TECHNICAL NOTE

USDA - Natural Resources Conservation Service
Boise, Idaho

TN Plant Materials NO. 51 **April 2012**
Revision

THREATENED, ENDANGERED, CANDIDATE & PROPOSED PLANT SPECIES OF IDAHO

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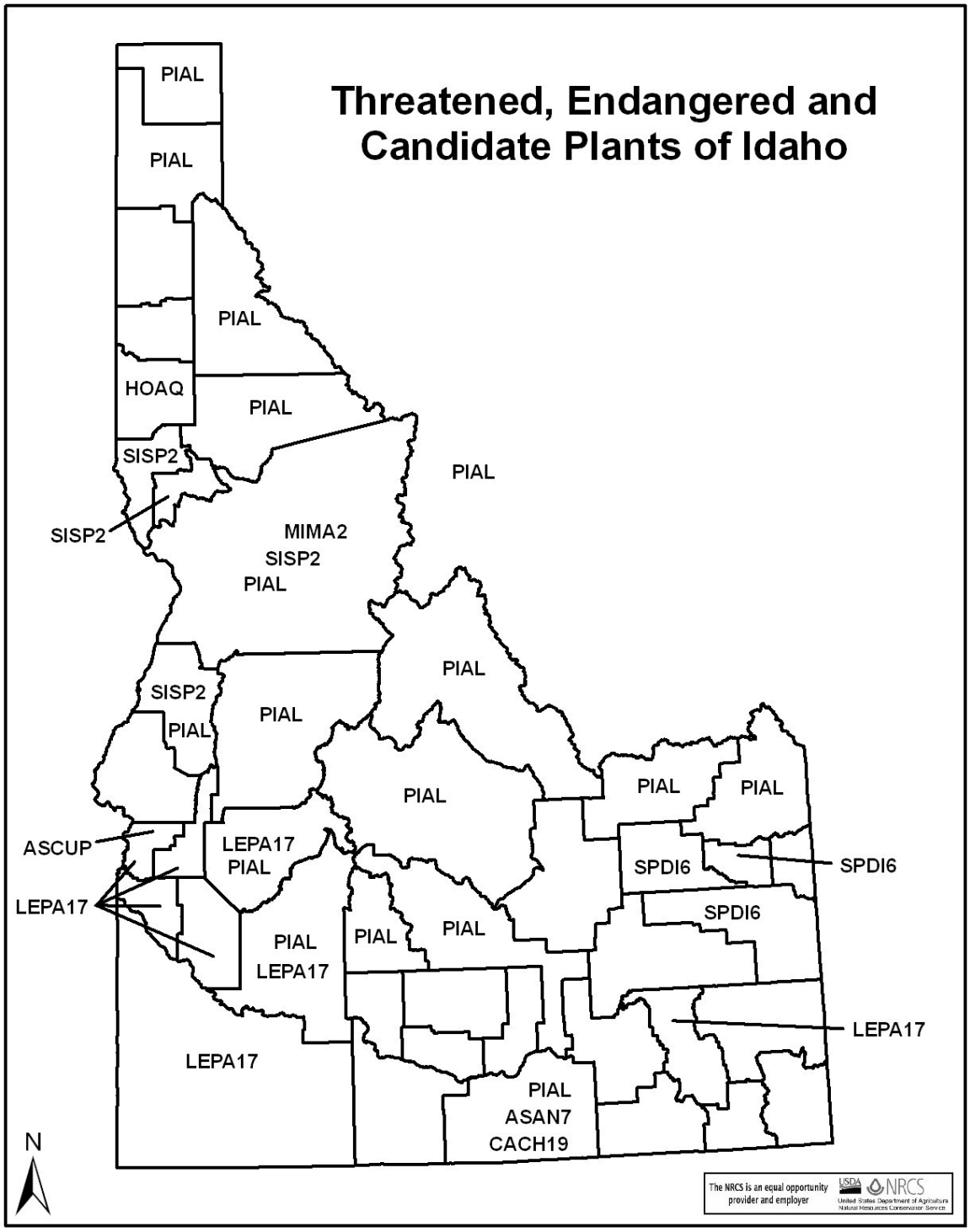
MacFarlane's four-o'clock (*Mirabilis macfarlanei*)

This technical note identifies the current threatened, endangered, candidate and proposed plant species listed by the U.S.D.I. Fish and Wildlife Service (USDI FWS) in Idaho. Review your county list of threatened and endangered species and the Idaho Fish and Game Conservation Data Center (CDC) GIS T&E database to see if any of these species have been identified in your area of work. Additional information on these listed species can be found on the USDI FWS web site under "endangered species". Consideration of these species during the planning process and determination of potential impacts related to scheduled work will help in the conservation of these rare plants. Contact your Plant Material Specialist, Plant Materials Center, State Biologist and Area Biologist for additional guidance on identification of these plants and NRCS responsibilities related to the Endangered Species Act.

Table of Contents



County distribution of Idaho's threatened, endangered and candidate plant species

Threatened and Endangered Species

Water Howellia
***Howellia aquatilis* A. Gray**

Plant Symbol = HOAQ
Listing Status: Threatened

Water howellia (*Howellia aquatilis*). Photo by Dieter Wilken

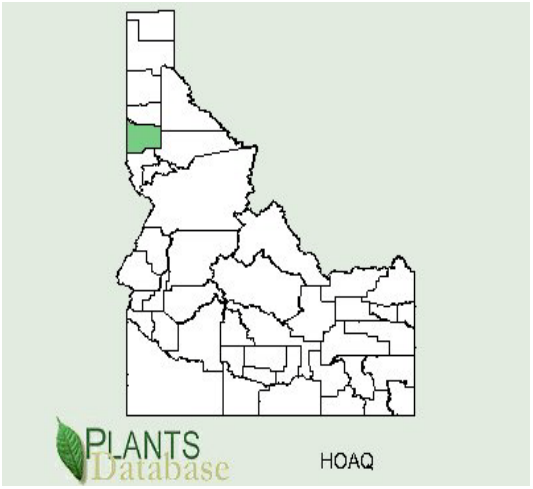
Alternate Names
This species has no known alternate names.

Uses
Water howellia forms a minor component of the aquatic flora in a limited number of wetlands, ponds and sloughs in the Pacific Northwest. It likely provides habitat for aquatic animals in the locations where it is found. It is also occasionally eaten by large animals.

Status
Water howellia was federally listed by the USDI Fish and Wildlife Service as threatened in 1994 (USFWS, 1994).

Description
General:
Bellflower family (Campanulaceae). Water howellia is a winter-annual emergent aquatic herb. The stems are submerged or floating on the surface and rooted into the pond bottom. Stems are extensively branching reaching 60 to 90cm (24 to 36 in) in length and bear narrow leaves from 1 to 5 cm (0.4 to 2 in) long. The plants produce two types of flowers. Small, inconspicuous cleistogamous (non-opening and self-pollinating) flowers are born beneath the water's surface, and showy larger whitish to pale lavender flowers 2 to 3 mm (0.08 to 0.11 inches) long, are born on emergent stems. The fruit is an inferior (below the petals) capsule approximately 2 cm (0.8 in) in length which contains up to 5 brown seeds.

Distribution:
Although water howellia at one time occurred over a large range throughout the northwestern United States, it is currently found in a limited number of locations in California, Oregon (possibly extirpated), Washington, Idaho and Montana (USDI-FWS, 2009). Water howellia is currently known from a total of six geographic regions: one in Idaho (Latah County), one in Montana (Lake and Missoula counties), one in California (Mendocino County) and three in Washington (Spokane, Clark and Pierce counties).



For current distribution, consult the Plant Profile page for this species on the PLANTS Web site.

