper and desert scrub.

Known and potential threats

There are no known threats and few potential threats for the species. Since, at least within PNF, it is known only to occur in the Verde Formation, threats to this habitat apply to this species (See discussion under habitats). Individuals of *Eriogonum ripleyi* occur abundantly on disturbed soils of the abandoned U. S. Mine in PNF.

Recommended conservation strategies

Like other taxa that occur primarily on the Verde Formation, conservation of habitat is of primary concern to the viability of the populations. Fortunately, since populations include large numbers of individuals, occasional mortality of a few individuals would probably not be as important as it would be for certain other taxa, such as *Anulocaulis leiosolenus*.

1. Surveys for new individuals

Surveys within areas where the Verde formation occurs in the Forest would help ascertain the presence of any additional populations. Surveys for individuals of *Eriogonum ripleyi* can be conducted concurrently with those for other taxa that occur within similar habitat, primarily the Verde Formation.

2. Prevention of off-road vehicle traffic

Impediments to off-road use in areas where individuals of the taxon occurs are of primary importance. Closing two-tracks and minor Forest roads with large boulders and/or other vehicle-proof structures at access points may be effective in this regard. Signs suggesting alternate and legal ORV areas in the vicinity may be useful. For example, the population at the US mine are easily assessable to ORV's but simple steps could be taken (probably a strong gate and minimum fencing) to keep vehicles from entering the area.

4. Grazing management

Although restricting cattle grazing may benefit populations of the species, wasted efforts in this regard may be avoided if populations are first monitored in order to ascertain if grazing is indeed a negative influence. In addition, if cattle are eating the plants, then other animals are probably eating them as well. If elk, for example, are impacting the site, then stronger fencing may need to be erected.

4. Fire management

Although historically habitats within the Verde Formation are not subject to fire, in years where non-native weeds, such as *Bromus rubens* (cheatgrass), are abundant, fire may be a problem. During such years, removal of weeds near individuals of *Eriogonum ripleyi* may be preventative.

Recommended monitoring

Baseline data that recorded the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. The interval of monitoring may also depend on baseline data. For example, if individuals of *Eriogonum ripleyi* appear to be healthy with no impacts, then monitoring could probably done less frequently.

References

Flora of North America Editorial Committee. 2005. Flora of North America. 5:253.

Hedeoma diffusum

Species overview

Hedeoma diffusum is a small perennial herb that often forms low dense mats, has simple, entire leaves, and bears rather showing pink-purple flowers that are hairy on the inside. It is easily distinguished from its closest relative, *H. nanum*, by its larger flowers, turpentine-like odor, and pubescent winter leaves. Another close relative, *H. drummondii*, has an odor of mint and glabrous winter leaves. The only other *Hedeoma* sympatric with *H. diffusum* is *H. oblongifolium*, which has a similar odor to *H. diffusum* but has strict (erect and straight) stems, often dentate leaves, and a corolla with essentially no hairs inside. Individuals of typical *H. diffusum*, however, differ in habit and flower characteristics from those recorded by Baker & Wright (1993) from PNF. The population from PNF, therefore, may belong to their own undescribed species.

Life history

Stems and leaves of *Hedeoma diffusum* persist throughout the winter, although its winter leaves are generally more pubescent and crowded than its warm-season leaves. Flowers emerge between May and August.

Distribution and abundance

Hedeoma diffusum is endemic to Coconino, Mohave, Pima, and Yavapai counties, Arizona, with 56 occurrences listed in Seinet and 14 localities from additional sources. The total distribution range for *H. diffusum* is 468km; in south-central Coconino County, there are 43 occurrences, ranging 38km; in northeast Mohave County, there is one occurrence; in northern Pima County, there is one occurrence; and in northeastern Yavapai County, there are 20 occurrences, ranging 29km. The remaining five records from Seinet have insufficient locality data.

Habitats

Populations Individuals of *Hedeoma diffusum* tend to occur on north and east-facing slopes, bottom of ravines, and cliffs; with substrates including cobbles, and sandstone. Elevation ranges between 1386m (4547ft) and 2131m (6991ft) with a mean elevation of 1758m (5756ft). Vegetation types include oak, juniper-piñon woodland, and ponderosa pine forest.

Known and potential threats

Most populations are recorded from habitats where fire is common but the effects of fire on the species are unknown. The generally rocky micro-habitat of the species may protect individuals from most fires, as well as off-road vehicle use, and cattle grazing. Within PNF, populations generally occur in wilderness areas that are far removed from human influence. There is some concern of potential impacts of invasive weeds, such as *Linaria dalmatica* (Arizona Game and Fish Department (2003).

Recommended conservation strategies

1. Taxonomic studies

Because of the taxonomic confusion between the typical *Hedeoma diffusum* and populations within PNF, a taxonomic comparison between the two forms is needed in order to establish which populations actually belong to *H. diffusum* and

to the potentially new taxon. It may be that, after review, individuals of one of the taxa are extremely rare and deserve heightened conservation efforts in order to insure viability of the species. A simple classical approach to the problem my suffice and would include a preliminary morphological comparison based on herbarium material and then visits to selected population sites in the late spring, when morphological measurements and more adequate photographs could be made of fresh material, and material collected for chromosomes counts.

2. Fire management

It has been suggested that at least for some populations, prescribed burning may facilitate the maintenance of populations by reducing overstory and litter (Arizona Game and Fish Department (2003). Prescribed burning may also act as a deterrent to catastrophic fires.

3. Grazing management

Although the habitat for this species suggests that grazing probably does not impart a negative influence on populations, impacts of grazing should be tested through initial monitoring efforts.

2. Surveys for new individuals

Since several populations of, at least the new taxon, are known within PNF, specific surveys for the species are not immediately necessary in order to evaluate the populations taxonomically and to begin monitoring them.

5. Prevention of off-road vehicle traffic

For populations recorded within PNF, it is doubtful that off-road vehicle traffic is a conservation consideration. However, it would be expedient to include notes on any evidence of ORV impacts during monitoring.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. In addition, because of the taxonomic confusion concerning the species, morphological data should also be recorded. The interval of monitoring may also depend on baseline data. For example, if individuals of appear to be healthy with no impacts, then monitoring could probably done less frequently.

References

Arizona Game and Fish Department. 2003. Plant abstract for *Hedeoma diffusum*. Phoenix, Arizona.

Baker, M. and T. Wright. 1993. A Botanical survey of the Apache Creek, Juniper Mesa, Sycamore Canyon and Woodchute wilderness areas of the Prescott National Forest. Report for the Chino Valley Ranger District of Prescott National Forest, Arizona.

Heuchera eastwoodiae

Species overview

Heuchera eastwoodiae is a unique species within the genus with six sepals. It is therefore, easily identified in the field with a hand lens. It is a low herb with attractive dark green, often mottled, suborbicular (nearly circular) leaves. Unlike many of its relatives that are grown in horticulture for both their attractive leaves and showy flowers, *H. eastwoodiae* flowers are comparatively inconspicuous with no or a very reduced corolla.

Life history

Although the leaves of *Heuchera eastwoodiae* persist through the winter, they often turn purple or red. Flowers appear between May and August (Flora of North America Editorial Committee 2009).

Distribution and abundance

Heuchera eastwoodiae is endemic to Coconino, Gila, Maricopa, and Yavapai counties, Arizona, with 24 occurrences listed in Seinet and 26 localities from additional sources. The total distribution range for *H. eastwoodiae* is 255km; in east-central Coconino County, there is one occurrence; in north, central, and west Gila County there are four occurrences, ranging 112km; in east Maricopa County, there is one occurrence; throughout Yavapai County, there are 43 occurrences, ranging 157km. The remaining record from Seinet has insufficient locality data. Thirty-three occurrences for the species are wide spread over PNF, ranging 79km.

Habitats

Individuals of the species tend to occur on North, Southwest and East-facing slopes, and along ridges; with substrates including basalt, granite, and granite schist. Elevation ranges between 1280m (4200ft) and 2400m (7870ft) with a mean elevation of 1839m (6035ft). Vegetation types include mixed Conifer, Aspen forests, and Highland forests.

Known and potential threats

Most populations are recorded from habitats where fire is common but the effects of fire on the species are unknown. Although these delicate herbs are probably grazed by cattle, they generally occur in microhabitats that are inaccessible.

Recommended conservation strategies

1. Fire management

Habitats where *Heuchera eastwoodiae* occurs are subject to fire but the effects of fire on the species are undocumented. Prescribed burning may facilitate the maintenance of populations by reducing overstory and litter. Prescribed burning may also act as a deterrent to catastrophic fires. Initial and repeat monitoring may provide some insight into whether fire management would enhance the viability of this species.

2. Surveys for new individuals

Surveys for the species within in the Forest would help ascertain the presence of any additional populations. Such knowledge would aid in assessing the rarity of the species and in turn its priority in Forest management.

4. Grazing management

Although the habitat for this species suggests that grazing probably does not impart a negative influence on populations, impacts of grazing should be tested through initial monitoring efforts.

5. Prevention of off-road vehicle traffic

As with grazing, this species occurs within habitats where off-road travel would not generally affect plants.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. Although the interval of monitoring may also depend on baseline data, monitoring selected populations every three to five years would probably be sufficient to detect new threats and address the viability of the species.

References

Flora of North America Editorial Committee. 2009. Flora of North America. 8:102

Heuchera novamexicana

Species overview

Heuchera novamexicana is similar in habit and leaf morphology to other species of the genus within PNF. Like *H. eastwoodiae*, it has short stamens (shorter than the sepals) and short pistils. The most common species in the forest, *H. rubescens* has long stamens and pistils. The flowers of both *H. novamexicana* and *H. rubescens* differ from those of *H. eastwoodiae* in being five parted and possessing a showy corolla.

Life history

Although the leaves of *Heuchera novamexicana* persist through the winter, they often turn purple or red. Flowers generally appear in June (Flora of North America Editorial Committee 2009).

Distribution and abundance

Heuchera novamexicana has a range from Arizona to New Mexico, ranging 638km. There are 67 occurrences listed in Seinet and four localities from additional sources. In Arizona, *H. novamexicana*, has ten occurrences, ranging 328km; in south Apache County, there are two occurrences, ranging 33km; in south central Coconino County, there are three occurrences, ranging 2km; in south Gila County, there are four occurrences, ranging 19km; and south Graham County, there is one occurrence. In New Mexico, *H. novamexicana*, has 57 occurrences, ranging 351km; throughout Catron County, there are ten occurrences, ranging132km; in northern Cibola County, there is one occurrence;

in central Dona Ana County, there are three occurrences, ranging 5km; in north central Grant County, there are eight occurrences, ranging 60km; in central Lincoln County, there is one occurrences; in north Luna County, there is one occurrence; in east and west Sierra County, there are eight occurrences, ranging 137km; and in south and central Socorro County, there are six occurrences, ranging 62km. The remaining 12 occurrences have insufficient locality data. Three occurrences for the species are in PNF, ranging 2km; all three occurrences are in the vicinity of Tule Canyon, 25km northeast of Sedona.

Habitats

Individuals of the species tend to occur on southwest and north-facing steep slopes, above riparian areas, and at base of boulders; with substrates including granite, sandstone, sandy soil, and deep humus. Elevation ranges between 883m (2900ft) and 3350m (11000ft) with a mean elevation of 2438m (8000ft). Vegetation types include pine/oak forest, piñon-juniper communities, Douglas fir and ponderosa pine forests.

Known and potential threats

Most populations of *Heuchera novamexicana* are recorded from habitats where fire is common but the effects of fire on the species are unknown. Although these delicate herbs are probably grazed by cattle, they generally occur in microhabitats that are inaccessible.

Recommended conservation strategies

1. Fire management

Habitats where populations of *Heuchera novamexicana* occur are subject to fire but the effects of fire on the species are undocumented. Prescribed burning may facilitate the maintenance of populations by reducing overstory and litter. Prescribed burning may also act as a deterrent to catastrophic fires. Initial and repeat monitoring may provide some insight into whether fire management would enhance the viability of this species within the Forest.

2. Surveys for new individuals

Surveys specific for *Heuchera novamexicana* within in the Forest would help ascertain the presence of any additional populations. Such knowledge would aid

in assessing the rarity of the species and in turn its priority in Forest management.

4. Grazing management

Although the habitat for this species suggests that grazing probably does not impart a negative influence on populations, impacts of grazing should be tested through initial monitoring efforts.

5. Prevention of off-road vehicle traffic

As with grazing, this species occurs within habitats where off-road travel would not generally affect plants.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. Although the interval of monitoring may also depend on baseline data, monitoring selected populations every three to five years would probably be sufficient to detect new threats and address the viability of the species.

References

Flora of North America Editorial Committee. 2009. Flora of North America. 8:103

Lesquerella cinerea (Physaria cinerea)

Species overview

Lesquerella cinerea is a small gray-green densely pubescent perennial from a short, branched caudex (thickened stem that occurs below on near the soil surface). Its leaves are ovate to suborbicular, which is usually broad for the genus. The fruits are pubescent and are borne on fairly straight pedicels. In *Lesquerella arizonica*, which also occurs on the Forest, the fruits are also pubescent but, unlike *L. cinerea*, the basal leaves are similar in shape to the stems leaves and the leaves are not well differentiated from their petioles.

Life history

Although, the herbage of *Lesquerella cinerea* often remains green and visible during the winter, individuals are generally short-lived. Flowers appear between March and May.

Distribution and abundance

Lesquerella cinerea is endemic to Coconino, Maricopa, Mohave, and Yavapai counties, Arizona, with 58 occurrences listed in Seinet and five occurrences from additional sources. The total distribution range for *L. cinerea* is 293km; in north central and south Coconino County, there are eleven occurrences, ranging 202km; in south Coconino County and along the border of Coconino and Yavapai counties, there are eleven occurrences, ranging 11km; along the northern border of Maricopa County, there are eight occurrences, ranging 2km; in southeast Mohave County, there are seven occurrences, ranging 59km, and in south and central Yavapai county, there are 38 occurrences, ranging 140km. Ten occurrences for the species are spread over PNF, ranging 75km; three occurrences are in the vicinity of Juniper Mesa, five occurrences are in the vicinity of the Black Hills east of Cottonwood, and two occurrences are in the vicinity of the Antelope Hills north of Cottonwood.

