

U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Artemisia campestris var. *wormskioldii*

Common Name:

Northern Wormwood

Lead region:

Region 1 (Pacific Region)

Information current as of:

06/01/2013

Status/Action

Funding provided for a proposed rule. Assessment not updated.

Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

New Candidate

Continuing Candidate

Candidate Removal

Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status

Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species

Range is no longer a U.S. territory

Insufficient information exists on biological vulnerability and threats to support listing

Taxon mistakenly included in past notice of review

Taxon does not meet the definition of "species"

Taxon believed to be extinct

Conservation efforts have removed or reduced threats

___ More abundant than believed, diminished threats, or threats eliminated.

Petition Information

___ Non-Petitioned

X Petitioned - Date petition received: 05/11/2004

90-Day Positive:05/11/2005

12 Month Positive:05/11/2005

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing?
Yes

Explanation of why precluded:

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for this species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The Progress on Revising the Lists section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

Historical States/Territories/Countries of Occurrence:

- **States/US Territories:** Oregon, Washington
- **US Counties:** County information not available
- **Countries:** United States

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories:** Oregon, Washington
- **US Counties:** Sherman, OR, Wasco, OR, Douglas, WA, Grant, WA, Klickitat, WA
- **Countries:** Country information not available

Land Ownership:

All of the known populations are on federal land. The Klickitat County population that occurs on Miller Island covers about 0.25 acres (ac) and is managed by the Columbia River Gorge National Scenic Area of the Gifford Pinchot National Forest. The Grant County population occurs on land owned by the Bureau of Reclamation, is managed by the Grant County Public Utility District (PUD), and is located along the shore of the Columbia River and on several peninsulas that become islands during periods of high water. This Grant County population covers approximately 2.8 ac and is managed in cooperation with the Washington State Natural Heritage Program.

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Biological Information

Species Description:

Artemisia campestris var. *wormskioldii* is a perennial plant in the aster family (Asteraceae). This variety is also commonly known as Pacific sagebrush. *A. campestris* var. *wormskioldii* is a low-growing plant, generally 15-30 centimeters (cm) (6-12 inches (in)) tall, but may grow up to 40 cm (16 in) in height. This plant has a taproot, and basal leaves are crowded in rosettes. The basal leaves are 2-10 cm (1-4 in) long and divided two or three times in mostly linear divisions. Leaves on the upper stems are similar but smaller and less divided. The stems and leaves are conspicuously covered with silky hairs. The fruits (achenes) and the enlarged upper ends of the flower-bearing stalks (receptacles) are without hairs. The arrangement of yellowish flowers (inflorescence) on the stem is narrow, and the involucre (bracts at the base of flowers) are about 0.3-0.5 cm (0.1-0.2 in). The flower heads are relatively large. The outer female flowers are fertile, and the sterile disk flowers have undeveloped ovaries (Hitchcock et al. 1955; Carlson 1997; Washington Natural Heritage Program (WNHP) and Bureau of Land Management (BLM) 1999).

Taxonomy:

Artemisia campestris var. *wormskioldii* was first collected along the Columbia River by David Douglas and described in 1833 by W. S. J. G. von Bessey as *A. campestris* var. *wormskioldii*. The variety is distinguished by having larger floral parts than other species in the genus and it is the only *Artemisia* that flowers in April and May (Caplow 2005).

The original and most recent descriptions for this taxon can be found in the following publications: *Artemisia borealis* Pall. var. *wormskioldii* Bess. in Hooker (1840) and *Artemisia campestris* L. var. *wormskioldii* (Bess. ex Hook) Cronq. in Cronquist (1950) (Meyers 2011, pers. comm.). In past Candidate Notice of Reviews (CNORs), we used both names, *A. campestris* var. *wormskioldii* and *A. borealis* var. *wormskioldii*, as these are considered to be synonymous. In this notice we are using the original form, *A. campestris* var. *wormskioldii*, the form currently receiving the widest usage, and so named in the Oregon Flora Project database (Cook et al. 2011).