Habitat:
Water howellia can be found in ephemeral glacial ponds and former river oxbows that fill with spring moisture and dry down throughout the growing season. The upland flora surrounding water howellia habitat is typically comprised of deciduous and evergreen trees and shrubs including Bebb willow, Drummond's willow, black cottonwood, quaking aspen, thinleaf alder, Engelmann spruce, Douglas fir, and lodgepole pine.

The ponds themselves contain herbaceous plants such as water parsnip, water plantain, and inflated sedge. The ponds are often inhabited by the introduced reed canarygrass (Lichthardt and Gray, 2003).

Adaptation
Due to low genetic variability, water howellia is limited to very specific habitats within its range (USDI-FWS 1994).

Establishment
Water howellia is limited by specific requirements for seed germination. Seed germinates in the fall when a pond has dried and the bottom is exposed to the air, thus reestablishment is dependent upon proper moisture conditions, and populations are vulnerable to abnormally wet or dry periods. Regeneration of populations require summer flowering, dry-down of the occupied portion of the pond, slight refilling in the fall and full filling the following spring.

Management
Water howellia habitat is threatened by logging, commercial and residential development, grazing and encroachment from invasive species such as reed canarygrass and purple loosestrife (USDI FWS, 1994). Recommended management strategies include controlling invasive species and limiting disturbances (logging, development) that might affect the hydrologic requirements of the species.

Pests and Potential Problems
Reed canarygrass and other invasive species threaten water howellia and its habitat by their ability to rapidly form dense monocultures and out-compete native species for available resources.

Environmental Concerns
This species is vulnerable to extirpation due to large variation in annual numbers, limited available habitat and low genetic variability (USDI-FWS, 1994).

References
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Slickspot peppergrass
Lepidium papilliferum (L.F. Hend.) A. Nelson & J.F. Macbr.

Plant Symbol=LEPA17
Listing Status: Threatened

Slickspot peppergrass (*Lepidium papilliferum*). Photo by Sheri Hagwood, USDI Bureau of Land Management

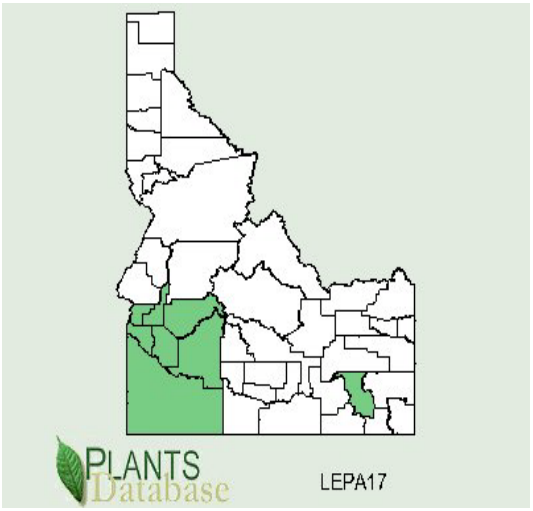
Alternate Names
Idaho pepperweed.
Lepidium montanum Nutt. Var. *papilliferum* (L.F. Hend.) C.L. Hitchc.

Uses
Slickspot peppergrass is a small, flowering plant in the mustard family which grows in unique microsites known as slick spots within the semiarid sagebrush-steppe of the Snake River Plain of southwestern Idaho. No large ungulates, either domestic or wild use the plant (USDI-FWS, 2009). This species has no known agricultural, economic, or other human uses at this time. This species may have scientific significance due to its evolutionary isolation which is an important subject in conservation biology research.

Status
The U.S Fish and Wildlife Service determined that slickspot peppergrass is a threatened species under the Endangered Species Act of 1973. The ruling became effective December 7, 2009.

Description
General: Mustard family (Brassicaceae). Slickspot peppergrass is an intricately branched, tap-rooted plant, averaging 5 to 20 cm (2 to 8 in) tall, but occasionally reaching up to 40 cm (16 in) in height. Leaves and stems are covered with fine, soft hairs, and the leaves are divided into linear segments. Flowers are numerous, 0.25 cm (0.1 in) in diameter, white, and have four petals. Fruits (siliques) are 0.25 cm (0.1 in) across, round in outline, flattened and two-seeded (Moseley, 1994). Plants can be annual or biennial. The annual form reproduces by flowering and setting seed in its first year, and dies within one growing season. The biennial form initiates growth in the first year as a vegetative rosette and flowers and sets seed the second year (Meyer, 2005). A third, but uncommon flowering pattern involves two episodes of reproduction, one late in the first year and one in the second year (White, 2009).

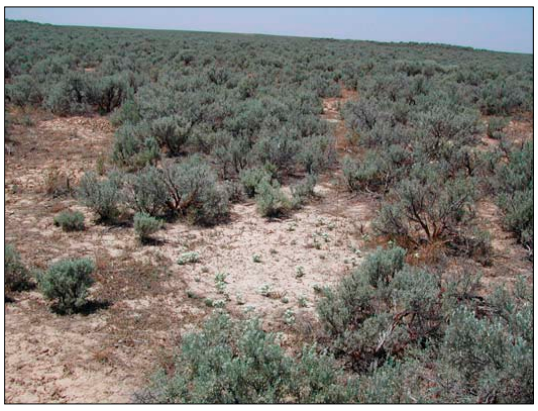
Distribution:
For current distribution, consult the Plant Profile page for this species on the PLANTS Web site.



Habitat:
Slickspot peppergrass is specialized to occupy a specific microhabitat within the sagebrush steppe vegetation of the Snake River Plains of southwestern Idaho. This specific microhabitat is referred to as “slick spots” which are small-scale sites of water accumulation in the gently undulating landscape. Dominant perennial species of the sagebrush steppe are usually excluded from slick spots, presumably because of the their inability to tolerate winter flooding even though the climatic regime of this region is characterized by low and variable winter and spring precipitation and dry summers with a mean annual precipitation under 10 inches (Meyer, 2005).

Slick spots are visually distinct small-scale (mostly between 10 to 20 square feet) depressions in the soil that collect water. These sparsely vegetated microsites are created by unusual edaphic conditions. Drainage swales commonly bisect the landscape and often contain the slick spots with ponded water. Slick spot soils are silt to clay in texture and mostly devoid of vegetation. Below the surface layer is a vesicular layer (defined as a structure probably caused by capillary pressure within air-filled voids surrounded by water) that is partially impermeable to water infiltration and can cause water ponding. The soil profile below the vesicular layer is dominated by a clay layer. Chemical properties indicate that soils are sodic and/or saline (high electrical conductivity, EC), have very low levels of C and N, and P and K levels are variable. The compositions of humic acids within slick spots fall within the range of values commonly reported for other soils (Palazzo, 2008).

Slick spots have a common visual appearance. The first visual cue is the smooth pan-like surface. Typically, the slick spot follows the general slope of prevailing landforms with a slight leveling or break on steeper slopes. On mostly level surfaces, slick spots are very shallow but rarely are closed depressions. They sometimes include smaller areas where remnants of thin soil-algal crusts indicate surface ponding of water (Fisher, 1996).



Slickspot. Photo by Dana Quinney, Idaho Army National Guard

Slick spots contain no perennial grasses or shrubs. Other than slickspot peppergrass, a wide variety of moss and lichen species cover 10 to 90 percent of the surface. Weedy invasions of cheatgrass, *Bromus tectorum* and burr buttercup *Ceratocephala falcata* (R*anunculus testiculatus*) rooted in surface cracks and in surface crusts are common (Fisher, 1996).