Habitats

Individuals of the species tend to occur on east-facing rocky slopes and ridgelines; with substrates including limestone, sandstone cobble, calcareous soils, gypsum soils, fossiliferous chert, and white lacustrine outcrops. Elevation ranges between 539m (1770ft) and 1889m (6200ft) with a mean elevation of 1889m (914ft). Vegetation types include piñon-Juniper, pine forest, Sonoran Desert, and chaparral.

Known and potential threats

Because individuals of *Lesquerella cinerea* occur in a variety of habitats and their habit is rather low and inconspicuous, threats to populations are probably minor and of little concern with respect to Forest management. Threats that could potential impact individuals are off-road vehicle use, herbivory, including grazing, and fire. Because they are short-lived, any individuals killed by occasional off-road use are probably not critical to viability of a population. The same could be said about grazing. In addition, the species being fairly common in grasslands where both grazing and fire occurs suggested that it has adapted to these impacts.

Recommended conservation strategies

Because of the varied habitats and large geographical distribution of *Lesquerella cinerea* within PNF, the following recommended conservation might be considered a low priority with respect to efforts centering on more rare and potentially threatened species, at least until occasional monitoring suggests otherwise.

1. Prevention of off-road vehicle traffic

Off-road vehicle use is probably the most important potential impact on individuals of *Lesquerella cinerea*. The impact, however, may have more to do with the general health of the habitat verses the impact to specific individuals. Since some populations do occur within the Verde Formation, efforts to protect that habitat would facilitate the efforts to enhance the viability of this species as well. Since the health of grasslands is of primary concern to the Forest, grassland management where populations of *L. cinerea* occur may be of particular concern. Perhaps it would be helpful to entertain the question as to whether *L. cinerea* is an indicator of healthy grassland, at least on certain soil types. In any case, impacts of off-road vehicle use should be reviewed through initial monitoring efforts.

2. Grazing management

Although the nature of habitats for this species suggests that grazing could have a negative influence on populations, they could just as easily have a positive influence. In this respect, occasional monitoring would be very useful in determining the effects of grazing. See also the discussion of grasslands under off-road vehicle use.

3. Fire management

Fire management for this species probably parallels that for grazing management and efforts would be greatly facilitated by first monitoring selected populations .

4. Surveys for new individuals

Because of the rather large geographical distribution and variety of habitats of *Lesquerella cinerea* within PNF, there are probably sufficient populations to initiate monitoring of the species.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. Although the interval of monitoring may also depend on baseline data, monitoring selected populations every three to five years would probably be sufficient to detect new threats and address the viability of the species.

References

Flora of North America Editorial Committee. 2010. Flora of North America. 7:631-632

Lesquerella pinetorum (Physaria pinetorum)

Species overview

Lesquerella pinetorum is a small gray-green densely pubescent perennial from a short, branched caudex with one to several stems. Its basal leaves are rhombic to elliptic, unlike the broad leaves of *L. cinerea*. Also unlike *L. cinerea*, the fruits of *L. pinetorum* are glabrous and are borne on mostly curved or even sigmoid pedicels. In *Lesquerella arizonica*, which also occurs on the Forest, the fruits are pubescent and the basal leaves are similar in shape to the stems leaves and the leaves are not well differentiated from their petioles.

Life history

Although, the herbage of *Lesquerella pinetorum* often remains green and visible during the winter, individuals are generally short-lived. Flowers appear between April and June (Flora of North America Editorial Committee 2010).

Distribution and abundance

Lesquerella pinetorum has a wide range from Arizona to New Mexico and into Texas, ranging 771km. There are 38 occurrences listed in Seinet and one occurrence from an additional source. In Arizona, *L. pinetorum*, has 23 occurrences, ranging 558km; in south Apache County, there is one occurrence; in east central Cochise County, there is one occurrence; in north, central, and south Coconino County, there are six occurrences, ranging 226km; in north Gila County, there are two occurrences, ranging 2km; in central and west Graham County, there are four occurrences, ranging 59km; in west central Pinal County,

there is one occurrence; and in north Yavapai County, there are eight occurrences, ranging 148km. In New Mexico, *L. pinetorum*, has 12 occurrences, ranging 315km; in east Bernalillo County, there is one occurrence; in central Grant County, there are three occurrences, ranging 29km; in southwest Lincoln County, there are two occurrences, ranging only 2km; in east Sierra County, there is one occurrence; and east central Otero County, there are five occurrences, ranging 29km. In Texas there is only one occurrence in north Hudspeth County. Three occurrences for the species are in PNF, ranging 15km; all three occurrences are in the vicinity of Prescott.

Habitats

Individuals of *Lesquerella pinetorum* occur on various slope aspects along riparian banks; with substrates that include sandy gravel, igneous, and limestone cobble. Elevation ranges between 1300m (4590ft) and 2400m (7870ft) with a mean elevation of 2051m (6730ft). Vegetation types include mixed conifer-oak forest, pine forest, (open meadows in forest), and *Pseudotsuga menziesii* forest habitats.

Known and potential threats

Because individuals of *Lesquerella pinetorum* occur in a variety of habitats and their habit is rather low and inconspicuous, threats to populations are probably minor and of little concern with respect to Forest management. Threats that could potential impact individuals are off-road vehicle use, herbivory, including grazing, and fire. Because they are short-lived, any individuals killed by occasional off-road use or grazing are probably not critical to viability of a population.

Recommended conservation strategies

Because of the varied habitats and large geographical distribution of *Lesquerella cinerea* within PNF, the following recommended conservation might be considered a low priority with respect to efforts centering on more rare and potentially threatened species, at least until occasional monitoring suggests otherwise.

Recommended conservation strategies

1. Fire management

Habitats where populations of *Lesquerella pinetorum* occur are subject to fire but any potential effects of fire on the species are undocumented. Prescribed burning may facilitate the maintenance of populations by reducing overstory and litter. Prescribed burning may also act as a deterrent to catastrophic fires. Initial and repeat monitoring may provide some insight into whether fire management would enhance the viability of this species within the Forest.

2. Surveys for new individuals

Surveys specific for *Lesquerella pinetorum* within in the Forest would help ascertain the presence of any additional populations. Such knowledge would aid in assessing the rarity of the species and in turn its priority in Forest management.

4. Grazing management

Although there is a potential for grazing within habitats for this species, the low stature of individuals of *Lesquerella pinetorum* may reduce its susceptibility. In any case, impacts of grazing should be tested through initial monitoring efforts.

5. Prevention of off-road vehicle traffic

As with grazing, this species occurs within habitats where off-road travel might affect plants but any impacts should be documented through the monitoring of selected populations before management practices are considered.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. Although the interval of monitoring may also depend on baseline data, monitoring selected populations every three to five years would probably be sufficient to detect new threats and address the viability of the species.

References

Flora of North America Editorial Committee. 2010. Flora of North America. 7:658

Lotus mearnsii var. mearnsii

Species overview

Lotus mearnsii var. *mearnsii* is a gray-green, low growing perennial herb with silvery pubescence. It is easily distinguished from its closest relative on the Forest, *L. wrightii*, by its long peduncles (inflorescence stalks), which greatly exceed the length of the leaves, distinct rachis of its pinnate leaves, and silvery (sericeous) pubescence. In contrast, the peduncles of *L. wrightii* are generally shorter than its leaves, the leaves appear digitate and appear green to yellow-green, without silvery pubescence. Hybrids, however, have been reported between the two species in Yavapai and other counties (Kearney and Peebles 1960). It should be noted that the much more rare variety, *L. mearnsii* var. *mearnsii*, occurs on Verde Formation just south of Yavapai County and should be sought on similar habitat within PNF.

Life history

Shoots of *Lotus mearnsii* var. *mearnsii* arise from deep-seated underground rhizomes and generally occur in small clones. This suggests that individuals may be long-lived. Flowers emerge between March and August.

Distribution and abundance

Lotus mearnsii var. mearnsii has a wide range from Arizona to New Mexico, ranging 700km. There are 84 occurrences listed in Seinet. In Arizona, *L. mearnsii var. mearnsii,* has 83 localities, ranging 610km; in south and central Cochise County, there are two occurrences, ranging 68km; in north, south, and central Coconino County, there are13 occurrences, ranging 214km; in north Maricopa County, there are seven occurrences, ranging 69km, in north and east-central Mohave County, there are five occurrences, ranging 227km; in south Navajo County, there are three occurrences, ranging 32km; in south and east Graham County, there are two occurrences, ranging 52km; in south Gila County, there is one occurrence; and in central Yavapai County, there are 50 occurrences, ranging 145km. In New Mexico, *L. mearnsii var. mearnsii,* has one occurrence in south Hildago County. Thirteen occurrences for the taxon are wide spread over PNF, ranging 92km.

Habitat

Lotus mearnsii var. mearnsii occurs in streambeds and on various aspects of dry rocky slopes and ridgelines. Substrates include limestone, clay, calcareous sand, gravel, and deep sand. Elevation ranges between 985m

(3231ft) and 1380m (4527ft) with a mean elevation of 1182m (3877ft). Vegetation types include piñon-Juniper woodland, blue grama grassland, and high desert grassland.

Known and potential threats

There are probably few threats to populations of *Lotus mearnsii var. mearnsii* within the Forest. Severe degradation of grasslands caused by over-grazing is probably the most viable threat, followed by off-road vehicle damage. Fire probably poses little danger to individuals of the taxon considering that the rhizomes probably survive the types of fires that occur in grasslands and woodlands.

Recommended conservation strategies

Because of the varied habitats and large geographical distribution of *Lotus mearnsii var. mearnsii* within PNF, the following recommended conservation might be considered a low priority with respect to efforts centering on more rare and potentially threatened species, at least until occasional monitoring suggests otherwise.

1. Grazing management

Although the nature of habitats for *Lotus mearnsii var. mearnsii* suggests that grazing could have a negative influence on populations, the rhizomatous nature and low habit of the taxon provides at least some resistance to grazing. The impact of grazing on populations of the taxon, however, may have more to do with its influence on the general health of the grassland rather than grazing of specific individuals. Since some populations do occur within the Verde Formation, efforts to protect that habitat would facilitate the efforts to enhance the viability of this species as well. Since the health of grasslands is of primary concern to the Forest, grassland management where populations of this taxon occur may be of particular concern. Perhaps it would be helpful to entertain the question as to whether *Lotus mearnsii var. mearnsii*, like *Lesquerella cinerea* is an indicator of healthy grassland, at least on certain soil types. In this respect, occasional monitoring would be very useful in determining the effects of grazing.

1. Prevention of off-road vehicle traffic

Off-road vehicle use is potentially the most damaging impact to populations of the taxon, especially where it causes erosion that leads to severe soil loss from habitats. Impacts of off-road vehicle use should be reviewed through initial

monitoring efforts. See also the discussion of grasslands under grazing management.

3. Fire management

Although fire is probably not an important factor in considering the viability of the taxon, specific management decisions would be greatly facilitated by first monitoring selected populations.

4. Surveys for new individuals

Because of the rather large geographical distribution and variety of habitats of *Lotus mearnsii var. mearnsii* within PNF, there are probably sufficient populations to initiate monitoring of the species.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. Although the interval of monitoring may also depend on baseline data, monitoring selected populations every three to five years would probably be sufficient to detect new threats and address the viability of the species.

References

Kearney, Thomas H., and Robert H. Peebles. 1960. Arizona Flora. University of California Press, Berkeley, California.

Lupinus latifolius var. leucanthus

Species overview

Although not strictly a wetland taxon as defined by the USDA, populations of *Lupinus latifolius* var. *leucanthus* within PNF nearly always occur along perennial streams or where the soil is wet all or most of the year. The stems are stout and often numerous from branched caudices. Healthy stands can be several meters broad and up to 2m tall. Unlike any of the other lupine species in the Forest, the flowers of *Lupinus latifolius* var. *leucanthus* are always nearly white with only a faint cast of color, except for a pale yellow-brown spot in the center of the upper petal (banner).

Life history

Although probably a long-lived perennial, the delicate herbage (the mostly green stems and leaves) dies back in during the winter, then resprouts in the early spring and grows rapidly. Flowers emerge between May and July.

Distribution and abundance

Lupinus latifolius var. *leucanthus* occurs in southern Utah and in Mohave, Gila, and Yavapai counties, Arizona, with 18 occurrences listed in Seinet and seven localities listed from additional sources. Depending on the taxonomic treatment, there may also be populations in Nevada, New Mexico, and California. The total distribution range for *L. latifolius var. leucanthus* is 278 km; in southeast Mohave County, there are two occurrences, ranging less than 1km; in north and central Gila County, there are three occurrences, ranging 56km; and in central Yavapai County, there are 21 occurrences, ranging 82km. Nineteen occurrences for the species are wide spread over PNF, ranging 72km.

Habitats

Populations of *Lupinus latifolius* var. *leucanthus* tend to occur on north-facing slopes, along streams, and near springs; with substrates including granite, granite cobble, and basalt. Elevation ranges between 1299m (4265ft) and 2099m (6889ft) with a mean elevation of 1699m (5577ft). Vegetation types include ponderosa pine forest, chaparral, mixed conifer forest, and riparian woodlands.

Known and potential threats

The primary threat to populations of *Lupinus latifolius* var. *leucanthus* is wetland degradation. Healthy populations of the taxon occur where there is a stable source of flowing water. Both drying of soil and severe flooding can kill entire stands. There is no evidence that grazing negatively affects plants and, because of the perennial nature of its underground stems, most fires probably do not kill individuals. Severe fires could kill stands by impacting wetland stability. Weed infestations are becoming an increasingly important problem within the Forest, especially along streams. Encroaching weeds, especially those with perennial rhizomes, are capable of crowding out native species.

Recommended conservation strategies

Because of the high correlation between healthy perennial streams and occurrences of *Lupinus latifolius* var. *leucanthus*, conservation strategies should focus on maintaining stability of perennial streams where populations of the taxon occur. Because streams are affected by influences to their entire watershed, the lower the habitat is downstream, the more area there is to manage. It this regard, focusing first on populations of *Lupinus latifolius* var. *leucanthus* that occur in the upper reaches of channels, especially those that occur at or near springs may facilitate conservation efforts.

An iterative approach to the conservation of *Lupinus latifolius* var. *leucanthus* populations is emphasized here because of the importance and dynamic nature of the wetland habitat. A cyclic regime of population assessment, monitoring, conservation efforts, and reassessment may be the only means of successfully insuring the viability of the taxon.