Habitat/Life History:

Artemisia campestris var. *wormskioldii* is restricted to exposed basalt, cobbly-sandy terraces, and sand habitat along the banks of the Columbia River at elevations ranging from 50 to 150 meters (m) (160 to 500 feet). The Klickitat County, Washington, population is found near water level in the crevices of basalt outcrops, compacted cobbly terrace, and sand. The Grant County, Washington, population occurs along the shore of the Columbia River and on several islands composed mostly of compacted cobbly terrace (Rush 1999). This population appears to be restricted to an area of compacted cobbles with varying amounts of sand and little, if any, soil development (Carlson 1997).

Historical Range/Distribution:

Historically, at least eight populations of *Artemisia campestris* var. *wormskioldii* occurred within the range of this variety. This plant was previously collected from sites along the banks of the Columbia River near the mouth of the John Day River in Wasco County, Oregon, west to the vicinity of Hood River in Hood River County, Oregon, a distance of 80 kilometers (km) (50 miles [mi]) (WNHP and BLM 1999). All of the historical locations were later re-surveyed and no populations were found. It is likely that disturbances due to the construction of several dams and subsequent flooding of habitat resulted in the extirpation of the historical occurrences (Carlson 1997; Rush 1999).

Current Range Distribution:

Currently, *Artemisia campestris* var. *wormskioldii* is known from only two sites along the Columbia River, separated by approximately 322 km (200 mi) in Klickitat and Grant Counties, Washington. These two populations were discovered in 1983 (Carlson 1997). Three large hydroelectric dam/reservoir complexes (Priest Rapids, McNary, and John Day Dams) separate the two sites (Carlson 1997; Rush 1999). Both populations are found just downstream of dams where current habitat most resembles historic habitat. There may be little or no suitable habitat between the two known populations because much of the original river bank has been inundated by the construction of the three dams and the use of riprap along the river banks; however, remnant populations may remain (Carlson 1997).

Although potential habitat is found on the Hanford Reach of the Columbia River, surveys of apparently suitable habitat have not detected any *A. campestris* var. *wormskioldii* plants. In 2002, intensive surveys of the islands in the Hanford Reach by staff from the Washington Natural Heritage Program and the Hanford Reach National Monument found no additional populations of *A. campestris* var. *wormskioldii* (Caplow 2003). In April 2013, staff from an Oregon private nursery, the U.S. Fish and Wildlife Service (FWS) Mid-Columbia Refuge Complex, and the Oregon State Ecological Services Office reintroduced *A. campestris* var. *wormskioldii* on two islands in the Hanford Reach, near Richland, Washington. Seedlings (220) were divided between the two islands and planted in varying patterns and heights above the mean water level to inform future planting projects. This outplanting will be monitored through 2014 and may be enhanced with additional plants in the future.

Amsberry et al. (2007) investigated outplanting *A. campestris* var. *wormskioldii* in Oregon. They found the species is not excessively difficult to cultivate, although some groups or batches of seed may be poor in quality. They also found suitable habitat for outplanting not difficult to select, and that outplanting is possible if seed viability is improved. Moderate levels of success, determined by plant survival, were reported in a spring 2008 reintroduction on different site types near Meyer State Park, in Oregon, west of the Dalles, near Rowena (Amsberry 2009, pers. comm.). In a subsequent outplanting in 2009 at Squally Point, the 257 individuals survived through December, 2010. Seedlings originating from these plants were discovered in January 2011, indicating the potential for the population to be self-sustaining, given proper site selection (Amsberry 2011, pers. comm.). Larger scale plantings over a broader portion of the presumed historic range between the two extant sites are currently being planned for 2013 and beyond.

Population Estimates/Status:

At the Klickitat County site in 1989, 75 *A. campestris* var. *wormskioldii* individuals occupied less than 0.4 hectare (ha) (1 ac) (Kaye 1995). In 1995, Kaye (1995) documented 109 individuals flowering. The majority of the plants were found on a sandy substrate above basalt bedrock and 16 plants were found on bedrock. A June 1999 census documented 142 individuals flowering (Rush 1999).