Adaptation

Slickspot peppergrass is found almost exclusively in the slick spots of southwestern Idaho. It has been infrequently documented to occur on disturbed soils along graded dirt roads and badger mounds but these observations are rare. In adapting to the environment of the lower Snake River Plains, slickspot peppergrass has undergone modifications in its adaptive strategy relative to a closely related and possible ancestor *Lepidium montanum*, a widely distributed species (biennial to perennial growth form) that is found in a variety of open habitats in arid to semiarid regions of the southern Intermountain area. The most obvious adaptation is the shift from biennial to summer annual. The dry summers in southwest Idaho have apparently applied strong selection pressure to the annual habit. Even in years when biennial forms are successful, their contribution to seed production may be small (Meyer, 2005). A third, but uncommon flowering pattern which involves two episodes of reproduction, one late in the first year and one in the second year is also an adaptive strategy to maintain gene flow within the species (White 2000). Another major adaptive feature is the evolution of seed dormancy that permits seeds to persist in the seed bank (Meyer, 2005).

Establishment

Slickspot peppergrass reproduces by seed. Seed germinates in the spring. Annual types are single-stemmed with few flowers and seeds. Biennial types overwinter as rosettes, blooming and setting seed the following spring or summer. The biennial types have multiple stems with hundreds of flowers and seeds. . Flowering usually takes place in late April and May, fruit set occurs in June and seed is ripe in late June to early July. Based on a 4 year demography study, survivor ship of the annual form was demonstrated to be higher than survivorship of biennial forms and the number of plants can vary widely from year to year depending on seasonal precipitation patterns (Meyer, 2005).

Laboratory seed germination studies with various combinations of temperatures, moist chilling, and gibberlic acid treatments resulted in low germination percentages. Highest laboratory germination percentages (10 %) are obtained

with 6 weeks of dry after-ripening at 50º C (122° F) followed by 8 weeks of moist chilling. Tetrazolium viability studies in combination with seed bank retrieval studies consistently showed seed viability to be very high (95 %+) (Meyer, 2005). Seed located near the soil surface show higher rates of germination and viability and the greatest seedling emergence rate. Deep burial of seed (greater than 5.5 inches) may preserve them beyond the 12 year period of viability (USDI-FWS, 2009).

Slickspot peppergrass relies primarily on cross pollination for successful seed production (Robertson, 2004). Through hand pollination experiments, it was determined that individual plants receiving pollen from distant sources had significantly higher percent fruit set than those relying on pollen from neighboring plants. Self pollinated plants produced little or no fruit.

Twenty five insect families from 5 orders have been observed and collected from slickspot peppergrass at 2 study sites in southwestern Idaho. The diversity of insects encountered on flowers differed between the study sites. The insects most likely responsible for pollinating slickspot peppergrass include members of the Apidae, Colletidae and Halitidae families of the Hymenoptera order (bees, ants, and wasps) (Robertson, 2003).

Management

Conservation management plans have been implemented to address the need to: maintain and enhance habitat; reduce intensity, frequency, and size of natural- and human-caused wildfires; minimize loss of habitat associated with wildfire-suppression activities; reduce the potential for invasion of nonnative plant species from wildfire; minimize the loss of habitat associated with rehabilitation and restoration techniques; minimize the establishment of invasive non-native species; minimize the degradation or loss of habitat from off road vehicle use; mitigate the negative effects of military training and other associated activities; and minimize the impact of ground disturbances caused by livestock trampling during periods when soils are saturated (USDI-FWS, 2009).

Pests and Potential Problems

The most abundant insect herbivore of slickspot peppergrass is a chrysomelid beetle (*Phyllotreta* sp.) which chews holes in the petals of the flower. This herbivory reduces the effectiveness of insect pollination, but does not physically inhibit pollination or seed production (Leavitt, 2006). The U.S. Fish and Wildlife Service does not consider herbivory by the chrysomelid beetle to be a significant threat at this time (USDI-FWS, 2009).

The Owyhee harvester ant was recently identified as a potentially important seed predator of slickspot peppergrass but there is no information indicating what the actual magnitude or severity of this threat may be (USDI-FWS, 2009).

Environmental Concerns

The U.S Fish and Wildlife Service determined that slickspot peppergrass is a threatened species under the Endangered Species Act of 1973. The ruling became effective December 7, 2009. The primary threat to slickspot peppergrass is the present or threatened destruction, modification, or curtailment of its habitat and range due to the increased frequency and extent of wildfires under a fire regime modified and exacerbated by the spread of invasive plants, particularly nonnative annual grasses such as cheatgrass. Other threats to slickspot peppergrass include human development, potential seed predation by harvester ants, and habitat fragmentation and isolation of small populations (USDI-FWS, 2009).

Seeds and Plant Production

No commercial or restoration protocols are known.

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Macfarlane's Four-O'clock
Mirabilis macfarlanei Constance & Rollins

Plant Symbol = MIMA2
Listing Status: Endangered

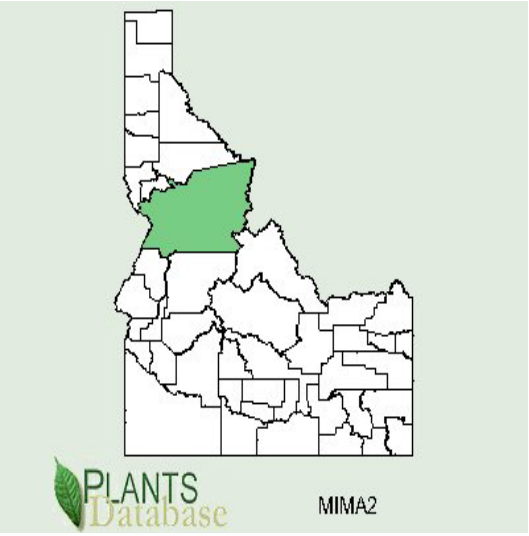
MacFarlane's four-o'clock (*Mirabilis macfarlanei*)

Alternate Names
This species has no known alternate names.

Status
MacFarlane's four-o'clock was listed endangered in 1979 when only 3 populations were known totaling approximately 25 plants (USDI-FWS, 1979). Since listing, additional populations have been found as a result of increased monitoring, and in 1996, the species was downlisted to threatened (USDI-FWS, 1996). The species is considered threatened in Idaho (State of Idaho, 2009) and endangered in Oregon (Oregon Department of Agriculture, 2009). Natureserve gives the species a global status of G2 (imperiled), and state rankings of S2 (imperiled) in Idaho and S1 (critically imperiled) in Oregon (Natureserve, 2009).

Description
General: Four-o'clock family (Nyctaginaceae). MacFarlane's four-o'clock is a perennial herb that forms hemispheric clumps from 58 to 81 cm (23 to 32 in) across (Spellenberg, 2003). The inflorescence is a cluster of 3 to 7 magenta flowers, each approximately 2.5 cm (1 in) in diameter. Flowering typically occurs from May to early June. Leaves are opposite, green above and waxy below. Lower leaves are widely ovate to deltoid with a rounded to heart-shaped base. The plants arise from a thickened tuber (1.5 to 3 inches thick) which sends out shoots to produce daughter clones.

Distribution:
There are currently eleven known populations in Idaho County, Idaho and Wallowa County, Oregon. The total geographic range covers approximately 47 by 29 km (29 by 18 mi) (Kaye, 1992).



For current distribution, consult the Plant Profile page for this species on the PLANTS Web site.

Habitat:
The species occurs in grassland habitats in steep river canyons from 1,000 to 3,000 feet in elevation. Populations occur primarily in bunchgrass communities dominated by bluebunch wheatgrass, Snake River wheatgrass, Sandberg bluegrass, sand dropseed and Fendler threeawn. Other species growing in association include cheatgrass, smooth sumac and rabbitbrush (USD-FWS, 2000).

Adaptation
MacFarlane's four-o'clock grows in regions with warm and dry conditions where precipitation occurs mostly as rain during winter and spring. Sites are dry and generally open, although scattered shrubs may be present. Average annual precipitation for the region is approximately 30 cm (12 in). The soils vary from sandy to talus substrate (USD, FWS, 1996).

Establishment
Plants are established via seed dispersal as well as asexually from a thick woody tuber. Seed is dispersed in June through July, falling near the parent plant and may be spread further by water, gravity or animals. Germination occurs in the spring under proper environmental conditions. Asexual reproduction however appears to be the primary mechanism for spread of the plants.

Management
This species is currently being managed through the reduction of livestock grazing and the restriction of recreational use (USDI-FWS, 2009). Due to the steep habitats on which the species occurs, weed control and wildfire suppression is difficult. Site specific monitoring and management plans are being developed by BLM and Forest Service. Additional studies are necessary to assess life history and ecological needs of the species.

Pests and Potential Problems
Large disturbances such as fire, herbicide drift and landslides have the potential to extirpate small populations. Poorly managed grazing has also been indicated as a threat to MacFarlane's four-o'clock habitat (USDI-FWS, 2009).

Lepidopterans and spittlebugs have been observed damaging plants (Baker, 1983; Kay et al., 1990). Feeding nymphs can cause floral abortion and shoot death. These threats do not appear however, to significantly affect existing populations (USDI-FWS, 2009).

The chief threat to MacFarlane's four-o'clock is the degradation of habitat caused by invasion of exotic plant species. Cheatgrass, yellow starthistle, toadflax and spotted knapweed are the major invasive species noted at or near established populations.

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Spalding's Catchfly
***Silene spaldingii* S. Watson**

Plant Symbol = SISP2
Listing Status: Threatened

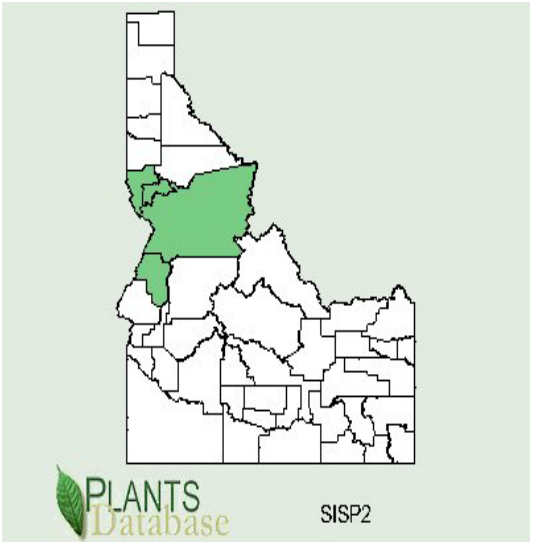
Spalding's catchfly. Photo by C. Menke

Alternate Names
Spalding's campion
Spalding's silene

Status
Spalding's catchfly was listed as threatened by the US Department of the Interior, Fish and Wildlife Service in 2001 (USDI-FWS, 2001). It is listed in Idaho as threatened (State of Idaho, 2009) and endangered in Oregon (Oregon Department of Agriculture, 2009). In Washington state it is considered threatened with a status of S2 (Washington State, 2010), and in Montana it has a rank of S1 (Montana Natural Heritage Program, 2010). Natureserve ranks it G2, Globally imperiled, with a US national status of N2, and Canada national status N1 (Natureserve, 2010). It is listed as endangered in Canada (Government of Canada, 2010).

Description
*General***:** Carnation or pink family (Caryophyllaceae). Spalding's catchfly is a long-lived perennial forb that emerges in spring from a woody root crown and dies back to below ground level each fall. Plants range from 20 to 76 cm (8 to 30 in) tall with generally one to few yellow-green stems per plant. Each stem bears four to seven (up to 12) pairs of 5 to 7.5 cm (2 to 3 in) long, lance-shaped leaves (Hitchcock et al., 1964). It has swollen nodes where the leaves attach to the stem. The plant is covered in dense sticky hairs that frequently trap dust and insects, hence the common name catchfly. Flowers have a tubular calyx approximately 1.5 cm (0.6 in) long; the pale white petals extend slightly beyond the sepals. Flowers bloom from mid-July through August and sometimes into September. It may remain dormant for 3- 6 consecutive years without emerging. The plant has a very large taproot (3 ft or longer).

Distribution:



Spalding's catchfly is native to portions of Idaho, Montana, Oregon, Washington, and British Columbia, Canada. It occupies five physiographic regions: the Palouse Grasslands in west-central Idaho and southeastern Washington; the Channeled Scablands in eastern Washington; the Blue Mountain Basins in northeastern Oregon; the Canyon Grasslands of the Snake River and its tributaries in Idaho, Oregon, and Washington; and the intermountain valleys of northwestern Montana. There are currently 99 known populations of Spalding's catchfly, 66 populations are composed of fewer than 100 individuals each. Twenty-three populations contain 100 or more individuals apiece, and the 10 largest populations are each made up of more than 500 plants (USDI-FWS, 2007).

For current distribution, consult the Plant Profile page for this species on the PLANTS Web site.

Habitat:
The species occurs in dry to moist grasslands in bunchgrass and sagebrush-steppe habitats with Idaho fescue and bluebunch wheatgrass being the dominant components. Occasionally plants can be found in open pine habitats. (USDI-FWS, 2007).

Adaptation
Plants can be found from 580 to 1,100 (1,900 to 3,600 ft) in elevation. Spalding's catchfly grows on all aspects but is most often encountered on north facing slopes. The plants prefer sites with deep silt-loam soils (Natureserve, 2010).

Establishment
Spalding's catchfly reproduces solely by seed. It does not spread by rhizomes or other asexual means. It is partially self-compatible (Lesica & Heidel 1996), but its offspring are more fit if cross-pollinated (Lesica 1993). Bumblebees appear to be the primary pollinator (Lesica and Heidel, 1996).

Seedlings germinate in the spring, form rosettes the first year, and occasionally flower the second year. Generally flowering does not occur until the third or subsequent growing seasons. Adult plants emerge from the caudex in spring as either a stemmed plant, a rosette, or occasionally as a plant with both rosette(s) and stem(s). Stemmed plants may remain vegetative or may become reproductive in July or August. Plants senesce or wither in fall (September or October), reappearing the next spring (USDI-FWS, 2007).

Laboratory studies have shown that seed germination increases following a four to eight week cold stratification period (Lesica, 1993).

Spalding's catchfly arises from a very large tap root which may be up to 1 m (3 ft) deep. This greatly reduces the potential for transplanting.

Management
Recovery strategies for Spalding's catchfly involve reducing identified threats to catchfly habitat. Measures include limiting adverse grazing and off-road vehicle use, protecting pollinators, incorporating integrated pest management strategies, and appropriate fire management (USDI-FWS, 2010).

Pests and Potential Problems
Threats to Spalding's catchfly primarily involve loss of habitat. This includes habitat loss due to human development, habitat degradation associated with domestic livestock and wildlife grazing, changes in fire frequency and seasonality, and invasions of aggressive non-native plants. Plants are also susceptible to herbicide spray drift and off-road vehicle use. The species may also suffer loss of genetic fitness from population fragmentation (USDA Forest Service, 2009).

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Ute Ladies' Tresses
***Spiranthes diluvialis* Sheviak**

Plant Symbol=SPDI6
Listing Status: Threatened

Ute ladies' tresses (*Spiranthes diluvialis*). Photo byTeresa Prendusi, USDA Forest Service

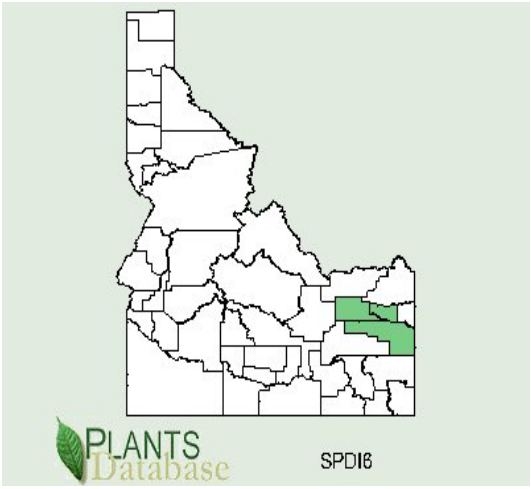
Alternate Names
Spiranthes romanzoffiana var. *diluvialis*

Uses
Ute ladies'-tresses is a showy, perennial flowering orchid that is difficult to propagate. It was first described by C.J. Sheviak in 1984. Ute ladies'-tresses are found in open wetland and riparian areas and are pollinated mostly by bumblebees (*Bombus* spp.). This species has scientific significance due to its evolutionary isolation, which is an important subject in conservation biology research. It has no known agricultural, economic, or other human uses at this time.

Status
In 1992, Ute ladies' tresses was designated as threatened throughout its range by the U.S. Fish and Wildlife Service. In 2004, USDI-FWS began a 5-year status review to determine if delisting the species was warranted (USDI-FWS, 2004). From 1995 to 2004, the number of known individuals had increased from 20,500 to approximately 60,000.

Description
Ute ladies' tresses is a perennial, terrestrial orchid, typically with a single stem, 12-50 cm (5-20 inches) tall, arising from tuberously thickened roots. It has linear-lanceolate leaves, 1 cm (0.4 in) wide and 28 cm (11in) long which persist during flowering. Basal leaves are the longest and become reduced in size up the stem. The inflorescence consists of few to many white or ivory flowers clustered in a spike of 3-ranked spirals at the top of the stem. The sepals and petals are oriented perpendicular to the stem, the lateral sepals often spreading abruptly from the base of the flower, and all sepals are free to the base. The lip petal is somewhat constricted at the median. Flowering occurs in early August and may persist into early September barring frost or drought. Flowers are faintly fragrant with the scent of coumarin. The seed is ellipsoidal and dust-like, very well adapted to being carried by the wind (Heidel, 1998) (Chelan county 2000) (Montana Field guide 2009).

Distribution:



Populations of Ute ladies'-tresses are known from three broad general areas of the interior western United States: near the base of the eastern slope of the Rocky Mountains in southeastern Wyoming and adjacent Nebraska and north central and central Colorado; in the upper Colorado River Basin, particularly the Uinta Basin; and in the Bonneville Basin along the Wasatch Front and westward in the eastern Great Basin, in north-central and western Utah, extreme eastern Nevada and southeastern Idaho. It has also been discovered in southwestern

Montana and in the Okanogan area and along the Columbia River in north-central Washington. Many populations have fewer than 100 individuals, though a couple of populations have over 500 plants (Heidel 1998).

Habitat:
Ute ladies' tresses occurs along riparian edges, gravel bars, old oxbows, high flow channels, and moist to wet meadows along perennial streams. It typically occurs in stable wetland and seep areas associated with old landscape features within historical floodplains of major rivers (Heidel 2009). It also is found in wetland and seep areas near freshwater lakes and springs.

Adaptation
Ute ladies'-tresses are restricted to a small, sporadic microhabitat represented by calcareous, wet-mesic, temporarily-inundated meadows and shallow wetlands. The shallow meandered wetlands are typically located in alluvial fans that correspond with two uncommon soils series. These microhabitat are temporarily inundated in the spring, often located right below the outer wetland margin. Subsurface hydrological conditions are ameliorated by high organic content at the surface, and coarse alluvial cobble directly below. Water chemistry as inferred from soils data is moderately alkaline and high in calcium carbonate. Soils are loamy calcareous wetland soils with gley features, generally high in micronutrients and organic matter, but are low in phosphorus compared to average values for agricultural soils. The range of pH values for these types of sites in Colorado and Utah is 6.6 to 8.1 and at sites in Nebraska, Wyoming and Montana 7.6-8.2. Most locations of Ute ladies'-tresses are classified as subirrigated ecological sites (Heidel 1998).

Establishment
Ute ladies'-tresses is a showy flowering orchid that is difficult to propagate. Efforts are underway by the Denver Botanic Gardens and the Red Buttes Gardens of Salt Lake City to determine if Ute ladies'-tresses can be propagated. The Cincinnati Zoo and Botanical Garden has grown Ute ladies'-tresses from seed. The plant can produce as many as 7,300 tiny seeds per fruit. Seedlings may persist for up to 8 years as subterranean saprophytes dependent on mycorrhizal fungi. Small inconspicuous leaf rosettes may emerge at the end of the growing season and overwinter. Individual plants may flower in consecutive years, or under adverse environmental conditions may persist below ground with their mycorrhizal symbionts. Reproduction is sexual in the strictest sense, though each year's plant comes from a separate lateral bud. Most orchids produce new tubers every year by lateral buds. There is no evidence that lateral buds produce separate underground shoots leading to new plants, but in collecting voucher specimens, it was observed that the multiple, tuberously-thickened roots have high turgidity and snap easily. Although the majority of plants are single-stemmed, a small number of multi-stemmed plants or small clumps have been noted in sites that were trampled by livestock; this may indicate vegetative reproduction (Heidel 1998).

Ute ladies' tresses exhibits a mixed-mating system. The degree of selfing depends in part upon the abundance of pollinators visiting the flowers. No self-fertile fruit set has been observed, indicating that a pollen vector is required for reproduction. The only pollinator visits observed have been late afternoon visits by bumblebees (*Bombus* spp.) (Sipes, 1995). Bees are provided nectar rewards but the pollen are in masses that are not available to them for food. The distinctive odor of coumarin from the flowers may indicate that there are other rewards to the bumblebee such as critical chemicals for producing pheremones. Other suspected pollinators are anthophorid bees and hawkmoths. Seeds are very short-lived and have a limited time span for germination after seed dispersal. They are generally considered to require endomycorrhizae to germinate in the field. Seeds are very small and require a narrow range of moisture and temperature conditions to germinate, and it is likely they require direct contact with mineral soil (Arft 1998) (Heidel 1998).

Management
Modeling of monitored populations in Colorado and Utah project population extinction for almost all of the populations under most agricultural practices. Species' longevity and the primary causes of mortality are unknown. At most observation sites, leaves of Ute ladies'-tresses showed signs of browse by herbivores. Even plants represented by immature rosette leaves under a continuous canopy cover of grass showed signs of browsing on one or more leaves. Livestock grazing takes place at many sites though it tends to be earlier in the growing season when the uplands are still green rather

than during flowering when only the wetlands and riparian areas are green. Vole herbivory of inflorescences at a Colorado site was identified as a significant threat. Land managers should include pollinators and pollen producing plants in their plans to preserve this rare orchid. The effects of pest management programs on bumblebees and the availability of suitable bee nesting habitat should be considered (Szalanski 2001) (Heidel 1998).

Pests and Potential Problems

Besides herbivory, the only other noted observations of pests were weevils browsing some inflorescences in Montana (Heidel 1998).

Environmental Concerns

Genetic divergence among the dispersed populations of Ute ladies'-tresses is low. Thus each population harbors most of the genetic variability found in the species. Therefore, no currently known populations of Ute ladies'-tresses are conservation priorities because of their genetic uniqueness (Heidel 1998).

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Candidate Species

Goose Creek Milkvetch

***Astragalus anserinus* N.D. Atwood, Goodrich and S.L. Welsh**

Plant Symbol = ASAN7
Listing Status: Candidate

Goose Creek milkvetch (*Astragalus anserinus*). Photo courtesy of Nevada Natural Heritage Program

Alternate Names
None

Uses
There are no known human uses of Goose Creek milkvetch. Grazing by rabbits has been observed.

Status
The USDI Fish and Wildlife Service determined in 2007 that Goose Creek milkvetch might be warranted for listing as threatened or endangered and began a status review of the species. In 2009, following a thorough review, USDI-FWS found that listing was warranted, however listing was precluded by higher priority actions (USDI-FWS, 2009). In 2010 the species was officially added to the candidate species list and was assigned a Listing Priority Number (LPN) of 5 due to high magnitude, yet non-imminent threats (USDI-FWS, 2010).

Description
General: Legume family (Fabaceae). Goose Creek milkvetch is a mat-forming perennial forb arising from a narrow taproot. The stems are 3 to 11 cm (1.2 to 4.3 in) long and lay prostrate on the ground. The leaves are pinnately compound with 5 to 15 wooly tomentose leaflets. Each leaflet is 3 to 7 mm (0.12 to 0.28 in) long and oval in shape. The flowers are 9 to 11 mm (0.35 to 0.43 in) long, pinkish purple and borne in clusters of 3 to 7 flowers per stem. The fruit is a claw shaped pod, 9 to 12 mm (0.35 to 0.47 in) long and 5 to 7 mm (0.20 to 0.28 in) wide, with 16 to 20 ovules (Welsh et al., 2003).

Distribution:
Goose Creek milkvetch occupies an area approximately 32.5 km (20 mi) long and 6.4 km (4 mi) wide where the Idaho, Nevada, and Utah borders meet. Known populations occur in the Goose Creek drainage in Cassia County, Idaho; Elko County, Nevada; and Box Elder County, Utah (USDI-FWS, 2009). There were an estimated 60,000 plants prior to 2007 when wildfires burned much of the known habitat. Accurate counts of Goose Creek milkvetch are complicated due to variability in annual abundance.

For current distribution, consult the Plant Profile page for this species on the PLANTS Web site.

Habitat:
Goose Creek milkvetch occurs from 1,500 to 1,790 m (4,920 to 5,870 ft) elevation in sagebrush steppe plant communities. It can be found growing in association with Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), Utah juniper (*Juniperus osteosperma*), green rabbitbrush (*Chrysothamnus viscidiflorus*), Sandberg bluegrass (*Poa secunda*), and needleandthread (*Heterostipa comata*).

Adaptation
Goose Creek milkvetch grows primarily on tuffaceous (a rock composed of the finer kinds of volcanic detritus usually fused together by heat) outcrops of the Salt Lake Formation in silty to gravelly sandy loam soils. The region of the

Goose Creek drainage receives 23 to 30 cm (9 to 12 in) of annual precipitation (USDI-FWS, 2010).

Management
Management and protection of this species should be centered on habitat protection, especially against invasion of cheatgrass (*Bromus tectorum*) and protection from wildfires.

The USDI-FWS has identified several threats to Goose Creek milkvetch. In 2007, wildfire severely impacted known populations of Goose Creek milkvetch. The threat of fire is increasing due to continued invasion of annual weeds including cheatgrass. Establishment of high densities of cheatgrass is known to increase the fire return interval, making more habitat loss from fire likely. Cheatgrass and other weeds such as leafy spurge (*Euphorbia esula*) are also known to compete directly with Goose Creek milkvetch; however, control efforts to date have been largely successful in keeping weed invasion limited (USDI-FWS, 2009). Much of the nearby habitat of Goose Creek milkvetch has been altered as a result of intentional seeding of crested wheatgrass (*Agropyron cristatum*); however Goose Creek milkvetch's primary habitat of steep slopes and rock composed of the finer kinds of volcanic detritus seems to preclude it from direct competition with crested wheatgrass. Habitat degradation from cattle grazing and development of livestock watering facilities also pose a threat to this species.

Pests and Potential Problems
There are no known potential problems from disease, insects or fungi associated with Goose Creek milkvetch.

Environmental Concerns
There are no known environmental concerns associated with Goose Creek milkvetch.

Seed and Plant Production
Goose Creek milkvetch plants flower from late May to early June with fruit set in early June. Pollination and seed dispersal mechanisms are unknown.

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Packard's Milkvetch
Astragalus cusickii A. Gray var. *packardiae* Barneby

Plant Symbol = ASCUP
Listing Status: Candidate

Seed pods and flowers of Packard's milkvetch (*Astragalus cusickii* var. *packardiae*). Photo by Mark Lowry, USDI-BLM

Alternate Names

None

Uses

There are no known human uses of Packard's milkvetch. Grazing by livestock has been observed (Mancuso, 1999).

Status

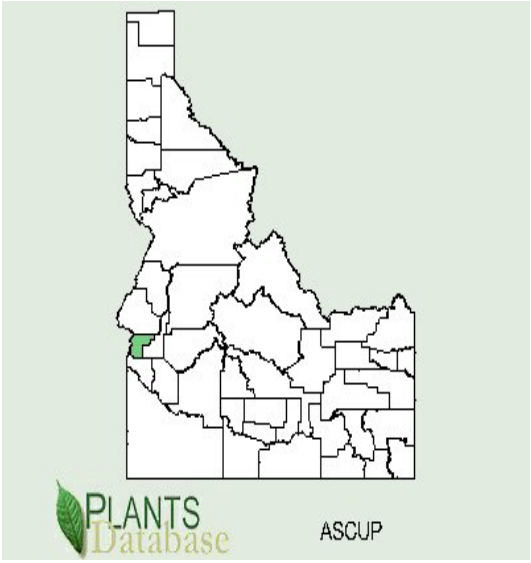
Packard's milkvetch was designated a candidate for listing as endangered or threatened in 2010 with a Listing Priority Number (LPN) of 3, a subspecies facing high-magnitude, imminent threat (USDI-FWS, 2010).

Description

General: Legume family (Fabaceae). Packard's milkvetch is an erect, multi-stemmed, perennial forb. Mature plants are 25 to 50 cm (9.8 to 19.7 in) tall. The leaves are pinnately compound with 2 to 9 broadly spaced leaflets. The upper leaves are often

reduced to a naked rachis, a stem with no leaflets. The leaflets are approximately 7 mm (0.3 in) long and 1 mm (0.04 in) wide. The inflorescence is a loose raceme with up to 20 creamy white, purple tinged flowers reaching approximately 1 cm (0.4 in) in length. The fruit is an inflated, narrowly elliptic, yellow-green pod with reddish mottling, approximately 4 cm (1.6 in) long and 1 cm (0.4 in) wide (Cronquist et al., 1989).

Distribution:
Packard's milkvetch is endemic to the northeastern corner of Payette County, Idaho. The known range of the species covers an area approximately 9.7 km (6 mi) long by 3.2 km (2 mi) wide.



For current distribution, consult the Plant Profile page for this species on the PLANTS Web site.

Habitat:
Packard's milkvetch occurs in an area of rolling uplands in the sagebrush steppe in what was historically a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and bluebunch wheatgrass (*Pseudoroegneria spicata*) plant community. Much of the surrounding habitat occupied by Packard's milkvetch has been altered by wildfire and grazing and has subsequently been invaded by introduced annual grasses (Mancuso, 1999). Packard's milkvetch is restricted to small islands of undisturbed habitat. Associated plant species include Blue Mountain buckwheat (*Eriogonum strictum*), bottlebrush squirreltail (*Elymus elymoides*), Sandberg bluegrass (*Poa secunda*), bluebunch wheatgrass (*Pseudoroegneria spicata*), basin wildrye (*Leymus cinereus*), and fernleaf biscuitroot (*Lomatium dissectum*).

Adaptation

Packard's milkvetch appears to be limited to a series of visually distinct sedimentary outcrops

exposed between Big Willow Creek, Little Willow Creek, Dry Creek and Stone Quarry Gulch (Mancuso, 1999). The exposed substrates are whitish in color, with relatively sparse vegetation and a high percentage of bare ground. Populations have been found from 823 to 975 km (2,700 to 3,200 ft) elevation in an area receiving approximately 40 cm (16 in) mean annual precipitation.

Management

Packard's milkvetch habitat is threatened by wildfire, non-native invasive plant species including cheatgrass (*Bromus tectorum*) and medusahead (*Taeniatherum caput-medusae*) and off road vehicle use (USDI-FWS, 2010). Heavy weed encroachment by cheatgrass and medusahead has been observed in the surrounding habitat, but appears to not be entering the specific edaphic substrates occupied by Packard's milkvetch (Mancuso, 1999). However, higher densities of annual grasses are known to contribute to increased frequency of wildfires.

ORV use is a widespread activity in Packard's milkvetch habitat resulting in crushed plants and accelerated erosion of the fine loose soils.

Although grazing by cattle and sheep has been observed, it is unknown if grazing is beneficial or deleterious to plant recruitment (Mancuso, 1999).

Pests and Potential Problems

There are no known pests associated with Packard's milkvetch.

Environmental Concerns

There are no known environmental concerns regarding Packard's milkvetch.

Seed and Plant Production

Flowers bloom in late May with fruit ripening in June. Pollination vectors are unknown (Mancuso, 1999).

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Christ's Paintbrush
***Castilleja christii* N.H. Holmgren**

Plant Symbol=CACH19
Listing Status: Candidate

Christ's paintbrush (Castilleja christii). Photo by Carol Dawson, Center of Plant Conservation

Alternate Names
None known.

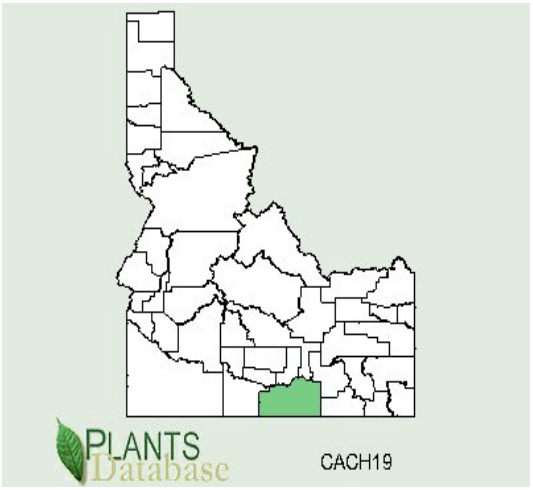
Uses
Christ's Indian paintbrush is one of Idaho's rarest plants. A single population occurs in the Albion Mountains of Cassia County, Idaho. It was named after John H. Christ, the first botanist to collect the species (Center for Plant Conservation 2006). This species has no known agricultural, economic, or other human uses at this time. This species may have scientific significance due to its evolutionary isolation which is an important subject in conservation biology research.

Status
Christ's Indian paintbrush is currently a Candidate for listing under the Endangered Species Act and is on the US Fish and Wildlife Service Notice of Review list. It is also a Sensitive plant species on the Regional Foresters Sensitive List for the Intermountain Region of the USDA Forest Service.

Consult the PLANTS Web site and your State Department of Natural Resources for this plant's current status (e.g. threatened or endangered species, state noxious status, and wetland indicator values).

Description
General: Perennial herb, 5 to 15 inches tall; stems erect to ascending, usually unbranched, several to a cluster; herbage glabrous to hispid with some hairs gland-tipped near the inflorescence. The leaves are 2-5 inches long, narrowly to broadly lanceolate, with 1 or maybe 2 pairs of lateral lobes, although sometimes all entire. The inflorescence is glandular, yellow to yellow orange, the bracts lanceolate to ovate, with 1 or 2 pairs of narrow lateral lobes; the calyx is 0.5 to 1 inch long, the primary lobes more deeply cleft in front than behind; the corolla is approximately 1 to 1.5 inches long, the galea about 0.5 inch and the lower lip much reduced with incurved teeth, the tube 0.5 to 0.75 inch long (Mosley 1993). This and other paintbrush species are often believed to be purely parasitic, meaning that they survive by using resources produced in another plant host. However, Christ's Indian paintbrush is actually hemi-parasitic in that it is capable of independent production of nutrients but gains additional nutrients through root attachment with surrounding plants (Center for Plant Conservation 2006).

Distribution:



Christ's paintbrush is known from one population on Mount Harrison, Cassia County, Idaho. For current distribution, consult the Plant Profile page for this species on the PLANTS Web site.

Habitat: Christ's Indian paintbrush is found in grassy upper sub-alpine meadows along the crest and slope of Mount Harrison in loamy gravel and occurs most often in areas where snowdrifts remain into early summer. It is found among stands of Sandberg bluegrass (*Poa secunda*), Idaho fescue (*Festuca idahoensis*), alpine goldenrod (*Solidago multiraciata*), western yarrow (*Achillea millefolium*) and coiled-beak lousewort *(Pedicularis contorta*) (Center for Plant Conservation 2006).

Adaptation
Christ's Indian paintbrush occurs almost exclusively on gentle, northerly facing slopes (9,100 feet elevation) of Mount Harrison, Cassia County, Idaho. It only rarely occurs in deep soils on south and west facing slopes. The soils are deep and gravelly appearing to have been derived from the underlying quartzite bedrock (Mosley 1993).

Establishment
Christ's Indian paintbrush reproduces by seed. Little is known about seed dispersal or viability and no pollinators have been observed. Growth begins slightly before or soon after the snow melts in late June to early July. Peak flowering occurs from mid-July to mid-August depending on the year. Fruits begin to mature soon after flowering and probably dehisce by mid-September (Mosley 1993). Seeds have been collected by Denver Botanic Gardens and are currently stored at the National Seed Storage Laboratory in Fort Collins, Colorado. Seed germination studies by Denver Botanic Gardens suggest that this species has strong seed dormancy since they may require three months or more of cool, moist conditions to germinate. This dormancy mechanism is likely due to the habitat where the plant is found (Center for Plant Conservation 2006).

Management
A Candidate Conservation Agreement outlining 10 years of conservation actions for this rare species was signed by the US Fish and Wildlife Service and USDA Forest Service in 2005 (USDA-FS 2009).

Pests and Potential Problems
Considerable pocket gopher digging takes place on sites occupied by Christ's Indian paintbrush. The species is threatened primarily by smooth brome (*Bromus inermus*), an aggressive introduced grass that is found within the population.

Environmental Concerns
The greatest threats to this species is habitat loss and degradation, due mainly to road construction and recreational activities. Although the site where the population occurs is closed to livestock grazing, trespass occasionally occurs (Center for Plant Conservation 2006). The long term effect of global climate change on this population may require extraordinary conservation measures such as ex situ conservation of the plant and its seeds to ensure its continued existence (USDA-FS 2009).

Seeds and Plant Production
No commercial or restoration propagation known.

Cultivars, Improved, and Selected Materials (and area of origin)
None.

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Whitebark Pine
***Pinus albicaulis* Engelm.**

Plant Symbol = PIAL
Listing Status: Candidate

Whitebark pine (left). Photo by Mark W. Skinner, PLANTS Database, USDA-NRCS, 2011.

Alternate Names
None

Uses

Whitebark pine provides biodiversity and performs important roles in the alpine ecosystems. As a pioneer species whitebark pines stabilize loose soils after disturbance. The trees capture snow drifts and create shade which slows snowmelt which improves hydrologic conditions on and off site.

Numerous Native American tribes used the seed as a food source (Moerman, 1998).

Whitebark pine seeds are eaten by Clark's nutcrackers and other birds and mammals. Grizzly bear females, in the Yellowstone ecosystem rely on the energy-rich seed of whitebark pine to increase their fat reserves prior to hibernation. The seeds are comprised of 21% carbohydrates, 21% protein, and 52% fat, which is significantly more fat than most other bear food sources. Female bears consume more whitebark pine seeds than males, and female grizzly bears that frequently made use of whitebark pine seeds reproduced at an earlier age and exhibited higher reproductive rates than females who consumed few pine seeds. The bears obtain seed by raiding red squirrel middens (Mattson and others, 1991).

Clark's nutcracker. Photo from USDA-FS.

Status

In 2011 the USDI Fish and Wildlife Service determined that listing whitebark pine as threatened or endangered is warranted. However, higher priority actions precluded immediate listing. Whitebark pine has been added to the candidate species list (USDI-FWS, 2011).

Populations appear to be in decline throughout the species' range of adaptation (Keane and others 2010). White pine blister rust, an introduced fungal pathogen, and mountain pine beetle are the greatest threats to this species. Infections continue to kill trees and reduce seed sources for reproduction. Climate change is also considered a threat to whitebark pine. Species not normally adapted to alpine areas at or near timberline are likely to spread to higher elevations with increases in temperatures. In Canada, the species is predicted to decline by 57% by 2100 (COSEWIC, 2010).

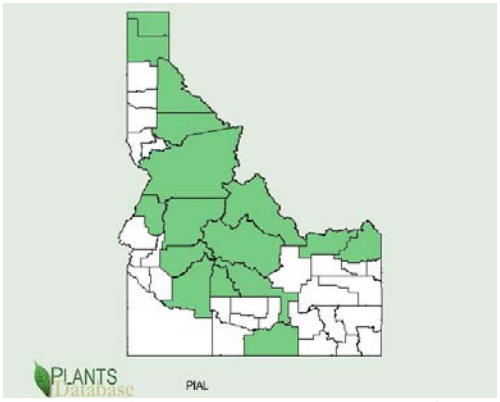
Fire suppression, resulting in fuel buildup over many years followed by high intensity wildfires is a major cause of mortality (USDI-FWS, 2011). Additionally, fire suppression has lead to a shift in plant communities and a reduction in open habitat for whitebark pine germination. Sites previously subject to relatively frequent

fires have become dominated by shade tolerant species, excluding whitebark pine.

Description

General: Pine family (Pinaceae). Whitebark pine is a medium to tall tree with a rounded or irregularly spreading canopy. Mature trees reach 5 to 20 m (16 to 66 ft). Whitebark pine trees are very long-lived. The oldest known specimen, over 1,200 years old, lives in the Sawtooth National Forest in Idaho (Perkins and Swetnam, 1996). In open areas the trees tend to be multi-stemmed and spreading, while in dense growth they are single-stemmed and upright. Above timberline they take on a krummholz (stunted, shrub-like) form. Whitebark pine has 5 needles per cluster (fascicle), 4 to 8 cm (1.5 to 3 in) long. Mature bark is whitish gray, while twigs are yellowish and pubescent. Whitebark pine trees are monoecious, bearing both male and female cones on the same plant. Female cones are dark brown to purplish, 5 to 8 cm (2 to 3 in) long (Davis, 1952). The seeds are 10 to 12 mm (0.4 to 0.5 in) long. The cones are indehiscent; seeds are not dislodged by wind. The seeds are spread almost solely by Clark's nutcrackers, which rip the cones apart, eating some and caching the rest.

Distribution: Whitebark pine trees are found on cold wind-swept ridges and peaks in western North America. Many stands are geographically isolated. Populations occur from the coastal mountain ranges of British Columbia, Washington and Oregon, south to the Sierra Range of California and east to the Rocky Mountains of Idaho, Montana, Wyoming and Alberta with scattered populations in the Great Basin. For current distribution, consult the Plant Profile page for this species on the PLANTS Web site.



Distribution of whitebark pine in Idaho. Image from the PLANTS Database. USDA-NRCS, 2011.

Habitat: Whitebark pine is adapted to steep slopes and windy exposures in subalpine and alpine habitats. It is often an early to mid-seral species. It grows with other cold and wind tolerant alpine trees such as lodgepole pine (*P. contorta*), Englemann spruce (*Picea engelmannii*), and subaplpine fir (*Abies lasiocarpa*).

Adaptation

Whitebark pine is adapted to cold, windy, snowy peaks with cool summer conditions. Whitebark pine tolerates poor soil conditions of weakly developed glacial soils. Precipitation requirements are broad. Populations are found in areas receiving 50 to 250 cm (20 to 100 in) of annual precipitation (USDI-FWS, 2011).

Establishment

Whitebark pine seeds are distributed almost exclusively by Clark's nutcrackers (Tomback and Linhart, 1990). The seeds may be carried several miles from the parent tree where the seeds are placed in caches for later consumption. Seed not eaten is available for germination under favorable conditions. Germination often occurs 2 or more years after caching.

Low germination rates are related to the development and condition of the embryo and to seed coat factors (McCaughy and Schmidt, 1990). Seeds from three Canadian sources germinated poorly, despite a variety of seed coat scarification techniques with and without cold stratification (Pitel and Wang, 1980). However, In another test, using seed collected from Idaho, 61 percent of the seed germinated after clipping of the seed coat. Stratification for 60 days plus clipping resulted in 91 percent germination. In another trial cold stratification for at least 150 days followed by cracking of the seed coat has resulted in 34 percent germination (Hoff, 1980).Low germination was found to be a result of seeds with a low proportion of fully developed embryos (McCaughy and Schmidt, 1990).

In areas with long-lasting snow cover , whitebark pine trees reproduce by asexual layering. Snow bends low flexible branches into the soil. The resulting stand is a patch of krummholz trees.

Management

Physical management (pruning) of whitepine blister rust infected trees has proven labor intensive and ineffective. Efforts are being made to develop whitebark pine trees with inherited resistance to white pine blister rust.

Chemical control options for mountain pine beetle are limited. At present, there are no labeled pesticides for use on mountain pine beetle Due to high elevations and remote locations, seeding, planting and restoration efforts are challenging.

Pests and Potential Problems

White pine blister rust and mountain pine beetle have significantly decreased stands and populations of whitebark pine. Mountain pine beetles are native to western North America and are a natural component in forest disturbance; however occasionally the beetles reach epidemic levels causing widespread mortality of pine trees.

White pine blister rust is an introduced fungal agent (*Cronartium ribicola*). This rust has affected all of the western 5-needle pines causing high rates of mortality. In areas of northwestern U.S. and southwestern Canada, white pine mortality caused by blister rust and mountain pine beetle exceeds 50%. Problems relating to white pine blister rust are exacerbated as climates become warmer in higher elevations due to climate change. The combination of these factors (fire suppression, white pine blister rust, climate change, and epidemic levels of mountain pine beetles) cause federal listing as threatened or endangered to be warranted (USDI-FWS, 2011).

Several other pathogens are known to infect whitebark pine; however these are not seen as major concerns. Stem infections, cankers, wood rots, molds and dwarf mistletoe have been identified on whitebark pine.

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Visit the following websites to learn more about these plant species

http://fishandgame.idaho.gov/cdc/plants/seid_plant_guide_intro.cfm

http://www.fws.gov/idaho/species/IdahoT&E.htm

http://www.centerforplantconservation.org/

http://fishandgame.idaho.gov/cdc/

and

http://plants.usda.gov/