1. Identification of manageable populations

Using a GIS layer of known populations, sites could be prioritized as to their management practicability. Those populations, for example, higher in the watershed and occurring at springs might be assessed a higher priority. Ground truthing could then be used to further assess populations based on vigor and abundance of individuals, and nature of microhabitat.

2. Fencing of springs

The fencing of springs to prevent elk, cattle, and burros from denuding vegetation may help maintain flow within the spring itself and downstream. The protection of springs has many auxiliary benefits, including the protection of habitat for other important wetland flora and fauna that may include T&E animal species, increased availability of clean water downstream to cattle and native fauna, and enhanced recreational use.

3. Fire management

Reducing the risk of catastrophic fires within the surrounding watershed would also reduce the risk of catastrophic flooding. Catastrophic flooding not only kills individuals of *Lupinus latifolius* var. *leucanthus* but also often destroys habitat by altering topographic, downcutting channels, and removing perennial forbs and grasses that slow water flow. In this regard, control burns and other means of removing excess fuel in the watershed may facilitate the viability of the taxon.

4. Grazing management

Since heavy grazing can reduce plant cover and increase runoff, an assessment of the degree of grazing could improve watershed conditions.

5. Revegetation

Reseeding and replanting perennial forbs and grasses that have been lost or reduced by grazing, fire, and flooding may be a viable conservation strategy under certain conditions. In this regard, healthy watersheds that are similar with respect to topography, soil type, and elevation could be used to determine which plant species would be best used to revegetate an area of conservation concern.

6. Weed removal

There are several species of invasive weeds that are newly invading streams within PNF. Many of these may still be controllable. The identification and removal of populations of these weeds is of immediate importance, especially in areas of recent disturbance.

Recommended monitoring

Baseline data recorded from selected populations could be used to assess the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use; weed infestation; fire; and other factors. Because of the somewhat volatile nature of stream habitat, yearly monitoring may be necessary to assess populations and their surrounding habitat.

References

Arizona Game and Fish Department. 2005. Plant abstract for *Lupinus latifolius* var. *leucanthus*. Phoenix, Arizona.

Mertensia macdougalii

Species overview

Mertensia macdougalii is a glabrous gray-green perennial herb with showy purple-blue, pendent, funnelform flowers. The nutlets possess a distinct lobed margin (Kearney and Peebles 1960). Populations of this unique species are often widely-spaced, especially within PNF. It is an attractive plant and garden-worthy. Although seeds are available from Europe, it does not seem to be in general cultivation.

Life history

Although no information was found on the root system of *Mertensia macdougalii*, other species within the genus possess rhizomes. If this is also true of *M. macdougalii*, then it could be more long-lived than if it possessed a simple taproot. The flowers emerge between April and June.

Distribution and abundance

Mertensia macdougalii is endemic to Coconino, Maricopa, Mohave, Gila, and Yavapai counties, Arizona, with 72 occurrences listed in Seinet. The total distribution range for *M. macdougallii* is 404km; in south and central Coconino County there are 63 occurrences, ranging 211km; in central Maricopa County there is one occurrence; in north Mohave County there are two occurrences, ranging 67km; in north Gila County there is one occurrence; and in north and central Yavapai County there are five occurrences, ranging 104km. Three occurrences for the species are located in PNF, ranging 86km; one occurrence in the vicinity of Prescott, and two occurrences in the vicinity of the Santa Maria mountains located 53km northeast of Prescott.

Habitats

Populations of *Mertensia macdougalii* occur on south and southwest-facing slopes with substrates that include sandstone cobble, clay loam, and red soil, sand, and duff. Elevation ranges between 1300m (4265ft) and 2500m (8200ft) with a mean elevation of 2137m (7014ft). Vegetation types include *Artemisia* scrub, blue grama grassland, oak woodland, and pine forest. Individuals tend to occur in open areas with low plant cover.

Known and potential threats

Species within the family (Boraginaceae) generally do not possess many plant secondary compounds to ward off herbivores. In this regard, individuals of *Mertensia macdougalii* are probably susceptible to herbivory and grazing. Fire is prevalent in all habitats in which it occurs. At least some of its populations are accessible to off-road vehicles.

Recommended conservation strategies

1. Grazing management

Since known populations within PNF inhabit small widely spaced sites, exclosures could be a cost-effective means of protecting individuals of the species from grazing. It is unknown, however, if grazing negatively impacts populations and, therefore, conservation efforts in this regard would be best served after initial monitoring of populations.

2. Fire management

Habitats where populations of *Mertensia macdougalii* occur are subject to fire but any potential effects of fire on the species are undocumented. Prescribed burning may facilitate the maintenance of populations by reducing overstory and litter; and act as a deterrent to catastrophic fires. Initial and repeat monitoring may provide some insight into whether fire management would enhance the viability of this species within the Forest.

2. Prevention of off-road vehicle traffic

Off-road vehicle use is potentially damaging to populations of the taxon, especially where it causes erosion that leads to severe soil loss from habitats. Impacts of off-road vehicle use should be reviewed through initial monitoring efforts.

4. Surveys for new individuals

Because populations of *Mertensia macdougalii* occur in common, widespread habitats, specific surveys for additional populations may not be practical, except perhaps within the immediate areas of known populations.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. Although the interval of monitoring may also depend on baseline data, monitoring selected populations every three to five years would probably be sufficient to detect new threats and address the viability of the species.

References

Kearney, Thomas H., and Robert H. Peebles. 1960. Arizona Flora. University of California Press, Berkeley, California.

Pediomelum mephiticum

Species overview

Apparently, at least some, if not all populations of *Pediomelum* within PNF now belong to a newly described and more rare species, *P. verdiensis* (Welsh & Licher 2010). Both *P. mephiticum* and *P. verdiensis* are low perennial herbs from a deep, vertical, tuberous taproot.

Life history

Because of the large size of their taproot, individuals are probably long-lived. The flowers emerge between April and June, and again after summer rains.

Distribution and abundance

Pediomelum mephiticum has a wide range from Arizona to Utah and Nevada, ranging 643km. There are 82 occurrences listed in Seinet. In Arizona, *P. mephiticum*, has 52 occurrences, ranging 448km; in south Apache County, there is one occurrence; in north and south Coconino County, there are four occurrences, ranging 249km; in central Gila County, there is one occurrence; in north and east Maricopa County, there are two occurrences, ranging 122km; in north and central Mohave County, there are 32 occurrences, ranging 225km; and in north Yavapai County, there are 12 occurrences, ranging 77km. In New Mexico, *P. mephiticum*, has 14 occurrences, ranging 457km; along the eastern border of Grand County, there is one occurrence, and throughout Washington County, there are 13 occurrences, ranging 90km. In Nevada, *P. mephiticum*, has one occurrence in central Lincoln County. The remaining 17 occurrences have insufficient locality data. Eight occurrences for the species spread over PNF, ranging 107km. Although herbarium specimens annotated by the authors of *P. verdiensis* were collected primarily from the Verde Formation in the Verde Valley, there were at least two collections annotated as *P. verdiensis* from near Perkinsville (Welsh & Licher 2010).

Habitats

Populations of *Pediomelum mephiticum* tend to occur on south-facing slopes, in open areas, and near drainages; with substrates including calcareous, sand, gravely limestone, gravely-loam, and basalt. Elevation ranges between 1542m (5000ft) and 1667m (5500ft) with a mean elevation of 1596m (5230ft). Vegetation types include desert foothills, Sonoran desert scrub, juniper-piñon pine woodlands, and Great Basin conifer forest.

Known and potential threats

There are probably few threats to populations of *Pediomelum mephiticum* within the Forest. Severe degradation of habitats caused by over-grazing is probably the most viable threat, followed by off-road vehicle damage. Fire probably poses little danger to individuals of the taxon considering that the rhizomes probably survive the types of fires that occur in grasslands and woodlands.

Recommended conservation strategies

At least some of the known populations occur on the Verde Formation those populations could be included in the umbrella protection of that habitat.

1. Taxonomic identification of populations

Because of the new taxonomic circumscription of the populations within PNF, it would be impractical to implement conservation strategies until each known population is identified as to which species it belongs. This might simply be done by reviewing herbarium material, much of which has already been annotated by the authors of *P. verdiensis*.

2. Surveys for new individuals

Because neither species has been on a target species list during rare plant surveys, at least in the areas where they occur, additional populations might easily be found with minimum effort. Surveys within the general area of occurrence in the Forest would help determine a better estimate of individuals. Because new individuals may be found, this may be an important step prior to any further conservation or monitoring efforts.

3. Grazing management

Although the nature of habitats for *Pediomelum mephiticum* suggests that grazing could have a negative influence on populations, the rhizomatous nature and low habit of the taxon provides at least some resistance to grazing.

4. Prevention of off-road vehicle traffic

Off-road vehicle use is potentially the most damaging impact to populations of the either taxon, especially where it causes erosion that leads to severe soil loss from habitats. Impacts of off-road vehicle use should be reviewed through initial monitoring efforts.

5. Fire management

Although fire is probably not an important factor in considering the viability of the taxon, specific management decisions would be greatly facilitated by first monitoring selected populations.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. Although the interval of monitoring may also depend on baseline data, monitoring selected populations every three to five years would probably be sufficient to detect new threats and address the viability of the species.

References

Kearney, Thomas H., and Robert H. Peebles. 1960. Arizona Flora. University of California Press, Berkeley, California.

Welsh, S. L. and M. Licher. 2010. *Pediomelum* Rydberg (Leguminosae) in Arizona and two previously undescribed species. Western North American Naturalist 70(1):9-18.

Phlox amabilis

Species overview

Phlox amabilis is a low perennial herb with showy pink flowers. It is probably common in PNF but the ambiguity of the taxonomy of it and its close

relatives makes identification very difficult. It differs from its closest relative only in the length of its stamens and styles.

Life history

It is not clear if individuals of *Phlox amabilis* possess a taproot or spread by rhizomes. It is possible that young plants possess taproots and develop rhizomes afterwards. The flowers emerge between March and May.

Distribution and abundance

Phlox amabilis is endemic to Coconino, Maricopa, Mohave, and Yavapai counties, Arizona, with 52 occurrences listed in Seinet. The total distribution range for *P. amabilis* is 371km; throughout Coconino County, there are 17 occurrences, ranging 274km; in north Maricopa County, there is on occurrence; in north central Mohave County, there are seven occurrences, with a range of 162km; and throughout Yavapai County, there are 27 occurrences, ranging 131km. Nine occurrences for the species spread over PNF, ranging 74km.

Habitats

Populations of *Phlox amabilis* tend to occur on north, west, and east-facing slopes and in open areas; with substrates that include limestone, fosslilferous chert, basalt, and granite. Elevation ranges between 1078m (3500ft) and 2734m (8970ft) with a mean elevation of 1960m (6430ft). Vegetation types include pine-juniper woodland, riparian areas, and deserts.

Known and potential threats

Most populations of *Phlox amabilis* are recorded from habitats where fire is common but the effects of fire on the species are unknown. Being primarily herbaceous, plants are probably grazed by cattle. There is some potential from ORV activity.

Recommended conservation strategies

1. Identification criteria

Because the species appears morphological similar to its closest relatives, several of which are also recorded for the Forest, good diagnostic descriptions, including photographs would enable personnel to more easily identify the species. Special attention should be paid to underground parts and longitudinal sections of flowers. The type locality is near Prescott and should be sampled, along with several nearby populations in order to document morphological variation within the species.

2. Surveys for new individuals

Surveys for the species within in the Forest would help ascertain the presence of any additional populations. Because *Phlox amabilis* is apparently common, at least in the vicinity of Prescott, finding new populations may take a minimum amount of effort. Additional populations would greatly aid determining the taxonomic status and validity of the species, as well as facilitating the continued viability of the species, assuming it is valid.

3. Fire management

Habitats where *Phlox amabilis* occurs are subject to fire but the effects of fire on the species are undocumented. Initial and repeat monitoring may provide some insight into whether fire management would enhance the viability of this species.

4. Grazing management

Although the habitat for this species suggests that grazing probably does not impart a negative influence on populations, impacts of grazing should be tested through initial monitoring efforts.

5. Prevention of off-road vehicle traffic

As with grazing, this species occurs within habitats where off-road travel would not generally affect plants.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. The interval of monitoring may also depend on baseline data. For example, if individuals of *Phlox amabilis* appear to be healthy with no impacts, then monitoring could probably done less frequently.

References

Arizona Game and Fish Department. 2005. Plant abstract for *Phlox amabilis*. Phoenix, Arizona.

Kearney, Thomas H., and Robert H. Peebles. 1960. Arizona Flora. University of California Press, Berkeley, California.

Polygala rusbyi

Species overview

Polygala rusbyi is a unique species; a low perennial with several short stems from deep-seated rhizomes. It differs from the other species in our area by its habit, rather wide pilose leaves, and large purple flowers with a yellow beak. It should be noted that its rhizomes are not described in the literature (Arizona Game and Fish Department 2003, Kearney & Peebles 1960). The flowers emerge between April and July.

Life history

Because of their deep rhizomes, individuals of *Polygala rusbyi* are probably long-lived in spite of the small size of their shoots. The flowers emerge between April and July.

Distribution and abundance

Polygala rusbyi is endemic to Maricopa, Mohave, and Yavapai counties, Arizona, with 83 occurrences listed in Seinet and eight localities from additional sources. The total distribution range for *P. rusbyi* is 382 km; in north Maricopa County, there are four occurrences, ranging 24km; in central Mohave County, there are five occurrences, ranging 31km; and in northeast and central Yavapai County, there are 78 occurrences, ranging 164km. Twenty occurrences for the species are spread over PNF, ranging 81km; there are six occurrences in the vicinity of Cottonwood and 14 in the vicinity of Paulden.

Habitats

Populations of *Polygala rusbyi* tend to occur on ridge tops and open mesas; with substrates including powdery gypsiferous limestone of tertiary

lakebed deposits (Verde Formation), red-wall limestone, and limestone-sandstone. Elevation ranges between 1000m (3280ft) and 1500m (4921ft) with a mean elevation of 1250m (8200ft). Vegetation types include pine-juniper woodlands and semi-desert shrub.