Surveys completed at Miller Island in Klickitat County between 2002 and 2011 show a clear decline (Table 1.) Between 2002 and 2004, annual population monitoring indicated the population declined (experiencing growth rates of 0.759 in 2002-2003 and 0.89 in 2003-2004) and small vegetative plants experienced the highest mortality (up to 68 percent) (Caplow 2005). Large reproductive plants were the most significant contributors to seedling recruitment; however, the average number of seedlings produced, 0.2 per plant

(flowering adult), was extremely low compared to results for the Grant County site where 1.4-14.7 seedlings per large reproductive plant were observed. If population trends continue at this site, the 25-year extinction probability at the site is 1.0, and extinction would likely occur within 25 years (Caplow 2005).

Table 1. Reproductive (flowering) *A. campestris* var. *wormskioldii* plants on Miller Island site (Klickitat Co.) and main population counts at Beverly (Grant Co.), years 2000-2012.

Date	# flowering adults (Miller Island)	Total # individuals (Beverly) (est.)
2000	-	1260+
4/23/02	99	-
5/1/03	78	-
5/6/04	79	-
5/5/05	69	1623-1710
4/27/06	42	-
5/2,3/07	39	1585-1656
5/9/08	35	1022-1084
2009	31	763-764
2010	29	401-405
2011	33	350-352
2012	33	421-424

* Counts of the main population, not including plants from two small outlying populations. Sources: Arnett 2011, pers. comm.; Amsberry et al. 2007, p. 29; Woodward 2013, pers. comm.

At the Grant County site, a demographic monitoring project was established in 2000, which used 31 plots within the largest subpopulation of 1,260 plants (Table 1.). The number of plants counted in the demographic plots is generally less than count totals presented in Table 1. A decrease in the number of flowering adults within the monitoring plots has been documented, while conversely, the seedling counts have shown a significant increase. As a result of the annual census of the main population in 2011, Grant PUD biological staff observed an estimated 352 flowering northern wormwood adults. The total number of *A. campestris* var. *wormskioldii* individuals declined every year between 2007 and 2012. In 2010, Grant PUD recorded finding 1,016 seedlings in the monitoring plots, which was less than the 2009 seedling count of 2,659, but remains higher than in years past. Seedling counts observed prior were much lower with a total of 44 seedlings observed in 2008 and 91 seedlings observed in 2007 (Clement 2012, pers. comm.).

In contrast to *A. campestris* var. *wormskioldii*, the closely-related and more common *A. campestris* var. *scouleriana* has seen a general increase within the plots since 2002. Interpreting the demographic data only, and not the census information, data from 2001 through 2011 indicated a steady decline in the Grant County population of *A. campestris* var. *wormskioldii* (Arnett 2010; Arnett 2010, pers. comm.). In contrast to this decline in flowering individuals at the Grant County site, the highest seedling count to date was recorded in 2009 at 2,653, increasing from 91 and 44 in 2007 and 2008, respectively (Woodward 2010, pers. comm.). The annual variability of plant reproduction and the number of adult plants is high (Clement 2007; 2010, pers. comm.). This indicates that moisture and temperature in any given year is highly variable and these factors directly affect the ability of plants to produce seed, germinate, and survive into mature flowering plants.

Some possible causes suggested for the decline in adults in 2009 at the Grant County site (Table 1) include the following:

1. A colder and extended previous winter might have been a factor affecting growth of adult plants.

2. Higher flows in 2008 might have deposited debris along the populations west shorelines where plants were persisting in the past; therefore, plants may have been buried by debris or they could have been scoured during this high flow event.
3. Herbivores might have caused depredation losses; Species such as Canada geese were observed utilizing the islands and peninsulas in the vicinity.

In 2011, Grant PUD biologists were only able to monitor 14 of the 31 plots prior to high water inundating the remaining plots. Grant PUD staff returned to the Beverly population after flows receded (August 9-12) and surveyed for presence/absence of plants noted in prior surveys. Biologists counted 1,041 *Artemisia campestris* (includes both *wormskioldii* and *scouleriana*) plants in 14 plots surveyed May, 2011. Grant PUD resurveyed those 14 plots in August and found 1,006 plants remaining (96 % survival) after flows decreased to elevations lower than the population. Most of the plants had survived and went about their usual business of reproduction. (Clement 2012, pers. comm.). Not observed until this event, this behavior indicates that this plant is tolerant of disturbance and is more resilient of variable flow regimes than previously thought.

In 2012, Grant PUD biologists were able to monitor 30 of the 31 demographic plots. One plot could not be located following 2011 high flows. Within the 30 plots monitored, Grant PUD staff counted 28 flowering individuals and a record 6,393 seedlings of *A. campestris* var. *wormskioldii*. Currently, Grant PUD is tracking 11,394 individual *A. c.* var *wormskioldii* within the 30 remaining plots (Woodward 2013, pers. comm.).

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or range:

The construction of dams along the Columbia River, and possibly railroad and highway construction, resulted in the direct loss of suitable habitat as well as individuals and populations of *Artemisia campestris* var. *wormskioldii* (Carlson 1997). Loss of habitat and individual plants probably resulted from both disturbances due to dam construction and the resulting inundation. Much of the existing river bank is riprap, which is not suitable habitat (Carlson 1997; Rush 1999).

Erosion by wind and water of the sandy substrate has been observed throughout the Klickitat County site and is causing mortality of adult plants and decreased seedling survival (Caplow 2005, Arnett 2010). Erosion of the habitat is the primary threat to *A. campestris* var. *wormskioldii* at the Klickitat County site (Caplow 2005, pers. comm.; Dobson 2006, pers. comm.). However, burial of plants at the Klickitat County site by deposition of sand was also noted in 2006 (Arnett 2007, pers. comm.), indicating the presence of an additional threat when sediments are carried by wind or water.

Recreational use at both the Klickitat County and Grant County sites leads to trampling of plants. The Grant County population has been affected by recreational use, including picnicking, camping, hunting, boating and vehicular traffic. Although the site is now entirely fenced to exclude vehicles, it is still accessible to boats (Caplow 2002, pers. comm.) and some walk-in use still occurs (Grant County PUD 2006). Therefore, fencing established at the Grant County site has reduced the threat of trampling but has not entirely eliminated it. At the Klickitat County site, the *A. campestris* var. *wormskioldii* population is immediately adjacent to a beach suitable for landing a boat (Carlson 1997; Rush 1999). The small size of the Klickitat County population and its proximity to the boat landing site make it particularly vulnerable to trampling (Caplow 2005, pers. comm.), and this population may benefit from fencing as well.

Two years of above average levels of rainfall in 1996 and 1997 produced high runoff and likely higher than normal releases of water from the upstream Grand Coulee and Wanapum Dams and caused excessively high water levels on the Columbia River at the Grant County population (Rush 1999). The high water levels may have washed away some *A. campestris* var. *wormskioldii* plants from the site. Currently, uncontrolled runoff

occurs very rarely in the system as high flows are moderated by storage, electricity generation, and to provide for sustained water releases from the Dams (spilling for listed salmonids).

B. Overutilization for commercial, recreational, scientific, or educational purposes:

There is no evidence that *Artemisia campestris* var. *wormskioldii* has been used for commercial or recreational purposes. Several cuttings have reportedly been taken from the Klickitat County population (Carlson 1997); however, there is no evidence that cuttings have been made recently, or that cutting, or collections of the plant are a threat. Overutilization for scientific or educational purposes is not known to occur at either population.

C. Disease or predation:

There is no evidence that disease or predation is a concern for *Artemisia campestris* var. *wormskioldii*, although herbivory (cattle grazing) could be a threat. The Klickitat County population occurs within an area formerly grazed by cattle (Carlson 1997). While the palatability of this variety is not known, some individual plants growing in a very loose substrate (sand) would be easily uprooted by cattle. Disturbance of the habitat by cattle grazing also may have contributed to the increase of nonnative plant species at the Klickitat County site (Carlson 1997). There is no evidence that cattle grazing has occurred at the Grant County site. It is unknown whether the presence of Canada geese (*Branta canadensis*) reported in 2009 by Grant County PUD has negatively affected the species at that location.

D. The inadequacy of existing regulatory mechanisms:

Artemisia borealis var. *wormskioldii* is designated as endangered by the states of Oregon and Washington (Oregon Department of Agriculture [OAR 6030730070], Washington Natural Heritage Program 2007, Washington Department of Natural Resources [WDNR] 2007); however, experimental outplantings notwithstanding, the variety is currently found entirely within Washington State, and presumed extirpated from Oregon (Camp and Gamon 2011, p. 57). At this time, there are no existing regulatory mechanisms that provide protection for State listed plants in Washington.