Known and potential threats

There are probably few threats to populations of *Polygala rusbyi* within the Forest. Severe degradation of grasslands caused by over-grazing is probably the most viable threat, followed by off-road vehicle damage. Fire probably poses little danger to individuals of the taxon considering that the rhizomes probably survive the types of fires that occur in grasslands and woodlands. At least some populations of the species occur in areas of the Verde Formation and thus should be included within the conservation of that habitat.

Recommended conservation strategies

Because of the varied habitats and large geographical distribution of *Polygala rusbyi* within PNF, the following recommended conservation might be considered a low priority with respect to efforts centering on more rare and potentially threatened species, at least until occasional monitoring suggests otherwise.

1. Grazing management

Although the nature of habitats for *Polygala rusbyi* suggests that grazing could have a negative influence on populations, the rhizomatous nature and low habit of its individuals provide at least some resistance to grazing. The impact of grazing on populations of the taxon, however, may have more to do with its influence on the general health of the grassland rather than grazing of specific individuals. Since the health of grasslands is of primary concern to the Forest, grassland management where populations of this taxon occur may be of particular concern. Perhaps it would be helpful to entertain the question as to whether *Polygala rusbyi*, like *Lotus mearnsii var. mearnsii* and *Lesquerella cinerea*, is an indicator of healthy grassland, at least on certain soil types. In this respect, occasional monitoring would be very useful in determining the effects of grazing.

1. Prevention of off-road vehicle traffic

Off-road vehicle use is potentially the most damaging impact to populations of the species, especially where it causes erosion that leads to severe soil loss from habitats. Impacts of off-road vehicle use should be reviewed through initial

monitoring efforts. See also the discussion of grasslands under grazing management.

3. Fire management

Although fire is probably not an important factor in considering the viability of the species, specific management decisions would be greatly facilitated by first monitoring selected populations.

4. Surveys for new individuals

Because of the rather large geographical distribution and variety of habitats of *Polygala rusbyi* within PNF, there are probably sufficient populations to initiate monitoring of the species.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. Although the interval of monitoring may also depend on baseline data, monitoring selected populations every three to five years would probably be sufficient to detect new threats and address the viability of the species.

References

Arizona Game and Fish Department. 2003. Plant abstract for *Polygala rusbyi*. Phoenix, Arizona.

Kearney, Thomas H., and Robert H. Peebles. 1960. Arizona Flora. University of California Press, Berkeley, California.

Salvia dorrii var. mearnsii

Species overview

Salvia dorrii var. *mearnsii* is a handsome shrub with savory, gray-green leaves and rather showy pale purple flowers. Often individuals are stunted with old, twisted stems giving the plants a bonsai appearance. The taxon differs from its closest relative, *Salvia dorrii* var. *mearnsii*, by its much wider leaves.

Life history

Individuals of *Salvia dorrii* var. *mearnsii* give the appearance of being very old. Individuals in cultivation in Chino Valley, thus far, have lived over ten years in pots. Flowers emerge between April and May.

Distribution and abundance

Salvia dorrii var. mearnsii is endemic to Yavapai County, Arizona, with 31 occurrences listed in Seinet and 43 localities from additional sources. The total distribution range for *S. dorrii var. mearnsii* is 68 km; with 38 occurrences of the species spread over PNF ranging 62km; 29 occurrences are in the vicinity of Paulden and nine occurrences are in the vicinity of Cottonwood.

Habitats

Individuals of the species tend to occur on various aspects of rocky slopes and ridgelines; with substrates including Limestone, sandstone, tan soil, Verde Formation, and Calcareous ridge tops. Elevation ranges between 1000m (3280ft) and 1500m (4921ft) with a mean elevation of 1250m (8200ft). Vegetation types include Pinus edulis-Juniperus woodlands, and semi-desert shrub.

Known and potential threats

Since individuals are restricted to the Verde Formation and certain other soils, primarily with a mixture of sandstone and limestone alluvium, the areas in which plants occur are restricted geographically. Plant densities tend to be low on these soils, with few large shrubs and cacti, making the sites attractive to off-road vehicles. Apparently, plants do not grow back in areas where surface disturbance has occurred (Arizona Game and Fish Department 2002). Individuals of the taxon do not appear palatable to livestock and no direct impacts from cattle have been recorded. Also, since cover is low within these soils, cattle do not seems to linger long enough to cause much damage. No damage from fire has been reported for the species

Recommended conservation strategies

Like other taxa that occur on the Verde Formation, conservation of habitat is of primary concern to the viability of the populations. For a more detailed account of the Verde Formation, see page 59.

1. Prevention of off-road vehicle traffic

Impediments to off-road use in areas where individuals of the taxon occurs are of primary importance. Closing two-tracks and minor Forest roads with large boulders and/or other vehicle-proof structures at access points may be effective in this regard. Signs suggesting alternate and legal ORV areas in the vicinity may be useful.

2. Surveys for new individuals

Surveys within areas where appropriate soils occur in the Forest would help ascertain the presence of any additional populations. Since much of the potential habitat for the taxon has been surveyed, at least within PNF, survey efforts may be minimal. Also, surveys for individuals of this taxon can be conducted concurrently with those for other taxa that occur within similar habitats.

3. Fire management
Although historically habitats within the Verde Formation and other soils where *Salvia dorrii var. mearnsii* occur are not subject to fire, in years where non-native weeds, such as *Bromus rubens* (cheatgrass), are abundant, fire may be a problem. During such years, removal of weeds near individuals of *Salvia dorrii var. mearnsii* may be preventative.

4. Grazing management

Until such time as negative grazing efforts are record for individuals of the taxon, conservation efforts centering on grazing management are not recommended.

Recommended monitoring

Baseline data that recorded the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. The interval of monitoring may also depend on baseline data. For example, if individuals of *Salvia dorrii var. mearnsii* appear to be healthy with no impacts, then monitoring could probably done less frequently.

References

Arizona Game and Fish Department. 2002. Plant abstract for *Salvia dorrii* var. *mearnsii*. Phoenix, Arizona.

Kearney, Thomas H., and Robert H. Peebles. 1960. Arizona Flora. University of California Press, Berkeley, California.

Sporobolus interruptus

Species overview

Sporobolus interruptus is a handsome bunchgrass with short rhizomes that is rarely seen within PNF. The evolutionary biology of the species is confusing in that it is thought to be a triploid suggesting plants are sexually sterile. If this is true, then the species is clonal, producing seeds apomictically. Often, triploids are products of hybridization, which would help explain the infrequent occurrence of populations. There is no mention, however, in the Flora of North America of this possibility and there are no other rhizomatous species of *Sporobolus* in our area (Flora of North America Editorial Committee. 2010).

Life history

The presence of rhizomes suggests that individuals of *Sporobolus interruptus* may be longer-lived than at least some dropseeds, such as *S. cryptandrus*. However, it is probably not as long-lived as the more robust dropseeds, such as *S. arioides*. Flowers emerge between July and October.

Distribution and abundance

Sporobolus interruptus is endemic to Apache, Coconino, Gila, Maricopa, Navajo, and Yavapai counties, Arizona, with 83 occurrences listed in Seinet. The total distribution range for *S. interruptus* is 378km; in south Apache County, there are two occurrences, ranging 4km; throughout Coconino County, there are 55 occurrences, ranging 244km; in north and central Gila County, there are twelve occurrences, ranging 133km; in west Maricopa County, there is one occurrence; and in south and central Yavapai County, there are six occurrences, ranging 84km. The remaining seven occurrences have insufficient locality data. There are five occurrences for the species spread over PNF, ranging 36km.

Habitats

Populations of *Sporobolus interruptus* tend to occur on southwest-facing slopes, mesa tops, and flat exposures; with substrates that include basalt, clay loam, and limestone. Elevation ranges between 1090m (3576ft) and 2340m (7677ft) with a mean elevation of 1750m (5741ft). Vegetation types include pine/juniper forest, oak woodland, and *Poa pratensis* grassland.

Known and potential threats

Sporobolus interruptus is highly relished by livestock (United States Department of Agriculture 1937) and fire is prevalent in all habitats in which it occurs. The presence of rhizomes, however, may offer some resistance to both grazing and fire impacts. At least some of its populations are accessible to off-road vehicles.

Recommended conservation strategies

1. Grazing management

Since known populations within PNF inhabit small widely spaced sites, a limited degree of grazing management might be needed to insured their continued viability. Limiting grazing on sites where the species occurs until after plants have set seed might be effective. Any more drastic conservation measures should probably wait until at least some monitoring of populations has been done.

2. Fire management

Habitats where populations of *Sporobolus interruptus* occur are subject to fire but any potential effects of fire on the species are undocumented. Most species of the genus respond well to occasional fires. Prescribed burning may facilitate the maintenance of populations by reducing overstory and litter and act as a deterrent to catastrophic fires. Initial and repeat monitoring may provide some insight into whether fire management would enhance the viability of this species within the Forest.

2. Prevention of off-road vehicle traffic

Off-road vehicle use is potentially damaging to populations of the taxon, especially where it causes erosion that leads to severe soil loss from habitats. Impacts of off-road vehicle use should be reviewed through initial monitoring efforts.

4. Surveys for new individuals

Because habitats where *Sporobolus interruptus* occurs are common and widespread, specific surveys for additional populations may not be practical, except perhaps within the immediate areas of known populations.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. Although the interval of monitoring may also depend on baseline data, monitoring selected populations every three to five years would probably be sufficient to detect new threats and address the viability of the species.

References

Flora of North America Editorial Committee. 2003. Flora of North America. 25:133-134.

United States Department of Agriculture. 1937. *Range Plant Handbook*. United States Government Printing Office, Washington, DC

Triteleia lemmoniae

Species overview

Triteleia lemmoniae a unique scapose perennial herb with bright yellow to orange turbinate flowers. It has 1-3 basal, grass-like leaves to 40cm long and is the only species of the genus in Arizona. Although it is most similar mophologically to *T. hyacinthina*, which occurs in the northwestern U. S., molecular data suggest that it is related to *T. montana*, which occurs in the Sierra Nevada of California. (Flora of North America Editorial Committee. 2002)

Life history

Leaves and flowering shoots emerge in the spring from a fibrous-coated corm similar to many native onions. Flowers open between May and August.

Distribution and abundance

Triteleia lemmoniae is endemic to Coconino, Gila, Navajo, and Yavapai counties, with 41 occurrences listed in Seinet. Its total distribution range is 221km; in south and southeast Coconino County, there are 23 occurrences, ranging 231km; in north and west Gila County, there are thirteen occurrences, ranging 70km; in south Navajo County, there is one occurrence; and in south-central Yavapai County, there is one occurrence. The remaining three

occurrences have insufficient locality data to map. There are no occurrences in PNF but there are two records within 2km of the northern boundary at Lake Pocket.

Habitats

Populations of *Triteleia lemmoniae* occur in open areas, near ponds, and on rocky hillsides; with substrates that include sandstone and volcanic soils. Elevation ranges between 980m (3215ft) and 2340m (7677ft) with a mean elevation of 1660m (5446ft). Vegetation types are pine and oak woodlands.

Known and potential threats

Because of its habit, *Triteleia lemmoniae* is probably not directly effected by either grazing or fire. Its leaves are inconspicuous and somewhat hidden among other herbs and grasses. Also the bulk of its energy stores are in the underground corm, which is protected from grazing and most fires. Impacts from fire and grazing, therefore, would primarily occur when they lead to soil damage and severe reduction in the amount of herbaceous cover. Some populations of the species are probably accessible to off-road vehicles.

Recommended conservation strategies

1. Surveys for populations within Prescott National Forest

Because there are no populations of the species within the Forest boundaries, surveys specific to the species must be conducted in order to ascertain if populations do occur within the Forest. Because of the apparent common nature of habitats for *Triteleia lemmoniae*, it may prove most efficient to begin surveys in the general areas where populations are known.

2. Grazing management

Impacts of grazing on populations of *Triteleia lemmoniae* may probably has more to do with their influence on the general health of the grassland rather than grazing of specific individuals. Since the health of grasslands is of primary concern to the Forest, grassland management where populations of this taxon occur may be of additional concern. For example, recruitment of individuals may be facilitated by limiting grazing until after plants have set seed. More drastic conservation measures should probably wait until at least some monitoring of populations has been done.

3. Fire management

Habitats where populations of *Triteleia lemmoniae* occur are subject to fire but any potential effects of fire on the species are undocumented. Prescribed burning may facilitate the maintenance of populations by reducing overstory and litter; and act as a deterrent to catastrophic fires. Initial and repeat monitoring may provide some insight into whether fire management would enhance the viability of this species within the Forest.

4. Prevention of off-road vehicle traffic

Off-road vehicle use is potentially damaging to populations of the taxon, especially where it causes erosion that leads to severe soil loss from habitats. Impacts of off-road vehicle use should be reviewed through initial monitoring efforts.

Recommended monitoring

Baseline data that record the presence or absence of impacts caused by grazing, browsing and other forms of herbivory; off-road vehicle use, weeds, fire, and other factors would be useful in determining better regime of conservation strategies. Although the interval of monitoring may also depend on baseline data, monitoring selected populations every three to five years would probably be sufficient to detect new threats and address the viability of the species.

References

Arizona Game and Fish Department. 2004. Plant abstract for *Triteleia lemmoniae*. Phoenix, Arizona.

Flora of North America Editorial Committee. 2002. Flora of North America. 26:345.

Part 3. Habitats of Special Concern

Verde Formation

Because of the particular importance of the Verde Formation habitats with respect to rare species within the Forest, threats to this habitat and conservation recommendations are presented in more detail below.

The Verde Formation is composed of tertiary lake bed deposits of powdery calcareous and gypseous soils from secondary deposition of limestone and dolomite alluvium, often mixed with red-brown clayey and sandy soils. Areas of Verde Formation within PNF are limited both in acreage and geography and occur along the easternmost boundary of the Forest. Outside the Forest, the Verde Formation habitat is threatened by gypsum quarries, urban development, utility right-of-ways, and off-road vehicle use. Some combination of these threats probably exists on Forest.

A list of taxa of conservation concern known to occur on Verde Formation habitat within PNF is provided in Table 4.

Table 4. Vascular plant taxa of conservation concern known to occur on Verde Formation habitat within PNF. All species listed are considered here an immediate viability concern.