A. campestris var. *wormskioldii* is managed as a sensitive species by the U.S. Forest Service (Forest Service), which provides management direction for the Klickitat County population at Miller Island (Dobson 2006, pers. comm.). Management by the Forest Service at the Klickitat site includes shared responsibility for monitoring the population with the Washington Natural Heritage Program. The Forest Service annually pulls *Centaurea diffusa* (diffuse knapweed), a Class B noxious weed, from Miller Island (Dobson 2006, pers. comm.). At the Grant County site, the Grant County PUD, in cooperation with the Bureau of Reclamation (BOR [site manager]), monitors the population annually and removes weeds by hand. The management by the two federal agencies (Forest Service and BOR) and Grant County PUD contribute to the conservation of the species; however, these actions are not sufficient to completely remove threats to the variety.

In 2008, as part of the Federal Energy Regulatory Commission dam re-licensing process, the Grant County PUD was required to complete a conservation plan for *A. campestris* var. *wormskioldii*, including an implementation schedule. The plan includes measures to: (1) ensure demographic monitoring annually; (2) provide fencing to control vehicle access at the site; and (3) control noxious weeds that occur at the site (Grant PUD 2008). The management by the two federal agencies (Forest Service and BOR) and efforts by the Grant County PUD contribute to the conservation of the species; however, these actions are not sufficient to completely remove threats or reverse the apparent declines in the species.

E. Other natural or manmade factors affecting its continued existence:

In addition to direct loss of habitat as a result of dam construction, the manipulation of water flow by

hydroelectric dams is a major threat to this variety. The severity of spring floods has been reduced or eliminated in most years. However, there have been years when *Artemisia campestris* var. *wormskioldii* populations become inundated for much of their growing season. At the Grant County site, the ground water that supports the plants is dependent upon the river elevations. Changes in the water level of the river could either desiccate or inundate this population. Manipulated water regimes do not mimic historic water flows, which were not controlled by dams and likely were much higher during the rainy season and lower during late-summer droughts, and may affect the ability of these plants to grow, flower, reproduce, and colonize (Rush 1999). In addition, reduced peak flows and augmented minimum flows often result in the succession from herbaceous to woody vegetation (Toner and Keddy 1997) and may reduce the potential for *A. campestris* var. *wormskioldii* to expand into new habitats.

Altered water regimes, as well as recreational uses and grazing, have allowed nonnative plants to invade both *A. campestris* var. *wormskioldii* sites (Rush 1999). *Centaurea diffusa*, a Washington State Class B noxious weed (Chap. 17.10 RCW, Chap. 16-750 WAC), is present and spreading at the Grant County site and was found scattered throughout the Klickitat County site in 2005 (Dobson 2006, pers. comm.). Noxious weed species pose a serious threat because they have the ability to displace native vegetation and outcompete native plants for resources (space, light, water and nutrients). *Linaria dalmatica* (Dalmation toadflax), another Washington State Class B noxious weed (Chap. 17.10 RCW, Chap. 16-750 WAC), is present at the Grant County site (Grant County PUD 2004). As of 2004, it has occupied approximately 0.5 ac and is being hand-pulled (Grant County PUD 2004). Once established, *L. dalmatica* spreads quickly via its root system and by seed production. Therefore, *L. dalmatica* represents a serious threat at the Grant County site, as well as to the surrounding upland habitats.

Another nonnative, invasive species, *Melilotus alba* (white sweet-clover), partially shares habitat with *A. campestris* var. *wormskioldii* and occupies a small area (less than 1 ac) at the Grant County site (Grant County PUD 2004). This species represents a potential threat that may develop over the long term as it begins to compete for resources with *A. campestris* var. *wormskioldii*.

The extreme loss of habitat that has resulted in two small, widely separated populations may affect the viability of *A. campestris* var. *wormskioldii*. Small isolated populations are more vulnerable to a variety of ecological and genetic factors, as well as naturally occurring random events (Gilpin and Soule 1986; Schemske et al. 1994). Stochastic events associated with highly variable weather, including flooding or drought, could cause extirpation of this variety.

Threats that are increasingly significant in smaller populations are related to the loss of genetic variability due to random changes in gene frequencies (genetic drift). Loss of genetic variability can affect disease resistance, response to climatic change, and reproductively compatible gene combinations (genotypes) (Hamrick and Godt 1996). Small populations are more susceptible to inbreeding, which can lead to reduced fitness of offspring (Lande and Barrowclough 1987; Ledig 1986). Crosses between closely related individuals may lead to reduced seed production due to insufficient numbers of genetically compatible individuals and low seed germination success (Richards 2000).

Both populations are threatened by trampling as a result of recreational use. The peninsula or islands at Beverly in Grant County and the boat landing site at Miller Island show signs of trampling of *A. campestris* var. *wormskioldii* plants (Dobson 2006, pers. comm.). Recreational use of the areas associated with each of the populations also serves as a vector to the spread of nonnative plants, which can be transported to the site on boats, footwear, and equipment of recreational users.

Two other *Artemisia*, that of *campestris* var. *scouleriana* and *A. ludoviciana*, occur at the Klickitat County site. Both taxa may hybridize with *A. campestris* var. *wormskioldii* (Caplow 2004, pers. comm.), although no evidence of hybridization has been detected.

Conservation Measures Planned or Implemented :

The Washington Natural Heritage Program, using funding provided under section 6 of the Endangered Species Act, prepared a conservation strategy and monitoring plan for *Artemisia campestris* var. *wormskioldii* (Rush 1999) and an updated plan in 2010 (Arnett). Management objectives include identifying and scheduling management actions that will remove or limit threats to this variety. The primary conservation goals of this plan are to protect existing populations and habitat and to maintain occupied and potential habitat in a condition that will sustain *A. campestris* var. *wormskioldii*. Actions such as fencing the Grant County population; active management to remove nonnative, invasive plant species; the collection of seed; outplanting individuals and reintroducing the species to suitable habitat; and the monitoring of the population are expected to contribute to the incremental recovery of the population over time. The storing of seeds in a Center for Plant Conservation facility allows for testing of the germination potential of the variety and contributes to recovery by producing plants that could be outplanted into each of the populations.

The WNHP initially obtained funding under section 6 of the Act to prepare a Conservation Plan with the Forest Service and FWS for the Klickitat County population (Rush 1999, Caplow 2005, pers. comm.). This plan (Arnett 2010) was updated and distributed in September 2010. The WNHP has conducted monitoring of the Klickitat County population from 2002 through 2012. This monitoring effort will continue through at least 2014 in order to fully identify trends and threats to the population (Arnett 2012, pers. comm.).

Grant County PUD began demographic monitoring and population modeling of *A. campestris* var. *wormskioldii* in 2001 and will continue this effort through 2020 according to the terms of their Northern Wormwood Conservation Plan arising from the Federal Energy Regulatory Commission relicensing process in 2008 (Grant County PUD 2004, 2008). Grant County PUD is also working with the Bureau of Reclamation to reduce the impacts from recreational use by limiting public access to the area by maintaining the fence that was constructed around the largest population of the variety and by discouraging motorized or overnight use of the Beverly peninsulas (Grant County PUD 2004). Grant County PUD has begun implementing weed control (hand pulling) to remove *Centaurea diffusa*, *Centaurea solstitialis* (yellow starthistle), *Bromus tectorum* (cheatgrass), and *Linaria dalmatica* on the site. Noxious weed control efforts by Grant County PUD staff continued at the site in 2011, with hand removal of approximately 1,000 *C. diffusa* plants from the population. Grant PUD staff treated approximately 250 *L. dalmatica* plants individually with glyphosate via a chemical injection gun. Grant PUD believes that *L. dalmatica* will be eradicated and *C. diffusa* will be significantly reduced from the site over the next two years due to its significant and aggressive weed control efforts (Clement 2012, pers. comm.).