Taxon	Common name	Occurs only on Verde Formation, at least within PNF?
Anulocaulis leiosolenus var. leiosolenus	Southwestern ringstem	Yes
Eriogonum ripleyi	Ripley's wild-buckwheat	Yes
Eriogonum ericifolium (*E. ericifolium* var. *ericifolium*)	Heathleaf wild buckwheat	Yes
Eriogonum arizonicum	Arizona wild-buckwheat	No, occurs in similar soil types over a large range
Lesquerella cinerea (*Physaria cinerea*)	Basin bladder-pod	No, also occurs in other limestone soils
Lotus mearnsii var. mearnsii	Mearns lotus	No, also occurs in other limestone soils
Pediomelum mephiticum	Skunk-top scurfpea	No, although the newly described species, *P. verdiensis* is mostly limited to the Verde Formation
P. verdiensis	Verde breadroot	
Polygala rusbyi	Hualapai milkwort	No, also occurs in other limestone soils
Salvia dorrii ssp. *mearnsii*	Mearns sage	No but occurs on similar soils to the west

Recommended conservation strategies

1. Prevention of off-road vehicle traffic

Impediments to off-road use in areas of the Verde Formation is of primary conservation concern. Soils within the Verde Formation are loose and fragile. Vehicles tend to make deep and lasting tracks and vegetation is easily uprooted. The closure of two-tracks and minor Forest roads in the vicinity of the Verde Formation might solve the problem. Because Forest visitors do not always obey signs, blocking access with large boulders and/or other vehicle-proof structures at access points may be necessary. A single off-road vehicle could cause damage that might take decades to heal. In addition, signs posted at block roads that suggest alternate and legal ORV areas in the vicinity may a viable deterrent.

2. Conservation designation

Any conservation designation that would reduce the risk of gypsum mines, pipe-lines, power poles, and other projects that would severely disturb habitats within the Verde Formation would provide additional protection for rare species that occur there.

3. Grazing management

Although restricting cattle grazing may benefit populations of the rare taxa that occur within the Verde Formation, wasted efforts in this regard may be avoided if rare plant populations are first monitored in order to ascertain if grazing by both cattle an elk is indeed a negative influence. If grazing is a problem, then perhaps the areas could be excluded from the grazing allotment by exclosures. If grazing by elk is also of concern, then stronger fencing would be required.

4. Weed management

The spread of invasive plants species is an increasing throughout the Forest. It may be of particular concern on the loose soils of the Verde Formation. For example, two species of invasive exotic species have recently become a problem within soils of the Verde Valley. One of these, *Centaurea solstitialis* (yellow starthistle), is a spiny cool season annual with bright yellow flowers. It can be fatal horses that feed on it. The other species, *Centaurea diffusa* (diffuse knapweed) is generally a biennial with white to lavender flowers. Both species, one established can be very difficult to eradicate and can severely alter the ecology of an infested area. Fortunately, both of the aforementioned weeds do not possess rhizomes and can be easily pulled out. Eradication, however, takes repeated treatments over several years. Probably the best management advice would be to try to catch infestations early on.

5. Fire management

Although historically habitats within the Verde Formation are not subject to fire, in years where non-native weeds, such as *Bromus rubens* (cheatgrass), are abundant, fire may be a problem. During such years, removal of such weeds from critical areas may be preventative.

Recommended monitoring

Because populations of several rare taxa occur within the Verde Formation, monitoring of several of these populations could be done concurrently. Recommended frequency of monitoring would, of course, depend on the types of impacts detected during initial data collection. Data collected should include date of collection, time of day, GPS coordinates of individuals or at least populations; numbers of individuals; size of individuals; stage of maturation; state of phenology (buds, flowers, fruits); overall herb cover; overall shrub and tree cover; percent covers of duff, soil, cobbles, rocks, boulders, and bedrock; presence of weed species, types of human impacts, signs of herbivory and disease, signs of grazing and associated impacts, signs of fire and associated impacts, and signs of flooding and/or erosion and associated impacts.

Part 4. Species Viability Summaries

Associated Habitats

A summary of all vascular plant species of viability concern and their associated habitats within Prescott National Forest boundaries is provided in Table 5.

Risk Factors

An overview of their risk factors is presented in Table 6.

Viability Ratings

Tables 7, 8, and 9 list the plant species by low, moderate and high at-risk viability. For the species that are at low risk for viability, the implementation of coarse filter plan components (e.g. desired conditions that apply to all vegetation types) should assure their continued viability. For species that are at moderate or high risk for viability, additional fine filter plan components (standards, guidelines) are necessary to assure their continued viability. Specific coarse and fine filter plan components are listed after each table.

Table 5. Vascular plant species of viability concern and their associated habitats within Prescott National Forest boundaries										
	Habitat type									
Taxon	**Grasslands, including P- J grasslands**	**Ponderosa Pine and Douglas Fir Forests**	**Riparian and springs**	**Moist, north-facing slopes**	**Rock cliffs, ledges, and outcroppings**	**Verde Formation**	**Calcareous alluvial soils, except Verde Formation**	**Cobbly ridges and hillsides**	**Archeological sits**	
Agave phillipsiana								Mostly	Often	
Agave delamateri								Mostly	Often	
Anulocaulis leiosolenus						Mostly				
Arenaria aberrans				Mostly						
Astragalus troglodytus	Mostly									
Cystopteris utahensis			Mostly		Mostly					
Desmodium metcalfei		Mostly	Mostly							
Eriogonum ericifolium					Always					
Eriogonum arizonicum							Often	Often		
Eriogonum ripleyi						Mostly	Often			
Hedeoma diffusum		Mostly	Often		Mostly					
Heuchera novamexicana				Mostly						
Heuchera eastwoodiae				Mostly	Mostly					
Lesquerella cinerea						Often	Often	Often		
Lesquerella pinetorum		Mostly					Often			
Lotus mearnsii var. *mearnsii*	Often					Often	Often			
Lupinus latifolius ssp. *leucanthus*			Mostly	Possibly						
Mertensia macdougalii	Often	Often		Often						
Pediomelum mephiticum	Often					Often	Often	Often		
Pediomelum verdiensis						Mostly				
Phlox amabilis	Often						Often	Often		
Polygala rusbyi	Mostly						Mostly	Often		
Salvia dorrii ssp. *mearnsii*						Often	Often	Often		
Sporobolus interruptus		Often	Often							
Triteleia lemmoniae	Possibly	Possibly								

Table 6. Vascular plant species of viability concern and their associated risk factors within Prescott National Forest boundaries									
	Risk Factors								
Taxon	**Off-road vehicle traffic**	**Grazing**	**Mining**	**Fire**	**Logging, thinning**	**Weed invasion**	**Flooding**	**Collecting**	**Herbivory**
Agave phillipsiana	Negative	Unknown	Negative	Unknown	Neutral	Negative	Neutral	Unknown	Unknown
Agave delamateri	Negative	Unknown	Negative	Unknown	Neutral	Negative	Neutral	Unknown	Unknown
Anulocaulis leiosolenus	Negative	Negative	Negative	Unknown	Neutral	Negative	Neutral	Neutral	Unknown
Arenaria aberrans	Negative	Unknown	Negative	Unknown	Unknown	Negative	Neutral	Neutral	Unknown
Astragalus troglodytus	Negative	Unknown	Negative	Unknown	Unknown	Negative	Neutral	Neutral	Unknown
Cystopteris utahensis	Unknown	Neutral	Unknown	Unknown	Unknown	Negative	Neutral	Neutral	Unknown
Desmodium metcalfei	Negative	Unknown	Negative	Unknown	Unknown	Negative	Unknown	Neutral	Unknown
Eriogonum ericifolium	Negative	Unknown	Negative	Unknown	Neutral	Negative	Neutral	Neutral	Unknown
Eriogonum arizonicum	Negative	Unknown	Negative	Unknown	Neutral	Negative	Neutral	Neutral	Unknown
Eriogonum ripleyi	Negative	Unknown	Negative	Unknown	Neutral	Negative	Neutral	Neutral	Unknown
Hedeoma diffusum	Negative	Unknown	Negative	Unknown	Unknown	Negative	Neutral	Neutral	Unknown
Heuchera novamexicana	Negative	Unknown	Negative	Unknown	Unknown	Negative	Neutral	Neutral	Unknown
Heuchera eastwoodiae	Negative	Unknown	Negative	Unknown	Unknown	Negative	Neutral	Neutral	Unknown
Lesquerella cinerea	Negative	Unknown	Negative	Unknown	Neutral	Negative	Neutral	Neutral	Unknown
Lesquerella pinetorum	Negative	Unknown	Negative	Unknown	Unknown	Negative	Neutral	Neutral	Unknown
Lotus mearnsii var. *mearnsii*	Negative	Unknown	Negative	Unknown	Neutral	Negative	Neutral	Neutral	Unknown
Lupinus latifolius ssp. *leucanthus*	Negative	Unknown	Negative	Unknown	Unknown	Negative	Negative	Neutral	Unknown
Mertensia macdougalii	Negative	Unknown	Negative	Unknown	Unknown	Negative	Neutral	Neutral	Unknown
Pediomelum mephiticum / Pediomelum verdiensis	Negative	Unknown	Negative	Unknown	Neutral	Negative	Neutral	Neutral	Unknown
Phlox amabilis	Negative	Unknown	Negative	Unknown	Neutral	Negative	Neutral	Neutral	Unknown
Polygala rusbyi	Negative	Unknown	Negative	Unknown	Neutral	Negative	Neutral	Neutral	Unknown
Salvia dorrii ssp. *mearnsii*	Negative	Unknown	Negative	Unknown	Neutral	Negative	Neutral	Neutral	Unknown
Sporobolus interruptus	Negative	Unknown	Negative	Unknown	Unknown	Negative	Neutral	Neutral	Unknown
Triteleia lemmoniae	Negative	Unknown	Negative	Unknown	Unknown	Negative	Neutral	Neutral	Unknown

Table 7. List of Vascular Plants on the Prescott NF having Low Risk to Viability.						
Name	**Status**	**Known Populations**	**Habitat Association**	**Viability Risk Factors**	**Viability Risk**	**Plan components that address viability concerns**
Tonto Basin Agave (Agave delamateri)	**S**	Coconino County: 4 Yavapai County: 36 PNF: 5	Cobbly ridges/ hills	Fire	Low	**Coarse Filter Components:** Desired Conditions-Veg-1,3,4,5
Phillips' Agave (Agave phillipsiana)	**S**	Coconino County: 15 Yavapai County: 21 PNF: 12	Cobbly ridges/ hills	Fire	Low	
Mt. Dellenbaugh Sandwort (Arenaria aberrans)	**S**	Coconino County: 7 Yavapai County: 13 PNF: 6	Moist, north-facing slopes	Fire	Low	
Creeping Milkvetch (Astragalus troglodytus)	O	Coconino County: 42 Yavapai County: 10 PNF: 3	Grasslands	No known threats	Low	
Utah Bladder Fern (Cystopteris utahensis)	O	Coconino County: 25 Yavapai County: 1 PNF: 1	Rock cliffs & ledges	No known threats	Low	
Metcalfe's Ticktrefoil (Desmodium metcalfei)	**S**	Coconino County: 1 Yavapai County: 1 PNF: 1	Ponderosa pine forests	No known threats	Low	
Flagstaff Pennyroyal (Hedeoma diffusum)	**S**	Coconino County: 43 Yavapai County: 20 PNF: 2	Rock cliffs & ledges	Weed invasion	Low	
Eastwood Alum-root (Heuchera eastwoodiae)	**S**	Coconino County: 1 Yavapai County: 43 PNF: 33	Moist, north-facing slopes	Fire	Low	
New Mexico Alum-root (Heuchera novomexicana)	O	Coconino County: 3 Yavapai County: 3 PNF: 3	Moist, north-facing slopes	Fire	Low	
Oak Creek Triteleia (Triteleia lemmoniae)	O	Coconino County: 23 Yavapai County: 5 PNF: 0	Grasslands; Ponderosa pine forests	Not known to occur on PNF	Low	

Prescott NF coarse-filter plan components developed to reduce plant viability concerns:

DC-Ecosystem Resilience - 1	• Ecosystems retain all of their essential components, processes, and functions under changing and uncertain future environmental conditions. These resilient ecosystems provide a wide range of ecosystem services for local and regional needs. • Prescott NF landscapes retain capacity to survive natural disturbances and threats to sustainability such as those driven by climate change and an increasing human population. • Ecosystem functions (e.g., nutrient cycling, water infiltration, and carbon sequestration) are sustained as forests, woodlands, grasslands, and desert communities adapt to changing conditions. • Ecosystems are resilient or adaptive to changing natural disturbance regimes (e.g., drought, wind, fire, insects, and pathogens), allowing for shifting of plant communities, structure, and ages across the landscape. • Ecological conditions for habitat quality, distribution, and abundance contribute to self-sustaining populations of terrestrial and aquatic plants and animals. Conditions provide for the life history, distribution, and natural population fluctuations of the species within the capability of the ecosystem.
DC-Veg-1	• Diverse vegetation structure, species composition, and densities, provide quality habitat for native and desirable nonnative plant and animal species throughout their life cycle and at multiple spatial scales. Landscapes provide for the full range of ecosystem diversity at multiple scales, including habitats for those species associated with old growth conditions. • Native plant communities dominate the landscape, while nonnative invasive species are nonexistent or in exist in low quantities. Establishment of invasive plant species new to the Prescott NF is prevented. Existing invasive plant species are prioritized for eradication, containment, or control.
DC-Veg-4	• Ecological conditions provide suitable habitat for plants identified as Southwestern Region sensitive species.
DC-Veg-5	• Locally endemic plant communities are intact and functioning. • Unique plant community habitats (e.g., limestone cliffs, margins of seeps and springs, Verde Valley Formation, basalt-lava flows/cinders, calcareous soil/alkaline clay, canyons/cliffs and ledges, granitic soils/igneous rocks, sandstone rocks/soils and riparian forest) are present to maintain well distributed populations of associated native plant species. • Native plants provide nectar, floral diversity, and pollen throughout the seasons that pollinator species are active. Desired habitat conditions promote pollinator success and survival. • Species identified as culturally important are valued and, therefore, enhanced and protected.

Table 8. List of Vascular Plants on the Prescott NF having Some Risk to Viability.

Name	RFSS Status?	Known Populations	Habitat Association	Viability Risk Factors	Viability Risk	Plan components that address viability concerns
Arizona Wild Buckwheat (Eriogonum arizonicum)	No	Coconino County: 1 Yavapai County: 10 PNF: 5	Cobbly ridges/ hills; Calcareous alluvial soils	OHV use	Some	**Coarse Filter Components:** Desired Conditions-Ecosystem Resilience-1; Desired Conditions-Veg-1,4,5; **Fine-Filter Components:** Std-Plants-1, Std-Rec-1, Guide-Plants-1,2,3,5 Guide-Range-4, Guide-Recreation-5, Guide-Minerals-Materials-5 *Guide-Fish/Aquatics-2, Guide-Recreation-8
Basin Bladderpod (Lesquerella cinerea)	No	Coconino County:11 Yavapai County: 38 PNF: 10	Cobbly ridges/ hills; Calcareous alluvial soils	OHV use	Some	
White Mountain Bladderpod (Lesquerella pinetorum)	No	Coconino County: 6 Yavapai County: 8 PNF: 3	Calcareous alluvial soils	OHV use	Some	
Mearns Lotus (Lotus mearnsii var. mearnsii)	No	Coconino County: 13 Yavapai County: 50 PNF: 13	Grasslands; Calcareous alluvial soils	OHV use	Some	
Broadleaf Lupine (Lupinus latifolius var. leucanthus)	**Yes**	Coconino County: 0 Yavapai County: 21 PNF: 19	Perennial streams, seeps and springs	Weed invasion, Wetland degradation*	Some	
Macdougal's Bluebells (Mertensia macdougalii)	No	Coconino County: 63 Yavapai County: 5 PNF: 3	Grasslands; Ponderosa pine forests	OHV use	Some	
Skunk-top Scurfpea (Pediomelum mephiticum)	No	Coconino County: 4 Yavapai County: 12 PNF: 8	Grasslands; Verde Formation	OHV use	Some	
Arizona Phlox (Phlox amabilis)	**Yes**	Coconino County: 17 Yavapai County: 27 PNF: 9	Cobbly ridges/hills	OHV use	Some	
Hualapai Milkwort (Polygala rusbyi)	**Yes**	Coconino County: 0 Yavapai County: 78 PNF: 20	Grasslands; Verde Formation	OHV use, weed invasion	Some	
Mearns Sage (Salvia dorrii ssp. Mearnsii)	**Yes**	Coconino County: 0 Yavapai County: 74 PNF: 38	Cobbly ridges/ hills; Verde Formation	OHV use, weed invasion	Some	
Black Dropseed (Sporobolus interruptus)	No	Coconino County: 55 Yavapai County: 6 PNF: 5	Ponderosa pine forests	OHV use	Some	

Prescott NF fine-filter plan components developed to reduce plant viability concerns:

Standard-Plants-1	Collection of Southwestern Region Sensitive Plants shall occur for research or scientific purposes only.
Guide-Plants-1	Design features and/or mitigation measures should be incorporated in all Forest Service projects, as needed, to insure that Southwestern Region Sensitive Plant Species do not trend toward listing as threatened or endangered. species.
Guide-Plants-2	Applicable design features in appendix B—Design Features, Best Management Practices, Required Protection Measures and Mitigation Measures—from the "Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds" (Forest Service, 2005a) or more current direction—should be followed in treating nonnative invasive plant species and for managing site disturbing projects and maintenance.
Guide-Plants-3	Efforts to improve severely disturbed sites, especially those within the vicinity of occupied Southwestern Region Sensitive Plant Species habitat, should be undertaken to reduce non-native invasive plant species colonization, protect soils, and improve watershed condition.
Guide-Plants-5	In cases where plant collection permits are issued, collecting seeds or cuttings should be encouraged, while digging or physically removing whole plants should be discouraged.
Guide-Range-4	Livestock salting should be located away from known locations of Southwestern Region Sensitive Plant Species so that plants are not adversely affected by associated trampling.
Standard-Rec-1	Only designated roads, motorized trails, and motorized use areas as depicted and described on the Motorized Vehicle Use Map are open to public motorized vehicle use.
Guide-Rec-5	Unauthorized travel routes should be returned to natural conditions to discourage continued use.
Guide-Minerals Materials-5	Occupied Southwestern Region sensitive species habitat should be avoided during development of new mineral material extraction sites. Heavy equipment use and material removal should not take place in occupied Southwestern Region sensitive species habitat within current or new permitted sandstone or dolomitic limestone quarries.

Fine-filter plan components developed to reduce viability concerns for plants found near streams, seeps and springs.

Guide-Fish/Aquatics-2	Design features, mitigation, and project timing considerations should be incorporated into ground-disturbing projects that may affect Southwestern Region sensitive species' occupied habitat near streams, seeps, and springs. Examples include, but are not limited to: undisturbed areas, timing restrictions, adjusted intensity of use, and avoiding use of large equipment.
Guide-Recreation-8	New developed campgrounds and designated dispersed campsites should be located away from riparian areas, floodplains, and other environmentally sensitive areas.

Table 9. List of Vascular Plants on the Prescott NF having Some Risk of Viability due to restricted locality.

Name	RFSS Status?	Known Populations	Habitat Association	Viability Risk Factors	Viability Rating	Plan components that address viability concerns
Southwestern Ringstem (Anulocaulis leiosolenus var. leiosolenus)	No	Coconino County: 5 Yavapai County: 5 PNF: 2	Verde Formation	OHV use, mining, weed invasion	Some	**Coarse Filter Components:** Desired Conditions-Ecosystem Resilience-1; Desired Conditions-Veg-1,4,5; **Fine-Filter Components:** Std-Plants-1, Std-Rec-1, Guide-Plants-1,2,3,5 Guide-Range-4, Guide-Recreation-5, Guide-Minerals-Materials-5 Guide-Plants-6
Yavapai Wild Buckwheat (Eriogonum ericifolium)	**Yes**	Coconino County: 0 Yavapai County: 22 PNF: 1	Verde Formation	OHV use, mining, weed invasion	Some	
Ripley's Wild Buckwheat (Eriogonum ripleyi)	**Yes**	Coconino County: 0 Yavapai County: 28 PNF: 6	Verde Formation	OHV use, mining, weed invasion	Some	
Verde breadroot (Pediomelum verdiensis)	**Yes**	Coconino County: 4 Yavapai County: 12 PNF: 8	Verde Formation	OHV use, mining, weed invasion	Some	

Prescott NFfine-filter plan components developed to reduce viability concerns for plants found within the Verde Formation:

Guide-Plants-6	Within the Verde Formation: • New developments for mineral materials and motorized trails should be located outside of areas identified as medium or high potential rare plant habitat. • Plant surveys for Southwestern Region sensitive species should be carried out before using any heavy equipment for the implementation of projects.

Appendix A.

List of vascular plant taxa of conservation concern for the Prescott National Forest for which there is no immediate viability concern and for which there are no specific conservation recommendations except that they remain as target species when general rare plant surveys are conducted and selected populations, if applicable, are occasionally monitored.

Abronia nana

Species overview

Abronia nana is a small perennial herb with rather showy white flowers.

Life history

Considering its small stature, individuals of *Abronia nana* are probably short-lived. Flowers emerge between April and August.

Distribution and abundance

A wide spread species occurring from Arizona (Apache, Coconino, Mohave, and Yavapai, counties), California (Inyo and San Bernardino counties), Colorado, (Mesa and Montrose counties), Nevada (Clark, Elko, Esmeralda, Eureka, Lincoln, Nye, and White counties), New Mexico (San Juan and Sandoval counties), and Utah (Beaver, Duchesne, Emery, Garfield, Juab, Kane, Millard, Sevier, and Washington counties).

Habitats

Populations of the taxon occur on rock ledges, among rocks, south and east-facing slopes, and sandy washes. Soil substrates include white gypsum, sand, red clay loam, and sandstone. Elevation ranges between 700m (2296ft) and 1432m (4698ft) with a mean elevation of 1066m (3497ft). Vegetation types include desert shrub, piñon-juniper woodland, and sagebrush- juniper woodland.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because Widespread and fairly common, collected only once in PNF but at edge of range no conservation strategies are recommended at this time.

Agastache rupestris

Species overview

Agastache rupestris is a rather tall, fragile perennial with very fragrant foliage. In the **HDMS**, it is referred to as the Baboquivari Giant Hyssop. The species is in cultivation and is being sold by native plant nurseries.

Life history

Individuals are probably short-lived. Flowers emerge between July and October.

Distribution and abundance

A widespread species occurring from Sonora, Mexico to Arizona (Gila, Graham, Santa Cruz, and Yavapai counties), and New Mexico (Catron, Dona Ana, Grant counties).

A population occurs along a narrow canyon south of the 89A pass at Mingus Mtn., possibly near Black Canyon Spring. The specimen may be in PNF herbarium (Erik Moore, pers. comm.). Better collection data may be available in a report by Eric Glomski and Erik Moore regarding the health of perennial streams in PNF. No copies of the report have been located and may all be in storage at Verde District Office. Eric Glomski, Eric Moore, and Ron Stein have been contacted but none have copies. A collection was made by L. N. Goodding (*210-47*) in the same area in 1947.

Habitats

Populations of the taxon tend to occur on exposed north and west-facing rocky slopes, near the tops and bottoms of cliffs and canyons, and among grantie boulders; with substrates including granite and limestone. Elevation ranges between 500m (1640ft) and 1300m (4200ft) with a mean elevation of 900m (3497ft). Vegetation types include pine forest, evergreen forest, piñon-juniper woodland, and chaparral.

Known and potential threats

No threats are known for the species.

Recommended conservation strategies

1. Verification of locations within the Forest. Since current records of the species within the Forest are ambiguous, an attempt to relocate and better document these sites would aid in monitoring and conservation efforts.

2. Maintain the species on target lists for future surveys of rare plant species.

Allium bigelovii

Species overview

Allium bigelovii is an herbaceous perennial that grows to 20cm tall.

Life history

Although small in stature, it is unknown how many years that plants can sprout from their underground corms. Flowers March through May.

Distribution and abundance

A widespread species occurring from Arizona (Coconino, Gila, Greenlee, Maricopa, Mohave, Navajo, and Yavapai counties), to New Mexico (Hidalgo, Grant, Luna, and Dona Ana counties).

This species has been collected twice within the Forest by T. Wright (*1043, 1441*), once within grassland and another in scrubland.

Habitats

Populations of the taxon tend to occur on east and north-facing slopes and on open rocky hilltops; with substrates including tertiary lake bed deposits, basalt, siltstone, sandstone, limestone, and gravel alluvium, with white and loamy soils. Elevation ranges between 558m (1500ft) and 1840m (1636ft) with a mean elevation of 1216m (3889ft). Vegetation types include *Bouteloua gracilis-Aristida purpurea* grassland, Sonoran desert scrub, semi-desert grassland, and juniper-canotia open grasslands.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species is widespread in Arizona and New Mexico and the habitat non-specific no conservation strategies are recommended at this time.

Apodanthera undulata

Species overview

Apodanthera undulata is a perennial vine extending 2-4m, with a disagreeable odor and generally a few yellow flowers.

Life history

Although the herbage dies back during the winter, the plants probably are long-lived resprouting indefinitely from their tuberous roots. Flowers May-October.

Distribution and abundance

A widespread species occurring from Aguascalientes (Calvillo), Sonora (Agua Prieta, Arivechi, Cucurpe, Granados, Magdalena, Naco, Nogales, Nacozari de Garcφa, Santa Cruz, and Yocora), Chihuahua, Coahuila, Durango, Guanajuato, and Oaxaca, Mexico, through Arizona (Cochise, Gila, Graham, Pima, Maricopa, Pinal, Santa Cruz, and Yavapai counties), New Mexico (Dona Ana, Hildago, Luna, Grant, and Otero counties), and Texas (El Paso county).

Populations of the species have been collected from two areas within or near to PNF, one south of Wilhoit (Baker 14913), and the other collected by Deaver in 1975 west of Cottonwood. The species is not listed in the Arizona's Natural Heritage Program's Heritage Data Management System (HDMS).

Habitats

Populations of the taxon tend to occur on gentile south and east-facing slopes, sandy flats, and highly disturbed areas; with substrates including decomposing granite, sand, silt and alluvial terrace. Elevation ranges between 550m (1840ft) and 2000m (6580ft) with a mean elevation of 1275m (4192ft). Vegetation types include grassland, Chihuahuan desert scrub, scattered oaks, and mesquite woodland.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species is a Chihuahuan Desert species and only occurs in PNF at the edge of its range no conservation strategies are recommended at this time.

Asclepias uncialis

Species overview

Asclepias uncialis is a small perennial herb with several to many spreading or erect stems (2-6 cm tall), with narrow to lance-shaped leaves occurring primarily opposite of each other and with clusters of 7 to 12 rose-purple flowers at the tips of the stems.

Life history

Flowers from late March to late May; fruiting occurs from May to early July**.** The flowers are highly modified in structure and require insect visitor for pollination. Seeds mature at a relatively fast rate of approximately 40 days after pollination.

Distribution and abundance

Asclepias uncialis occurs over a large geographical area (Wyoming to New Mexico), but it is currently only known from about 25-30 localities. In Arizona, it is known from Coconino, Pima and Santa Cruz Counties. It exhibits a natural rarity and low population sizes. There are no documented surveys for the species in Yavapai County. It is not known to occur on the Prescott NF. The species may be easily overlooked by surveyors, due to its extremely small size, early bloom period, and the lack of widespread botanical focus.

Habitats

Populations of the taxon are most often found in grassland vegetation types on bare, open patches of soil between clumps of grasses in areas dominated by *Bouteloua gracilis* (blue gramma) and adjacent open woodlands dominated by pinyon and juniper or madrean evergreen oaks. Elevation ranges between 1461m (4790ft) and 1525m (5000ft) based on collections in SEINet.

Known and potential threats

The species occurs most often in plant communities that appear to be in a stable condition with little change in plant composition. The species does not appear to tolerate competition from weedy annual species. It is unknown what impact fire and livestock grazing has on the species. Overgrazing could alter the composition of native plant communities in an area, increasing competition from weedy species and possibly altering the spectrum of pollinators available (Locklear 1991). In some cases, this species has been found on soils disturbed by vehicles or other human activities.

Recommended conservation strategies

Because the species occurs over a large geographical area (Wyoming to New Mexico), and is found in only three counties within Arizona, no conservation strategies are recommended until it is found to occur within Yavapai County.