Grant County PUD has collected seed from the *A. campestris* var. *wormskioldii* population and deposited it into the Center for Plant Conservation facility at the Berry Botanic Garden, Portland, Oregon (Dresser 2004, pers. comm.). Grant County PUD and WNHP staff collected 20 flowering plants of *A. campestris* var. *wormskioldii* and *A. campestris* var. *scouliana* to compare seed production and viability (Clement 2007, pers. comm.). In addition, 16 greenhouse-grown *A. campestris* var. *wormskioldii* plants were outplanted within the fenced area at the Beverly site in March 2006. As of June 2010, the plants, which were purposely planted below the elevation of the extant population, had survived and showed robust growth (Clement 2010, pers. comm.). Grant PUD is also continuing to collect and provide seeds to Oregon State University's Department of Botany and Plant Pathology (Amsberry 2011). The researchers are using the seeds collected at the Beverly population to propagate surrogate *A. campestris* var. *wormskioldii* populations in nursery environments for reintroduction in the lower Columbia River, near the Dalles (Woodward 2012, pers. comm.).

An Oregon State University transplant study in 2011 has demonstrated considerable success on Rufus Island, Oregon, near the town of Rufus. The project involved creating a new population of *A. campestris* var. *wormskioldii* and investigating the effects of environmental factors on transplant success. In June 2011, 3,400 seeds were germinated from several generations of greenhouse-grown source plants and seeds directly collected from both the Klickitat and Grant County populations. Seed germination varied by source with average total germination at 62 percent within a range of 8 to 92 percent. In October 2011, 2,091 *A. campestris* var. *wormskioldii* seedlings were introduced on Rufus Island, where habitat is similar to extant

sites in Washington. Of these, 1,450 were transplanted in experimental plots to examine the impacts of three environmental factors: (1) substrate type; (2) distance from the water; and (3) presence or absence of the invasive shrub *Amorpha fruticosa* (false indigo), a Class B noxious weed. Intended to create a new population, the remaining 650 plants were placed in four subpopulations across the island. In January 2012, a monitoring visit showed an average of 86 percent survival. About half of the losses were due to transplant shock while the other half were attributed to possible beaver activity (Brickner 2013, pers. comm.).

From the fall 2012 monitoring at the Rufus site, Brickners reproductive output data shows that this population may have produced over 200,000 viable seeds of *A. campestris* var. *wormskioldii*. The total transplant survival of the reintroduced population of plants at Rufus Island was 823 plants, or 39.36 percent. Eleven new seedlings were found on the site, but these were not included in the total survival figure. Of the three substrates tested, sand, compacted rock and loose rock; the transplants in the sand performed best in terms of survival after one year. Transplants in the compacted rock had similar survival rates as the sand in May 2012 but decreased significantly over the summer. This may be due to the higher elevation of this planting site. While only a meter or so higher than other sites, this may be significant in terms of available ground water for *A. campestris* var. *wormskioldii* plants. The loose rock substrate performed poorly from spring to fall, probably due to the nature of the substrate. Results from the distance from the water line transects indicate that transplants should be placed at least 9 m from the water line. Finally, there was no significant difference in survival between the presence or absence of *A. fruticosa*. Because *A. fruticosa* is a shrub, these two plants may occupy different areas of space and have low competition when planted together. However, due to its invasive nature and ability to grow in the same substrate as *A. campestris* var. *wormskioldii*, it may represent a threat should appropriate habitat for *A. campestris* var. *wormskioldii* become available. In May 2012, there was a significant amount of herbivory observed in some areas, indicating a potential threat to this population. Many inflorescences were observed eaten down to the base of the plant and some plants were completely uprooted and consumed, potentially by beaver or resident geese. The results from this planting study indicate that reintroduction is a feasible conservation tool for *A. campestris* var. *wormskioldii*. More detailed habitat data from this study may later aid in determining new planting locations (Brickner 2013, pers. comm.).

Summary of Threats :

Only two widely separated populations exist for *Artemisia campestris* var. *wormskioldii*. Direct loss of suitable habitat through regulation of water levels in the Columbia River and placement of riprap along the river bank has occurred at both the Klickitat and Grant County sites. Recreational use that results in trampling of plants is a threat at both sites. Competition with nonnative invasive species, including Class B noxious weeds at both locations, occurs and is a threat at both sites. Both sites have a small population size that makes them susceptible to genetic drift and inbreeding that could lead to poor seed production and low seed germination success (Richards 2000). The study by Brickner (2012) has shown that in habitat with the right conditions, and in a favorable year, this variety can produce robust amounts of seed.