Astragalus calycosus var. scaposus

Species overview

Astragalus calycosus var. scaposus is a perennial herb with silvery leaves and purple and white flowers; extraordinarily large plants have been collected in PNF.

Life history

Flowers from April –June, and some have been documented to be flowering in October.

Distribution and abundance

A widespread species occurring from Arizona (Apache, Coconino, Gila, Mohave, Yavapai, and Navajo counties), Colorado (Montezuma and Monroe counties), Nevada (Lincoln and White Pine counties), New Mexico (Catron, San Juan, Cibola, La Plata, McKinley, Sandoval, and Socorro counties), and Utah (Iron, Juab, Kane, San Juan, and Washington counties).

Although most collections for the taxon have been made within the Verde Valley, many have been recorded outside of the area in several habitats. The species is not listed in the Arizona's Natural Heritage Program's Heritage Data Management System (HDMS). Herbarium specimens should be re-examined to verify that they are identified properly.

Habitats

Populations of the taxon tend to occur on all aspects of steep and shallow slopes and in canyons; with substrates including fine brown silt, quartzite, basalt, sandstone, gravel, and limestone. Elevation ranges between 699m (2293ft) and 2145m (4665ft) with a mean elevation of 1422m (4665ft). Vegetation types include bouteloua grassland, mixed shrub, pine and juniper communities, and desert shrub.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because there have been many collections from Arizona, New Mexico, and Utah showing

that the species is common over a large range no conservation strategies are recommended at this time.

Carex ultra

Species overview

Carex ultra is a herbaceous perennial that can grow up to 2m tall, with spikelets that are long for a sedge, 5.0-10.2 cm (2.0-4.0 in.), generally occurring in shady areas and in moist soils.

Life history

Individuals are robust and probably long-lived if conditions are favorable. Flowers March through September

Distribution and abundance

A widespread species occurring from Mexico (Sonora and Coahila), to Arizona (Cochise, Coconino, Graham, Pima, Pinal, Santa Cruz, and Yavapai counties), and New Mexico (Grant, Hildalgo, and Sierra counties).

Habitats

Populations of the taxon tend to occur is shaded areas on east and south-facing slopes, riparian areas, and the bottom of canyons; with substrates including granite, sand and gravel, and alluvial soils. Elevation ranges between 610m (2001ft) and 1800m (5905ft) with a mean elevation of 1205m (4002ft). Vegetation types include riparian woodland, oak- piñon woodland, and mixed conifer forest.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species occurs at the southern edge of PNF but has not actually been found in the forest no conservation strategies are recommended at this time.

Cleome lutea var. jonesii

Species overview

Cleome lutea var. jonesiii is a generally tall annual, growing up to 2m (6ft), with yellow flowers.

Life history

The species flowers May through September.

Distribution and abundance

The species is endemic to Arizona (Cochise, Coconino, Mohave, Gila, Pima, Pinal, Santa Cruz, and Yavapai counties).

Populations of this taxon occur within PNF in grasslands to the east and north of Chino Valley. The species is not listed in the Arizona's Natural Heritage Program's Heritage Data Management System (HDMS).

Habitats

Populations of the taxon tend to occur in riparian areas, flood plains, dry gullies and disturbed areas such as road sides; with substrates including basalt, gravel, and sandy soils. Elevation ranges between 610m (2001ft) and 1640m (5546ft) with a mean elevation of 1128m (3723ft). Vegetation types include *Populus-Salix* woodland, grasslands, and oak woodland.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because of the widespread distribution of the species in Arizona and a somewhat weedy nature no conservation strategies are recommended at this time.

Cupressus arizonicus (pygmy)

Species overview

Unlike the pygmy cypress that occurs in California (*Cupressus pigmaea*), the pygmy Arizona cypress of PNF have not been formally named. The unique form of individuals within the pygmy forest of PNF are most certainly caused by the nature of their habitat such as shallow

soils overlaying bedrock.

Life history

Although severely stunted, individuals within the pygmy forest are probably very old. Like typical individuals of *Cupressus arizonicus*, cones form between

Distribution and abundance

The species is endemic to Arizona (Cochise, Coconino, Mohave, Gila, Pima, Pinal, Santa Cruz, and Yavapai counties).

Habitats

Populations of the taxon tend to occur in riparian areas, flood plains, dry gullies and disturbed areas such as road sides; with substrates including basalt, gravel, and sandy soils. Elevation ranges between 610m (2001ft) and 1640m (5546ft) with a mean elevation of 1128m (3723ft). Vegetation types include *Populus-Salix* woodland, grasslands, and oak woodland.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because of the occurrence of the species within habitat that is not threatened by human or natural disturbances no conservation strategies are recommended at this time.

Draba asprella var. stelligera

Species overview

Draba asprella is a small perennial herb to 15cm tall with a rosette of simple entire leaves; *D. asprella* var. *stelligera* is distinguished by its fruits covered in short, dense hairs. Another variety, *D. asprella* var. *kaibabensis* is not recognized by FNA (Flora of North America Editorial Committee. 2010)

Life history

Often protected by limestone and sandstone outcrops. Flowers between April and July.

Distribution and abundance

Populations of the taxon are endemic to Coconino and Gila County, with 34 occurrences listed in Seinet and two localities listed from additional sources. In Coconino County, there are 29 occurrences in the central and southern portions, ranging 210km; and in northern Gila County, there is a single occurrence. There are six records in Seinet without locality data. For the species, there are six locations spread over PNF with a range of 88km with two locations within 1km of each other. Note that there are an additional 21 records in Seinet for *Draba asprella* var. *kaibabensis* and a total of 148 records for the species, most of which have not been identified to species.

Habitats

Populations of the taxon tend to occur on northeast and southwest-facing slopes; with substrates including sandy loam and alluvial soil. Elevation ranges between 1311m (2132ft) and 2134m (5741ft) with a mean elevation of 1200m (3936ft). Vegetation types include Pine forest, Evergreen forest, piñon-juniper woodland, and Chaparral.

Known and potential threats

Fire is a potential threat for the species but there is no information on fire tolerance for the species.

Recommended conservation strategies

1. A review of herbarium material is necessary to determine whether the taxon (*Draba asprella* var. *stelligera*) occurs within the Forest.

2. Maintain the species on target lists for future surveys of rare plant species.

Recommended monitoring

If a review of herbarium material and/or natural populations determines that the taxon does occur within the Forest, then monitoring of selected populations would be a useful step in determining whether threats exist and whether conservation strategies would facilitate the viability of the taxon.

References

Flora of North America Editorial Committee. 2010. Flora of North America. 7:293-294.

Echinocereus yavapaiensis

Species overview

Echinocereus yavapaiensis is a cespitose shrub with thick succulent stems and showy red flowers. It differs from its closest relative, *E. coccineus*, in having more ribs, more uniform spines, and occurring in lower, dryer habitats. Also, *E. coccineus* has 44 chromosomes and *E. yavapaiensis* has 66, which is the highest number in the genus.

Life history

Individuals of *Echinocereus yavapaiensis* probably live decades and produce clusters of over a hundred stems. Individuals grow fairly quickly, however, and may not be as old as they appear. Plants can germinate from seeds and flower within three years. Flowers generally open in March.

Distribution and abundance

Although known populations of the *Echinocereus yavapaiensis* are restricted to Yavapai County, Arizona, they are common within their range and individuals are generally abundant. The species is not listed in the Arizona's Natural Heritage Program's Heritage Data Management System (HDMS).

Habitats

Populations of the taxon tend to occur on south-facing hills, in canyons, in boulder outcrops and in dry washes; with substrates including granite, basalt, dark gray purple schist, red rhyolite, and quartzite. Elevation ranges between 650m (2132ft) and 1750m (5741ft) with a mean elevation of 1200m (3936ft). Vegetation types include *Quercus emoryi* scrub, *Pinus edulis* woodland, desert scrub, and transition scrub.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the occurrence of the species is primarily in protected habitats where it is common and abundant within its limited range no conservation strategies are recommended at this time.

Ephedra fasciculata

Species overview

Ephedra fasciculata is a perennial

Life history

Gymnosperm

Distribution and abundance

A widespread species occurring from Mexico (Baja Cal Norte), through Arizona (Apache, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pinal, Yavapai, and Yuma counties), California (Imperial, Inyo, and San Bernardino counties), Nevada (Clark county), and Utah (Washington County.

Habitats

Populations of the taxon tend to occur north, east, and west-facing steep slopes, along benches and saddles, in sandy washes, amount large rocks, and along roadsides; with course soil substrates including igneous gravel, granite, and sandy soils. Elevation ranges between 335m (1099ft) and 1300m (4265ft) with a mean elevation of 817m (2682ft). Vegetation types include upland Sonoran desert, juniper grassland, piñon-juniper-scrub oak.

The species is not listed in the Arizona's Natural Heritage Program's Heritage Data Management System (HDMS).

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species is wide spread and common no conservation strategies are recommended at this time.

Erigeron anchana

Species overview

Life history

Flowers May through August

Distribution and abundance

The species is endemic to Arizona (Gila, Maricopa, Pinal and Yavapai counties).

Habitats

Populations of the taxon tend to occur north, east, and south-facing cliffs, rock crevices, ledges, and rock faces; with substrates including weathered granite, limestone, rhyolite, and quartzite. Elevation ranges between 1068m (3503ft) and 2135m (7009ft) with a mean elevation of 1601m (5252ft). Vegetation types include chaparral to pine forests.

A single collection within the general PNF area for the species was made (*Baker 14203*) in the Granite Dells. Populations generally occur on rock faces near perennial streams.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species has not been found in PNF no conservation strategies are recommended at this time.

Erigeron saxatilis

Species overview

Life history

Flowers April through October

Distribution and abundance

The species is endemic to Arizona (Coconino, Gila, and Yavapai counties).

Habitats

Populations of the taxon tend to occur on various aspects of slopes, canyons, shaded cliffs, and rock outcrops; with substrates including limestone and sandstone. Elevation ranges between 1355m (4445ft) and 2545m (6397ft) with a mean elevation of 1950m (6397ft). Vegetation types include deciduous forests and chaparral.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species occurs primarily in protected habitats no conservation strategies are recommended at this time.

Eriogonum corymbosum var. glutinosum

Species overview

Eriogonum corymbosum var. glutinosum is a perennial.

Life history

Arizona specimens are not quite typical.

Distribution and abundance

A widespread species occurring from Arizona (Apache, Coconino, Cochise, Mohave, Yavapai, and Navajo counties), through Nevada (Clark county), and Utah (Emery, Iron, Kane, Utah, Washington, and Wayne counties).

The species is listed in the Arizona's Natural Heritage Program's Heritage Data Management System (HDMS) as a G5 S3. No records of occurrences within PNF or surrounding areas for the species were found.

Habitats

Populations of the taxon tend to occur on shallow north-facing slopes; with substrates including cinders, sandstone, clay, shale, and gypsum. Elevation ranges between 650m (2132ft) and 2470m (8103ft) with a mean elevation of 1560m (5117ft). Vegetation types include deciduous ponderosa pine forest, short-grass grassland, atriplex desert, desert shrub.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species has not been found in PNF no conservation strategies are recommended at this time.

Eriogonum ericifolium var. pulchrum

Species overview

Eriogonum ericifolium var. pulchrum is a small subshrub with pubescent leaves. It generally has a somewhat bonsai form and is rather attractive with its clusters of white flowers.

Life history

Although small, individuals have the appearance of age. Flowers emerge between August and November.

Distribution and abundance

The species is endemic to Arizona (Apache, Coconino, Mohave, and Navajo counties).

Habitats

Populations of the taxon tend to occur on north, west, and south-facing slopes, small washes, and on the edge of mesas; with substrates including limestone, sandstone, chert, gravel and basalt. Elevation ranges between 1372m (4051ft) and 1770m (5807ft) with a mean elevation of 1571m (4929ft). Vegetation types include high desert and piñon-juniper woodland.

Populations for this taxon are restricted to the Verde Formation at the eastern edge of the Forest in the Verde Valley.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species has not been found in PNF no conservation strategies are recommended at this time.

Eriogonum heermannii var. floccosum

Species overview

Eriogonum heermannii var. floccosum is a small to medium sized subshrub with rather brittle stems an large clusters of white flowers.

Life history

At least some individuals of *Eriogonum heermannii var. floccosum* appear to be very old. Flowers May through October

Distribution and abundance

A widespread species occurring from Arizona (Mohave and Yavapai counties), California (San Bernardino county), and Nevada (Clark county).

Habitats

Populations of the taxon tend to occur on south-facing slopes, shaded cliffs and rock outcrops; with substrates including limestone, and granite. Elevation ranges between 925m (3034ft) and 2116m (6942ft) with a mean elevation of 1520m (4986ft). Vegetation types include *Juniperus osteosperma* woodland, *Yucca brevifolia* woodland, *Larrea tridentata- Ambrosia dumosa* scrub, and chaparral.

A single collection within PNF for the taxon was made (*Baker 9929*) in the Juniper Mesa Wilderness Area. Populations generally occur on rock faces or rocky slopes.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species occurs on protected habitat, or at least where there are probably no conservation options, no conservation strategies are recommended at this time.

Fremontodendron californicum

Species overview

Fremontodendron californicum is woody shrub with large orange flowers. It is frequently planted in California for its ornamental properties,

Life history

These often large shrubs are probably long-lived and may represent relic populations. The flowers appear April through October.

Distribution and abundance

A widespread species occurring from Mexico (Baja California Norte and Baja California Sur), through Arizona (Coconino, Gila, Maricopa, Pinal, and Yavapai counties), and California

(Fresno, Imperial, Kern, Lake, Las Angeles, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, Tulare, and Ventura).

A single collection within PNF for the taxon was made (*Baker 15070*) in the southern Bradshaw Mountains, just west of the summit of Twin Peaks. This is a widespread species with numerous isolated populations.

Habitats

Populations of the taxon tend to occur on west and north-facing slopes; with substrates including basalt, quartzite talus, and granite, and schist and sandy soils. Elevation ranges between 700m (2296ft) and 2050m (6725ft) with a mean elevation of 1375m (4510ft). Vegetation types include chaparral, piñon -juniper woodland, ponderosa pine woodland, and oak woodlands.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species has a wide range, although rare within PNF, no conservation strategies are recommended at this time.

Lepidium montanum var. glabrum

Species overview

Lepidium montanum var. glabrum is a perennial with stems slightly woody at base and small flowers.

Life history

Flowers between April and October

Distribution and abundance

A widespread species occurring from Arizona (Coconino, Apache, Mohave, Navajo, and Yavapai counties), Utah (San Juan and Wayne counties), and New Mexico (Dona Ana county).

The taxon has not yet been verified as occurring within PNF, although collections have been made very close to the eastern boundary in the Verde Valley. The species is not listed in the Arizona's Natural Heritage Program's Heritage Data Management System (HDMS).

Habitats

Populations of the taxon tend to occur on northeast and southeast-facing slopes; with substrates including white limestone, red sand and deep sandy soils. Elevation ranges between 914m (2998ft) and 2179m (7148ft) with a mean elevation of 1546m (5073ft). Vegetation types include desert shrub, piñon-juniper woodland, grasslands, and cottonwood riparian areas.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species has not been found in PNF no conservation strategies are recommended at this time.

Leptodactylon caespitosum (var. or sp. Nov.)

Species overview

Leptodactylon caespitosum is a matted perennial obligate to dolomite cliff faces. Out populations differs from the typical form farther north by having five corolla lobes instead of four.

Life history

Probably long-lived. Flowers May through August

Distribution and abundance

A widespread species occurring from Arizona (Yavapai county) Colorado (Moffat county), Nevada (Elk, Eureka, Lander, Nye, and White Pine counties), and Utah (Dagget, Emery, Garfield, Juab, Millard, and Weber countes).

Habitats

The taxon is a cliff obligate and populations are found on north and south-facing cliffs; with substrates including dolomite, limestone, gravel, and sand. Elevation ranges between 1600m (4645ft) and 2560m (8398ft) with a mean elevation of 2080m (6521ft). Vegetation types include J*uniperus coahuilensis* and *Pinus edulis* woodland.

Populations of *Leptodactylon caespitosum* within PNF may represent a new taxon. Individuals appear to be cliff-obligates and are presently known only from dolomite cliffs north and northwest of Paulden. Surveys for the taxon have been conducted within all of the known

potential habit within PNF (Baker 2001).

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species occurs primarily in protected habitats no conservation strategies are recommended at this time.

Lesquerella arizonica

Species overview

Lesquerella arizonica is a low perennial with showy yellow flowers.

Life history

Probably short lived. The flowers occur April through June

Distribution and abundance

A widespread species occurring from (Apache, Coconino, Maricopa, Mohave, Navajo, Santa Cruz, and Yavapai counties), to Utah (Kane and Washington counties).

The taxon has not yet been verified as occurring within PNF, however, collections have been made very close to the northern boundary, south of Ashfork. Specimens originally identified within PNF as *Lesquerella arizonica* have been corrected to *L. cinerea* by Andrew Salywon. The species is not listed in the Arizona's Natural Heritage Program's Heritage Data Management System (HDMS). The species needs to be examined more closely taxonomically or, at the very least, its diagnostic characters need to be clearly defined and photographed.

Habitats

Individuals of the species occur on north-facing slopes, along ridgelines and benches, in dry stream beads; with substrates including sandstone, limestone, gravel, and fosslilferous chert. Elevation ranges between 500m (4645ft) and 2135m (7004ft) with a mean elevation of 1317m (4322ft). Vegetation types include piñon -juniper woodlands, and ponderosa forest.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species has not been found in PNF no conservation strategies are recommended at this time.

Margaranthus solanaceus

Species overview

Margaranthus solanaceus is a small annual herbaceous plant with leafy stems and small white flowers.

Life history

Flowers August through September.

Distribution and abundance

A widespread species occurring from Mexico (Sonora, Agua Prieta, and Santa Cruz Municipio), through Arizona (Cochise, Gila, Pima, Santa Cruz, and Yavapai counties), New Mexico (Eddy, Hildago, Otero, and Luna counties), and Texas (Hudspeth). A single collection within PNF for the taxon was made (*Baker 14980*) in the Bradshaw Mountains, at the Cements. Another collection was made near the Forest in Watson Woods Riparian Preserve (*Baker 12740*). This is a widespread species with numerous isolated populations.

Habitats

Individuals of the species occur on south-facing slopes, along sandy river banks, washes and in flood plains; with substrates including sand, rhyolite, limestone basalt, igneous rock, and granite cob. Elevation ranges between 768m (2519ft) and 2286m (7500ft) with a mean elevation of 1527m (5009ft). Vegetation types include riparian scrub, desert scrub, oak-juniper woodland, and oak grasslands.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species has a wide range and somewhat common in south-east Arizona, no conservation strategies are recommended at this time, even though it is rare within PNF.

Nicotiana quadrivalvis var. bigelovii

Species overview

Nicotiana quadrivalvis var. bigelovii in a annual herbaceous plant with long, white flowers. It was used extensively by native cultures as tobacco.

Life history

Flowers in June

Distribution and abundance

Although this is widespread species throughout much of the western states, there has been only a single collection for the species in Arizona: from the southern Bradshaw Mountains, just south of Minnehaha Flats, near Rush Springs, 5,100' (*DJM 1852*). The collection in Minnehaha Flats may have cultural significance.

Habitats

The species is known to occur in flat areas with sandy soils, at an elevation of 250m (820ft), within ponderosa pine woodlands.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species is widespread in California and Oregon, though rare in PNF, no conservation strategies are recommended at this time

Penstemon nudiflorus

Species overview

Penstemon nudiflorus is a perennial herb with showy lavender flowers.

Life history

Flowers March through September

Distribution and abundance

A species that occurs from Arizona (Yavapai, Gila, Navajo, Apache, and Coconino counties, to New Mexico (Sandoval and Bernalillo counties).

Habitats

Individuals of the species occur on north and south-facing slopes, and along dry streams; with substrates including basalt. Elevation ranges between 1531m (5022ft) and 2302m (7555ft) with a mean elevation of 1917m (6289ft). Vegetation types include grass-scrub oak mosaic, ponderosa pine forest, and *Bouteloua gracilis* grassland.

Although only a few collections for this distinct species have been made within PNF, it was not listed as a target species for past surveys. It is quite possible, therefore, that the species is much more common within PNF than the collections would indicate. Although apparently endemic to the state, it is a fairly widespread species of central and northwestern Arizona.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Thought the species has a limited distribution, it is common within its range, especially within PNF so no conservation strategies are recommended at this time.

Penstemon oliganthus

Species overview

Penstemon oliganthus is a low growing annual with stems arising from rosettes with not very showy purple flowers.

Life history

The species flowers March through September

Distribution and abundance

A widespread species occurring from Arizona (Apache, Coconino, Greenlee, Mohave, Navajo, and Yavapai counties), New Mexico (Cibola, Colefax, Grant, McKinley, Santa Fe, Sandoval, Socorro, Taos, Torrance, and Valencia counties).

Habitats

Individuals of the species occur on north-facing slopes, in open grassy areas and along among low growing shrubs; with sandy and volcanic soils, and substrates including gravel loam. Elevation ranges between 1500m (4921ft) and 3400m (11,154ft) with a mean elevation of 2450m (8038ft). Vegetation types include mixed conifer forest and grasslands.

This distinct species is fairly widespread in northeastern Arizona and New Mexico. It appears that the single collection (McLellan 2027) within PNF may be close to the southwestern edge of its range. The species is not listed in the Arizona's Natural Heritage Program's Heritage Data Management System (HDMS).

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species is fairly widespread, though only one locality within PNF, no conservation strategies are recommended at this time.

Perityle congesta

Species overview

Perityle congesta is densely clumped subshrub to 30cm tall that generally occurs on cliff faces. It differs from other *Perityle* species in the area in having non-ciliate achenes.

Life history

Although individuals of *Perityle congesta* are small, they appear to be long-lived. Flowers May through Septembers

Distribution and abundance

A species that has a range from Arizona (Coconino county) to Utah (Washington county).

Habitats

Populations of the taxon tend to occur on north and west-facing slopes, and in crevices along dripping cliffs; with substrates including sandstone and sculptured bedrock. Elevation ranges between 498m (1633ft) and 2316m (7598ft) with a mean elevation of 1407m (4612ft). Vegetation types include riparian woodland, desert scrub, and piñon -juniper woodland.

At present, there is no record of the species occurring in PNF. There is a record close to

the PNF boundary in the Sycamore Canyon Wilderness Area (Wright 92). The species is not listed in the Arizona's Natural Heritage Program's Heritage Data Management System (HDMS).

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species has not been found in PNF no conservation strategies are recommended at this time.

Phacelia rupestris

Species overview

Phacelia rupestris is a bushy but herbaceous perennial or even suffrutescent shrub with brittle stems and delicate leaves. It is a somewhat showy species with often large clusters of white flowers. It is the only cliff-face perennial *Phacelia* in our area with white flowers.

Life history

Although the herbage dies back during the winter, individuals of *Phacelia rupestris* can be long-lived with rather thick trunks. Flowers April through September.

Distribution and abundance

A widespread species occurring from Mexico (Nuevo Leon) through Arizona (Coconino, Gila, Greenlee, La Paz, and Yavapai counties), to New Mexico (Bernallilo, Dona ana, Eddy, Grant, Hildago, Luna, Otero, Sierra, and Soccoro counties).

The species is not listed in the Arizona's Natural Heritage Program's Heritage Data Management System (HDMS).

Habitats

Populations of the taxon tend to occur on steep north, west and south-facing slopes near the top, and in narrow canyons; with substrates including limestone, sandstone, gravel, loam, igneous rock, and basalt. Elevation ranges between 304m (997ft) and 2439m (8001ft) with a mean elevation of 1236m (4499ft). Vegetation types include juniper- pine woodland.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species is widespread in New Mexico, Texas, and Mexico, thought rare in Arizona, no conservation strategies are recommended at this time.

Puccinellia parishii

Species overview

Puccinellia parishii is a dwarf annual

Life history

Flowers April through July

Distribution and abundance

A widespread species occurring from Arizona (Yavapai, and Coconino county), to New Mexico (Apache, Catron, Cibola, Grant, Hidalgo, McKinley, Sandoval, and San Juan counties), and California (San Bernardino county).

No records of *Puccinellia parishii* occur within PNF but there are is at least one record from Yavapai County near Bagdad.

Habitats

Populations of the taxon tend to occur on open flat areas; with soil substrates including sandy clay loam and muddy flats. Elevation ranges between 792m (2600ft) and 2240m (7349ft) with a mean elevation of 1516m (4974ft). Vegetation types include riparian communities.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species has not been found in PNF no conservation strategies are recommended at this time.

Stachys rothrockii

Species overview

Stachys rothrockii is a perennial herb that grows in colonies from deep rootstocks with generally wilted corollas that are purple.

Life history

Flowers June through October

Distribution and abundance

A widespread species occurring from Arizona (Apache, Coconino, La Paz, Navajo, and Yavapai counties) and New Mexico (Catron, Cibola, Colfax, McKinley, Mora, Otero, San Juan, and Valencia counties).

Although there are no records for PNF, there is one record for Prescott. *Stachys rothrockii* is not listed in the Arizona's Natural Heritage Program's Heritage Data Management System (HDMS).

Habitats

Populations of the taxon tend to occur on rocky north, west and east-facing slopes, and hill tops; with substrates including basalt, gravel, clay loam, and sand. Elevation ranges between 1600m (5249ft) and 2256m (7401ft) with a mean elevation of 1928m (6325ft). Vegetation types include piñon - juniper community.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species has not been found in PNF no conservation strategies are recommended at this time.

Talinum validulum

Species overview

Talinum validulum is a small perennial herb with narrow succulent leaves and pink

flowers that open in the late afternoon. It differs from a similar species that also occurs in the Forest by having fewer stamens.

Life history

In cultivation, individuals are short-lived but are easily grown from seeds. Flowers June through September

Distribution and abundance

The species is endemic to Arizona (Coconino and Yavapai couties).

Habitats

Populations of the taxon tend to occur on northeast and southeast-facing slopes; with substrates including limestone, fosslilferous chert, rock and gravel. Elevation ranges between 475m (1558ft) and 2156m (7032ft) with a mean elevation of 1315m (4314ft). Vegetation types include pine/oak/Juniper woodlands and mixed conifer forests.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species occurs primarily in habitats little effected by grazing, fire, and other potential threats no conservation strategies are recommended at this time.

Thelypodiopsis ambigua var. ambigua

Species overview

Thelypodiopsis ambigua var. ambigua is an erect biennial with purple flowers.

Life history

Flowers in May

Distribution and abundance

The species is endemic to Arizona (Coconino, Mohave, and Yavapai counties).

Although there are no records of the taxon in PNF, the species was collected at the Granite Dells, near Prescott. The taxon is not listed in the Arizona's Natural Heritage Program's Heritage Data Management System (HDMS).

Habitats

Populations of the taxon tend to occur on south and west-facing slopes; with substrates including basalt and gravel. Elevation ranges between 790m (2591ft) and 1770m (5807ft) with a mean elevation of 1280m (4199ft). Vegetation types include juniper-yucca woodland.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species is not know to occur in PNF no conservation strategies are recommended at this time.

Thelypteris puberula var. sonoernsis

Species overview

Thelypteris puberula var. sonoernsis is a woodland fern with long-creeping, scaly rhizomes.

Life history

Fertile from March to October

Distribution and abundance

A widespread species occurring from Mexico (Sonora, Alamos, Chihuahua, Baja California Norte, Guaymas Municipio, Rio Mayo Reigon, Shuaripa, San Javier, Santa Ana, and Yécora), through Arizona (Coconiono, Gila, Mohave, Pima, Pinal, and Yavapai counties), and California (San Bernardino, Los Angeles, and Santa Barbara counties).

Known populations of *Thelypteris puberula* var. *sonorensis* closest to PNF are near the Santa Maria River, Arizona. According to Flora of North America, *Thelypteris puberula* var. *puberula* does not occur in the U. S.

Habitats

Populations of the taxon tend to occur on east and north-facing slope, in canyons, especially along streams and seepage areas; with substrates including calcareous tufa. Elevation ranges between 100m (328ft) and 2100m (6889ft) with a mean elevation of 1100m (3608ft). Vegetation types include oak woodland, riparian forest, Mohave Desert springs, and

tropical deciduous forests.

Known and potential threats

There appear to be no serious threats to the continued viability of this species.

Recommended conservation strategies

Because the species is not known to occur in PNF, no conservation strategies are recommended at this time.