At the Klickitat County site, erosion or deposition of sandy substrate is the primary threat to this variety. Recreational use at this site is not controlled or minimized through fencing or signage, and one heavy-use weekend could result in or severely trampled plants or could even extirpate this population. Invasion by nonnative plant species is a considerable threat to *A. campestris* var. *wormskioldii* at the Klickitat County population. A major threat to the Grant County population is the manipulated water levels in the Columbia River, either through control of the water level at the dams or from lack of water at critical periods during the year, usually in late summer and fall. This change in water levels would likely result in plant desiccation when the water table is below root level for extended periods. Alternately, high water events that require water releases from the dams may flood or inundate this population which could affect the ability of the variety to grow, flower, reproduce or expand into unoccupied habitat. High water events could also cause the existing population to become buried in debris or scoured by swiftly moving water.

We find that this species is warranted for listing throughout all of its range, and, therefore, find that it is

unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

A Spotlight Species Action Plan has been completed by the FWS (USFWS 2011) suggesting several actions for the species intended to move it toward recovery. The plan provides additional detail and recommends the following actions.

Klickitat County site:

- Control nonnative, invasive plant species.
- Discourage recreational use, possibly by constructing a fence around the population and informing the public of the presence of sensitive plants using signage.
- Investigate measures to reduce erosion and deposition of the sandy substrate.
- Augment population through seed collection and outplanting.
- Continue demographic monitoring through 2020, to be consistent with the monitoring for the Beverly, Grant Co. population.

Grant County site:

- Initiate dialog with PUD regarding future water control to aid reintroduction.
- Develop conservation easement with Bureau of Reclamation.
- Augment population through seed collection and outplanting.
- Continue demographic monitoring through 2020.

Priority Table

Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/Population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/Population	6
Moderate to Low	Imminent	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

Magnitude:

Only two widely separated populations exist for this variety. Because of the relatively small size of the populations and their small spatial distribution, a single disturbance, such as the spread of nonnative invasive plants or high recreational use, could eliminate one or both populations. Threat levels that may be considered moderate to low for a more widespread species likely represent higher threats to these small, disjunct, isolated populations.

Imminence :

High water flows, as occurred in 1996 and 1997, are random, naturally occurring events that may occur unpredictably and could inundate, uproot or bury plants. During years of low flows when soil water decreases, desiccation becomes a threat. There is ongoing human access for recreational purposes that threatens both populations due to the risk of trampling. Invasive nonnative plant species occur at both sites, threatening the variety by competing for space, light and nutrients. Therefore, threats to this variety continue to be imminent.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

Emergency Listing Review

No Is Emergency Listing Warranted?

Both populations are on Federal land and are being monitored. The Grant County population has been fenced to prevent human access. Although flooding is a threat to both populations, the separation of the two populations by intervening dams and reservoirs makes it unlikely that both would be entirely destroyed in the same flood event.

Description of Monitoring:

The Washington Natural Heritage Program monitors this variety at both sites. The Forest Service also monitors the Klickitat County population. The Grant County PUD also monitors the Beverly population. The FWS maintains contact with the responsible agencies and species experts and annually requests their reviews and updates to the candidate assessment forms during the revision process. Relevant literature and data for this variety are obtained principally from contacts with responsible agencies, species experts and their reports. Periodic literature searches for this variety are also ongoing. Because of the limited number of sites, and the few responsible agencies and species experts, this approach is the most effective for monitoring this species.

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

Oregon, Washington

Indicate which State(s) did not provide any information or comment:

none

State Coordination:

Numerous contributions to this assessment were provided either directly through personal communications, or through the dedicated work products of the WDNR and Oregon Department of Agriculture/Oregon State University botanists. *A. campestris* var. *wormskioldii* is listed as critically imperiled (S1) by the WNHP, but receives little protection as such under State law. The riparian and shrub steppe habitat surrounding the species is also considered a Priority Habitat under Washingtons Comprehensive Wildlife Conservation Strategy (WDFW 2005). This strategy is a non-regulatory statewide approach to conservation and describes general and specific problems facing wildlife species, but it does not include an assessment of plants.

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Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:



06/13/2013

Date

Concur:

A handwritten signature in blue ink, appearing to read "Dom Ales".

10/28/2013

Date

Did not concur:

Date

Director's Remarks: