

***Astragalus applegatei* (Applegate's Milk-vetch)
5-Year Review
Summary and Evaluation**



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**U.S. Fish and Wildlife Service
Klamath Falls Fish and Wildlife Office
Klamath Falls, Oregon**

January 2009

5-YEAR REVIEW

***Astragalus applegatei* (Applegate's Milk-vetch)**

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service or USFWS) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

I.A. Methodology used to complete the review:

This review was prepared by Trisha Roninger and Ron Larson with the Klamath Falls Fish and Wildlife Office (KFFWO), based on information contained in files. In addition, the KFFWO worked closely with The Nature Conservancy, the Oregon Natural Heritage Program and the Oregon Department of Agriculture to obtain current information on the status of the species.

I.B. Reviewers

Lead Region – Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, and Jenness McBride, Fish and Wildlife Biologist, Region 8, California and Nevada; (916) 414-6464.

Lead Field Office – Laurie Sada, Project Leader, Klamath Falls Fish and Wildlife Office; (541) 885-8481

I.C. Background

I.C.1 FR Notice citation announcing initiation of this review:

A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on February 14, 2007 (72 FR 7068). No information was received as a result of that announcement.

I.C.2. Listing history

Original Listing

FR notice: 58 FR 40551

Date listed: July 28, 1993

Entity listed: *Astragalus applegatei* (Applegate's milk-vetch), a plant species

Classification: Endangered

State Listing

Astragalus applegatei (Applegate's milk-vetch) was listed as endangered by the Oregon Department of Agriculture under the Oregon Endangered Species Act (ORS 564.100-564.135) and pursuant regulation (OAR 603, Division 73) on October 27, 1989.

I.C.3. Associated rulemakings: None

I.C.4 Review History

No 5-year review or other document containing a five-factor analysis has been initiated or completed since the species was listed on July 28, 1993.

I.C.5. Species' Recovery Priority Number at start of review

The recovery priority number for Applegate's milk-vetch is 5 according to the Service's 2006 Recovery Data Call for the Klamath Falls Fish and Wildlife Office, based on a 1 to 18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a monotypic species that faces a high degree of threat and has a low potential for recovery.

I.C.6. Recovery Plan or Outline

Name of Plan: Recovery Plan for the Applegate's Milk-vetch (*Astragalus applegatei*)

Date issued: April 10, 1998.

Previous revisions: None

II. REVIEW ANALYSIS

II.A. Application of the 1996 Distinct Population Segment (DPS) policy

II.A.1. Is the species under review listed as a DPS? No. The Endangered Species Act defines "species" as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition limits listing as DPS to only vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species' listing is not addressed further in this review.

II.B. Recovery Criteria

II.B.1. Does the species have a final, approved recovery plan? Yes.

II.B.2. Adequacy of recovery criteria.

II.B.2.a. Do the recovery criteria reflect the best available (i.e., most up-to-date) information on the biology of the species and its habitat?

No. The recovery criteria for the species are out of date. Three recovery areas are identified in the recovery plan for this species, which were the three known extant occurrences in 1998 when the recovery plan was finalized. Since the recovery plan was published, three new occurrences of Applegate's milk-vetch have been found. The recovery criteria state that in order to meet or achieve downlisting to threatened status, self-sustaining populations must be preserved at the three recovery areas known to exist in 1998. However, since three new occurrences have been discovered, the recovery criteria should be modified to include opportunities to achieve self-sustaining populations at the newly discovered sites.

II.B.2.b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and there is no new information to consider regarding existing or new threats)? Yes.

II.B.3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors* are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.

The Service has no evidence that Applegate's milk-vetch faces a significant threat from any other factor other than the continued destruction, modification or curtailment of its habitat or range, and loss of habitat through competition with non-native weeds (Factors A and E). Herbivory has been observed and documented by caterpillars, rabbits, and grazing by cattle. Pre-dispersal seed predation by insect larvae (most likely a beetle or weevil) has also been documented (Factor C). Herbivory by itself is likely not a major threat, but when coupled with other threats likely is retarding recovery. Further research must be done to quantify the effects of herbivory and predation by insects.

Recovery Objective: The objective of the following recovery criterion is to increase the stability of Applegate's milk-vetch to the point where it is no longer in danger of extinction (USFWS 1998), can be reclassified to threatened status and ultimately, recover

*A) Present or threatened destruction, modification or curtailment of its habitat or range;
B) Overutilization for commercial, recreational, scientific, or educational purposes;
C) Disease or predation;
D) Inadequacy of existing regulatory mechanisms;
E) Other natural or manmade factors affecting its continued existence.

to the point where it can be removed from the Endangered Species List. Due to lack of information on the taxon, delisting criteria were not included in the recovery plan.

Recovery Criteria: Applegate's milk-vetch will be considered for downlisting to threatened status when:

At least two natural and/or introduced self-sustaining populations are preserved in each of the three recovery areas (Ewauna Flat, Miller Island, and Worden), for a total of six or more populations in habitat permanently secured and managed for the benefit of the species. A minimum of 4,500 reproductive plants is needed for a recovery area to meet the downlisting threshold. Self-sustaining populations are defined as containing a minimum of 1,500 reproductive plants, plus sufficient individuals in younger age classes to suggest population stability or growth.

To date, only the Ewauna Flat Preserve occurrence and recovery area meets the definition of self-sustaining since its discovery and is secured and managed for the benefit of the species. However, this occurrence has only met the downlisting threshold of a minimum of 4,500 reproductive plants per recovery area in six of the last ten years and there is an overall decreasing trend at this site (Borgias and Sullivan 2007) meaning this site may not meet this criterion in the future.

The Miller Island and Worden recovery areas do not have sufficient numbers of plants to meet the recovery criteria listed above. The Miller Island occurrence is secure, however, the Worden occurrence is not.

Two additional occurrences have been discovered since the publication of the Recovery Plan that meet the criteria outlined above as reproductive, self-sustaining populations. However, these sites are not secured and managed for the benefit of the species and therefore do not meet the recovery criteria outlined above.

There has been no reduction in the magnitude of the threats to the species from habitat loss or modification. Agricultural and urban development continues to limit the amount of habitat currently available to the species. Currently, the Service does not have sufficient information to evaluate the threat of competitive exclusion from non-native plants or herbivory on the species. However, these threats may be significant, especially when considered cumulatively with the threat of habitat loss and modification.

II. C. Information on species and its status:

Since the 1993 listing and development of the recovery plan in 1998 for Applegate's milk-vetch, a considerable amount of new information has been obtained on the extent of the species in the Klamath Basin, the types of soils where Applegate's milk-vetch occurs, fire effects, and cultivation of the species. New information relevant to the status of Applegate's milk-vetch is summarized below.

Species biology and life history

Astragalus applegatei (Applegate's milk-vetch) is a slender, low-growing, vine-like herbaceous perennial in the Fabaceae (pea family). Plants have multiple sprawling stems 12 to 36 inches long and small white to light-pink to lavender flowers that are present from June to September. The Melissa blue butterfly (*Plebejus melissa*) is a specific known pollinator (58 FR 40548).

Fire Effects on Seed Germination

Despite ample production of viable seeds, very few Applegate's milk-vetch seedlings have been observed in native populations. Species in the Fabaceae family, including Applegate's milk-vetch, require scarification to the seed coats before the seed can germinate. In some species of this family, germination is enhanced by low-temperature ground fires (Gisler 2002b). In the fall of 2002, experiments were conducted to test whether or not Applegate's milk-vetch was one of these fire-dependant species. The study design included ten different treatments involving scarification, burning (including a light and heavy fuel burn), and burial. The unburned, pre-scarified control seeds, and the seeds that were both pre-scarified and protected from heat through burial, germinated normally, while the burned seeds experienced a negative effect on germination (Gisler 2002b). This study shows that Applegate's milk-vetch is not a fire-dependant species.

Distribution and Abundance (at time of listing and current)

Applegate's milk-vetch is a narrowly distributed endemic, known to occur only in southern Klamath County, Oregon, with currently occupied sites located within five miles of the City of Klamath Falls. Applegate's milk vetch was believed extinct until its rediscovery in 1983 (Yamamoto 1985).

This species is limited to a very specific soil regime resulting in a very specific habitat type. At one time, this species likely occupied many more areas in the Klamath Basin. However, agricultural and urban development have resulted in widespread depletion, fragmentation, and modification of Applegate's milk-vetch habitat. Although we are unsure if these current sites where the species occurs are genetically distinct, separate locations identified in this analysis are termed "sites" or "occurrences" (used interchangeably) that can be comprised of multiple patches or groups.

At the time of listing *Astragalus applegatei* was known from two extant sites and one historical site (58 FR 40548). These extant sites are currently identified as Miller Island and Ewauna Flat. At the time of listing Miller Island supported an estimated 30 to 80 plants while the Ewauna Flat site supported up to an estimated 30,000 plants. The historical occurrence identified in the listing was the Keno site. Herbarium records indicate this site was last found in 1931 and was located approximately two miles east of the town of Keno, Oregon. Since that time, efforts to relocate Applegate's milk-vetch in the Keno area have proven unsuccessful; widespread habitat conversion to fields and pastures likely extirpated the species in this portion of its historical range (USFWS 1998).

The 1998 Recovery Plan for Applegate's milk-vetch stated that the species was historically known from only four sites, with the species present at three of the four sites (USFWS 1998). The additional site discovered after the 1993 listing and described in the 1998 Recovery Plan is the Worden site. This site is the most southerly occurrence of Applegate's milk-vetch and is located on private land approximately three miles north of the California border in Klamath County, Oregon. In 1997, three plants were discovered at the site by the Oregon Department of Transportation (ODOT 1997).

In 2007, the Oregon Natural Heritage Information Center (ORNHIC) conducted surveys of selected known occurrences of Applegate's milk-vetch. These surveys attempted to relocate and provide a summary of the species' status for each inventoried site (ORNHIC 2007a) and helped form the basis of this review. No Applegate's milk-vetch plants were found in 2007 by ORNHIC (ORNHIC 2007a) at the Worden site and the site was thought to be extirpated. In 2008, USFWS and ORNHIC conducted a more extensive search of the Worden site and found 9 plants in a location north of the last known occurrence (USFWS 2008). No seedlings were observed at this site (USFWS 2008). The status of this occurrence is unknown, however, it is likely a remnant of a larger occurrence. See Appendix A for a map showing the location of this site. Table 1 shows a summary and status of all of the known sites in 1993, 1998, 2007 and 2008.

In 1998, the largest extant site known was the Ewauna Flat Preserve, located near Ewauna Lake at the southern edge of the city of Klamath Falls. See Appendix A for a map of the location of this site and Table 1 for a summary of site information. This site is owned and managed by The Nature Conservancy (TNC). TNC has monitored the Applegate's milk-vetch occurrence at Ewauna Flat since 1988. The earliest estimates for milk-vetch on the preserve documented the presence of 7,900 plants of all life stages (seedling, vegetative, or reproductive stages) (Borgias and Sullivan 2007), although the proportion of growth stages was not recorded at the site until 1994. Borgias and Sullivan (2007) report that the occurrence size varied between 1988 and 1991, and was estimated at nearly 30,000 individuals in 1991. The occurrence varied between 15,000 and 20,000 plants through 1994, and then declined substantially in 1995 (Borgias and Sullivan 2007). The estimated number of reproductive plants on the sampled portion of the preserve has ranged as low as 3,480 (90% confidence range = 1,867 to 5,093) in 2006 (Borgias and Sullivan 2007). Although the occurrence has decreased since 1998, this site currently meets the definition of a self-sustaining population according to the 1998 recovery plan criteria, with the estimated number of reproductive plants annually exceeding the 1,500 plant threshold, and with vegetative plants and seedlings present to contribute to population stability and growth. Almost 1,300 reproductive plants were counted in the 2007 partial census (Borgias and Sullivan 2007). In 2008, 768 plants in all life stages were counted outside of the macroplot and an estimated 10 percent of the plants were non-flowering, meaning approximately 691 plants were reproductive (Perchemlides, pers. comm. 2008). Therefore, the total number of reproductive plants for entire Ewauna Flat Preserve is approximately 1,990 plants in 2008 (Perchemlides, pers. comm. 2008).

Table 1. Summary of Site Information at the Time of Listing, Publication of the Recovery Plan, and Present						
Site Name	Number of Plants known during Listing (1993)	Number of Plants known during 1998 Recovery Plan	2007 surveys	2008 surveys	Current Status	Ownership
Ewauna Flat Preserve	Up to 30,000 plants	Approximately 11,500 plants	Partial survey – see 2008	Total for 2007 and 2008 = 2197 plants (estimated)	Declining	The Nature Conservancy
Miller Island	30 to 80 plants	Fewer than 500 plants	38 plants	112 plants	Unknown	State of Oregon
Keno	Historical (extirpated)	Historical (extirpated)	Historical (extirpated)	Historical (extirpated)	Historical (extirpated)	Private (extirpated)
Worden	Undiscovered	3 plants	Extirpated	9 plants	Unknown	Private
Collins Tract	Undiscovered	Undiscovered	Thousands of plants (area not counted)	10,143 plants	Unknown	Private
Klamath Falls Airport	Undiscovered	Undiscovered	Approx. 1000 plants (area not completely surveyed)	21,049 plants	Unknown	City of Klamath Falls
Washburn Way-railroad	Undiscovered	Undiscovered	Approx. 100 plants	307 plants	Unknown	Private
Klamath Falls Population	Believed to have been extirpated	13 plants found in 1994	Extirpated – site developed	Extirpated – site developed	Extirpated	Private (extirpated)

Although the Ewauna Flat Preserve occurrence has met the definition of self-sustaining since its discovery, the site has only met the downlisting threshold of a minimum of 4,500 reproductive plants per recovery area in six of the last ten years (Borgias and Sullivan 2007). The total number of plants in all life stages is approximately 2,197 plants in 2008 (Perchemlides, pers. comm. 2008). The overall declining trend suggests that the threshold set by the recovery criteria may not be achieved in the near future and viability could then decline more rapidly.

The Klamath Falls Population site shown on the map in Appendix A and in Table 1 was first discovered in 1983 on private land. Collectively, approximately 100 plants were documented at these sites (ORNHIC 2007b). By 1992, the site was developed by several businesses and was believed to be extirpated. In 1994, 13 plants were discovered across the street from the development, but in 2007, this site has been developed as well (ORNHIC 2007b) and is considered extirpated. In 1998, this site was lumped with the Ewauna Flat site in the Recovery Plan.

The second extant site described in the 1993 final rule and the 1998 recovery plan is Miller Island. This site is located at the Klamath Wildlife Area in Klamath County, Oregon, and is owned by the State of Oregon and managed by the Oregon Department of Fish and Wildlife. See Appendix A for a map of the location of this site and Table 1 for a summary of site information. This site includes four small patches of plants (USFWS 1998) each about 0.5 mile apart from the others. This site was originally discovered after the plants were accidentally burned in the early 1990's (Gisler 2002b). In 1995 and 1996, observations of one patch documented approximately 500 plants (ORNHIC 2007b). In 1998, a survey of the entire site was conducted by Oregon Department of Agriculture (ODA). This survey relocated all four known patches of plants; however, the report did not indicate how many plants were found and no new Applegate's milk-vetch sites were discovered during that survey. Surveyors did note a relative abundance of what appeared to be suitable habitat, although these areas supported weeds (Gisler 1998). These potential habitat areas identified in 1998 constituted a promising locality for establishment of reserves and future outplanting sites.

In 2007, ORNHIC revisited the four sites at Miller Island as part of the effort to update the status of the species. One of the four sites was overtaken with dense, weedy shrubs and is assumed to no longer be suitable habitat as no milk-vetch plants were found. Another site, which supported approximately 500 plants in 1995 and 1996, now has only one plant. The third site surveyed in 2007 had 22 plants in fruit and flower and ORNHIC counted 13 plants in fruit and flower at the fourth site (ORNHIC 2007a). Two plants were also located in 2007 at a site where transplanting occurred in 1999 (ORNHIC 2007a). In 2008, ORNHIC and USFWS conducted a more extensive search of the 2007 sites with 22 and 13 plants and discovered 101 plants at one site and 11 plants at the other (USFWS 2008). Seedlings were observed at the site with 101 plants, but not at the other site (USFWS 2008).

Because there have been no attempts to count specific numbers of plants prior to 2007 and 2008, the status of the Miller Island sites are unknown. However, there is documentation of competition with invasive plant species and herbivory. The small number of plants documented at the site in 2007 and 2008 and the lack of seedling recruitment at one of the two sites indicates that it is unlikely that this occurrence will increase in numbers even with active management.

Therefore, it is also unlikely that the recovery criteria for a viable population will be met at this site.

Since the publication of the recovery plan in 1998, there have been numerous cooperative efforts made by ODA, ORNHIC, TNC, the Service, and private landowners to conduct inventories for Applegate's milk-vetch throughout most of its historical range. Inventorying for undiscovered sites is one of the primary recovery actions identified in the Recovery Plan. In 1999, predictive modeling for potential Applegate's milk-vetch sites was done by TNC. This modeling was based on soil types and suitable land use, namely the lack of land conversion and/or lack of hydrologic alteration (TNC 1999). All of the high potential sites identified by the model were surveyed in 1999 by TNC and no new occurrences were discovered. Almost all of the twenty sites identified as potential sites had been altered to some degree (i.e., developed, plowed, irrigated, etc.) and no longer contained native vegetation, and therefore were unlikely to support Applegate's milk-vetch (TNC 1999). Although the modeling failed to produce discoveries of new sites, three additional sites have been discovered since the 1998 Recovery Plan was published and are described below.

The first site discovered since 1998 is identified as the Collins Tract. See Appendix A for a map of the location of this site and Table 1 for a summary of site information. The site is privately owned by the Collins Company and is currently leased for grazing. Applegate's milk-vetch was first observed on this site on July 11, 2002, by PacifiCorp biologists as part of their sensitive species surveys conducted for the Federal Energy Regulatory Commission's re-licensing of the Klamath Hydroelectric Project. In 2002, 50 to 60 plants were observed (PacificCorp 2004), but the survey was limited to a corridor approximately 250 feet wide along the Klamath River. The Collins tract was revisited on June 20, 2007. During this visit, the property was surveyed and the entire site was mapped by ORNHIC. Thousands of plants were observed (ORNHIC 2007b) in two areas each several acres in size. Neither an accurate count nor a record the life stages present was documented during this survey. In 2008, a large effort to count all of the plants on the site was done and 10,143 plants in all life stages were documented (USFWS 2008). Seedlings were also observed in many of the patches within the occurrence (USFWS 2008). Population trend information for this site is unknown because there has been no baseline information prior to 2008. This site is currently grazed by cattle and has been grazed by cattle and horses annually since the mid-1980's (DeVore, pers. comm. 2007). The owners have no future development plans for this site (DeVore, pers. comm. 2007) and are currently working with the Service to develop a conservation agreement for the management of the site.

The second site discovered since 1998 is the located at the Klamath Falls Airport. This site is owned by the City of Klamath Falls. See Appendix A for a map of the location of this site and Table 1 for a summary of site information. Three patches of Applegate's milk-vetch were discovered on May 30, 2007. The first patch contained a minimum of 100 individuals, the second patch contained approximately 10 individuals, and the third contained approximately four individuals (Storey, 2007). A second visit to the site on July 13, 2007, resulted in the discovery of another large milk-vetch patch of approximately 1,000 plants located in the northeast portion of the airport property (Larson, pers. obs. 2007). In 2008, a comprehensive survey was done of the property and 21,049 plants were discovered (USFWS 2008). Some seedlings were observed, but were limited in distribution (USFWS 2008). Most of this site is currently mowed to

minimize debris on the runways. The status of this site is unknown because there has been no baseline information for this site prior to 2008. The Klamath Falls Airport is planning to expand and would like to develop part of the area where the largest numbers of individual of Applegate's milk-vetch plants are currently found. The airport, Oregon Department of Agriculture, and the Service are working together to identify measures to minimize and compensate for any future impacts to Applegate's milk-vetch.

The Washburn Way-Railroad track site is the third site discovered since 1998. The site is small, approximately 0.25 acre in size, and is privately owned. See Appendix A for a map of the location of this site and Table 1 for a summary of site information. Approximately 100 plants are estimated to occur at this site based upon a June 22, 2007, survey by ORNHIC. These plants were observed in flower and appeared to be vigorous (ORNHIC 2007a). No attempt was made to get an accurate count or record the life stages of the plants. In 2008, Service personnel visited the site and a comprehensive count located 307 individual plants, with many seedlings observed (USFWS 2008). There are no population trend data for this site. This site is likely a remnant of larger historic occurrence, but areas around this are now developed. This site is very small and there may be too few plants to sustain a viable population in the future.

In 1998, surveys were conducted by ODA at Lower Klamath National Wildlife Refuge, managed by the Service and located in Siskiyou County, California, and Klamath County, Oregon. This area is near the Worden site, and was selected for this project due to the public ownership, close proximity to extant occurrences, and the abundance of contiguous, undisturbed habitat (Gisler 1998). No occurrences of Applegate's milk-vetch were documented as a result of these surveys and very little suitable habitat was identified that matched the character of the extant Applegate's milk-vetch sites (Gisler 1998).

Summary of Distribution and Abundance

Astragalus applegatei (Applegate's milk-vetch) was known at the time of listing from two extant occurrences that supported about 30,100 plants and two historical occurrences. Applegate's milk-vetch is currently known to be extant at three large occurrences, Ewauna Flats Preserve, Collins Tract, and the Klamath Falls Airport, and three smaller ones at Washburn Way-Railroad, Miller Island, and Worden. Collectively, these sites support approximately 33,000 individuals. There are additionally two historical occurrences. See Appendix A for a map of the locations of the described sites. The addition of several extant occurrences to those known in the listing rule should not be interpreted as the species is increasing in abundance, but rather, additional occurrences have been detected since the listing. Currently, only the Ewauna Flat Preserve and Miller Island occurrences are managed and secured for the benefit of the species. The Service is working with the owners of the Klamath Falls Airport and Collins sites to develop conservation agreements, but this process is not complete.

Seed Collection, Propagation, Cultivation and Outplanting

One way to mitigate decline in native plants, and offset their genetic losses, is to develop new populations, or augment existing populations by planting individuals propagated in greenhouses or field plots (Gisler and Meinke 2001). Seed collection and propagation of Applegate's milk-

vetch is an action identified in the Recovery Plan. In 1999, the Service contracted ODA to attempt to cultivate and outplant Applegate's milk-vetch. However, attempts to cultivate the species were not successful (Gisler and Meinke 2001).

Following the initial trials, ODA conducted studies to determine if Applegate's milk-vetch is dependent on a soil symbiont for growth. The results of these studies clearly showed that Applegate's milk-vetch grew best when the potting media was inoculated with field soil (Gisler and Meinke 2001) collected from the immediate vicinity of natural occurrences of Applegate's milk-vetch. Experiments were also conducted by ODA to determine if commercially-produced vesicular-arbuscular mycorrhizae (VAM), a soil fungus, and *Rhizobium* bacteria could further enhance Applegate's milk-vetch cultivation versus cultivating seeds in field soil alone. Plants grown in field soil alone were more vigorous than plants treated with VAM, *Rhizobium*, or the two in combination, suggesting that Applegate's milk-vetch likely requires specific species or strains of symbionts occurring in native soils (Gisler and Meinke 2001).

Following successful soil symbiont studies and milk-vetch cultivation, ODA began efforts to augment the existing Applegate's milk-vetch population. Applegate's milk-vetch plants were grown in a greenhouse from seeds collected at KWA and Ewauna Flat. Transplanting at KWA in November 1996, November 1997, and April 1998 was conducted in both fall and spring to help identify the optimal timing (Gisler and Meinke 2001) and 250 plants were transplanted over the three seasons. Direct seeding efforts were also made with 800 seeds in the spring and fall of 1997, using both scarification and burial treatments. All plots were monitored for a 2-year period at regular intervals (Gisler and Meinke 2001). Only four of the original 100 plants placed in November 1996 survived after three years and only five of the original 100 plants placed in November 1997 survived after two years (Gisler and Meinke 2001). There was no survival of the 50 plants placed in April 1998 (Gisler and Meinke 2001). Also, there was no evidence of reproduction among the surviving plants (Gisler and Meinke 2001). Results of direct seeding were unsuccessful with no seedling emergence and establishment regardless of treatment (Gisler and Meinke 2001).

Efforts to establish new Applegate's milk-vetch occurrences at Miller Island were carried out at several locations in November 1998, April 1999, and November 1999. A total of 1,236 plants were out-planted over the three seasons. Among the 236 plants placed in November 1998, 19 were alive after two years, 12 of which produced both flowers and pods (Gisler and Meinke 2001). None of the plants placed in April 1999 survived after the first year. Among the 888 transplants placed in November 1999, 342 plants survived after one year and 99 of them were reproductive with flowers and pods (Gisler and Meinke 2001). In 2007, ORNHIC surveyed these sites and found two plants (ORNHIC 2007a). ORNHIC noted in their report of this survey that the area is dominated by non-native intermediate wheatgrass. They also observed a lot of rabbit pellets.

An additional attempt was made to augment the occurrence at Miller Island in 2002. One hundred-seventy transplants were brought to Miller Island and monitored four and six months after transplanting. There was a 53 percent transplant survival after four months and 26 percent survival after six months (Gisler, 2002a). In 2007, ORNHIC relocated these sites, but no Applegate's milk-vetch plants were seen (ORNHIC 2007a).

Seed collection began in 1984 after the plant's rediscovery in 1983. The first seeds collected came from the Ewauna Flat site. The seeds were sent to the Berry Botanical Garden in Portland, Oregon, for long-term storage (Gisler 2002a). Seeds were collected and banked again from this site in 1986 and 2000. Additionally, seeds were collected and banked from Miller Island in 2000. Seed collection and banking continued in 2002 with seeds collected from the Washburn Way-Railroad site. No seeds have been banked yet from the Collins Tract or the Klamath Falls Airport occurrences. Viability tests were conducted by Berry Botanical Garden in 1998 on the seeds collected in 1984. The study revealed that 60 percent of the seeds tested germinated after 14 years of storage (Guerrant, pers. comm. 2007).

Habitat Description

Vegetative Community

The vegetative community in which Applegate's milk-vetch sites occurs is classified as interior alkali grassland (TNC 1999). Most of the habitat for this natural community has been converted to agriculture or pasture, and developed or disturbed such that the existing sites are now dominated by non-native, weedy species. The two most frequent native species which occur on all milk-vetch sites are species of rabbitbrush (*Ericameria nauseosus* and *E. viscidiflorus*). Other native species that occur on at least half of the milk-vetch sites include *Sarcobatus vermiculatus* (greasewood), *Elymus elymoides* (bottlebrush squirreltail), *Epilobium brachycarpum* (autumn willowweed), *Distichlis stricta* (saltgrass), *Achillea millefolium* (yarrow), and *Juncus balticus* (Baltic rush) (TNC 1999). Weedy species associated with the endangered species include *Elitrigia* or *Elytrigia repens* (creeping quackgrass), *Lactuca serriola* (prickly lettuce), *Apera interrupta* (dense silkybent), *Bromus secalinus* (rye brome), *Bromus tectorum* (cheatgrass), *Elitrigia* or *Elytrigia intermedia* (intermediate wheatgrass) (TNC 1999), *Cirsium* spp. (thistles) and many others. *Hordeum murinum* (mouse barley) has also been documented at the Collins site (USFWS 2008).

Elitrigia or *Elytrigia repens* (creeping quackgrass) is an invasive, non-native rhizomatous grass that can transform previously open prairie into a dense, monospecific meadow. It is of particular concern because it forms very thick layers of thatch, making it nearly impossible for seedling to germinate and penetrate the layer of thatch. In 1996 and 1997, TNC conducted a series of experiments at Ewauna Flat Preserve to try to control quackgrass. The experiments included mowing, burning, and herbicide applications of Fluazifop, Sethoxydim, and Glyphosate alone or in combination. Herbicides and type of disturbance were both significant in *Elytrigia repens* chlorosis 30 days post treatment (Borgias et al. 2000). The study found that Fluazifop significantly reduced *Elytrigia repens* cover when combined with burning, and TNC is planning to implement an adaptive management program with control efforts focused primarily on the use of burning and Fluazifop under carefully controlled experimental conditions (Borgias et al. 2000). Attempts to control non-native species like creeping quackgrass, support recovery actions identified in the Recovery Plan.

Creeping quack grass is present at Ewauna Flat, Miller Island and Washburn Way-Railroad. Additionally, intermediate wheatgrass dominates the Miller Island site (ORNHIC 2007a) and

Klamath Falls Airport site (USFWS 2008). Although there are quite a few non-native plants at the Airport, especially in areas disturbed by construction, most of the Applegate's milk-vetch sites did not have high densities of weeds, likely due to mowing, high soil salinity and a lack of moisture for much of the growing season (USFWS 2008).

Soils

Soils in typical Applegate's milk-vetch habitats are characterized as being gray in color, slightly alkaline, with a shallow water table and groundwater with a relatively high salinity due to periodic flooding and evaporation (TNC 1999). The soils on these sites belong to the Henley, Laki, and Poe series with inclusions in the Calimus series, and are very deep, coarse-loamy, mixed superlative, mesic Haplic Durixeroll (TNC 1999). A weakly developed duripan at 127 to 254 inches is usually present and accounts for the pooled surface water during the spring at most sites (TNC 1999). Little is known about the alkalinity tolerance of this species or to what degree edaphic specialization may have historically helped it to compete against other less alkaline-tolerant plants. However, most sites have some evidence of salts at the surface, suggesting the plant is tolerant to some degree of increased alkalinity or salinity. Plants are not found where salt encrustations are most developed, but in the vicinity of these encrustations (TNC 1999).

II.D Five Factor Analysis (threats, conservation measures and regulatory mechanisms)

II.D.1 Factor A: Present or threatened destruction, modification or curtailment of its habitat or range

In the final listing rule (58 FR 40549), highway construction, commercial development, and lack of seasonal flooding were listed as threats to this species attributable to this factor.

Most of the known sites of Applegate's milk-vetch occur within the historical floodplain of the Klamath River that was affected by seasonal flooding from the river. Most of these sites still do experience some local flooding in the late winter and spring. Seasonal flooding may provide openings for the establishment of Applegate's milk-vetch and limit the dominance of other species (Yamamoto 1985). The final rule states that irrigation and water control along the Klamath River have eliminated the seasonal flooding that once occurred along floodplains supporting the species. While some adverse affects cannot be ruled out from this hydrologic alteration, declines appear to be mostly due to other factors. The current water management system has been in place for many decades and the species has persisted. Further studies are needed to quantify possible effects.

Agricultural and urban development has resulted in widespread depletion, fragmentation, and modification of Applegate's milk-vetch habitat, to the extent that even small (an acre or less) parcels of truly undisturbed habitat are uncommon (USFWS 1998). Habitat is very limited for Applegate's milk-vetch. Currently, Applegate's milk-vetch is extant at six sites around the City of Klamath Falls, Oregon. It is considered to be

extirpated at another two sites. Two of the sites occur on State-protected lands (the Miller Island and Klamath Falls Airport sites); all of the other sites occur on private land.

Habitat loss and modification from both urban and commercial development and expansion are still the most significant threats to the species within its historic range. We do not anticipate any reduction in threats associated with development because the human population in the Klamath Falls area is growing. The estimated population growth for Klamath Falls from 2000 to 2005 was 2.2 percent (see <http://www.citytowninfo.com/places/oregon/klamath-falls>, accessed for this review on October 4, 2007). Although this population growth rate is not as high as other areas in the United States, an increasing growth rate does show that opportunities for additional discoveries of new occurrences of Applegate's milk-vetch may be limited in the future as development continues.

At the Klamath Falls Airport, there are plans to expand and develop the area where the largest occurrence of Applegate's milk-vetch is currently found. The airport is currently filling in wetlands around the perimeter of the property to reduce bird collisions with the air traffic where milk-vetch occurs. Additionally, the airport has plans to expand runways, build more hangars, and is looking to alter areas to provide better drainage along runways. The airport, Oregon Department of Agriculture, and the Service are working together to identify measures to minimize and compensate for any future impacts to Applegate's milk-vetch at the airport.

The Service is also currently exploring conservation agreement opportunities with the Collins Company to protect the Collin Tract occurrence on private land. The Collins Company has no future plans for the area other than its present use for cattle grazing (DeVore, pers. comm. 2007), but without a conservation agreement the Service has no assurance that develop of the site won't occur.

The Ewauna Flat site is owned by TNC and is managed for the benefit of the species. However, this site is located in area where the City of Klamath Falls has plans to build a north-south bi-pass street for traffic through town. Areas along this proposed street are likely to be developed in the long-term and could affect the site.

II.D.2 Factor B: Overutilization for commercial, recreational, scientific, or educational purposes.

In the final rule listing rule (58 FR 40549), the Service identified illegal collection for scientific or horticultural purposes and excessive visits by individuals interested in seeing rare plants as a potential threat to the species. We have no evidence to document overutilization of this species and we do not consider this to be a significant threat at this time.

II.D.3 Factor C: Disease or predation.

In the final listing rule (58 FR 40549), disease was not discussed as a threat but the

Service identified rabbit predation as one of the major obstacles to the survival of Applegate's milk-vetch. Since listing, herbivory by rabbits (ORNHIC 2007a and 2007b), insects, cattle, and horses has been documented to occur on this plant.

All of the information concerning herbivory on Applegate's milk-vetch plants has been anecdotal. There have been no comprehensive studies to quantify the effects of herbivory on Applegate's milk-vetch. In the 1993 listing rule, the Service identified rabbit predation as one of the major obstacles to the survival of Applegate's milk-vetch. In 1991 and 1992, ORNHIC (2007b) noted that the Miller Island population was struggling due to rabbit grazing. In 2007, ORNHIC reported observations of jack rabbit pellets at several Applegate's milk-vetch sites at Miller Island (ORNHIC 2007a). Jack rabbits are plentiful at the Klamath Falls Airport site as well (Hancock, pers. comm. 2007). The Melissa blue butterfly (*Plebejus melissa*) is a small butterfly commonly seen around Applegate's milk-vetch plants. Herbivory from insects includes the larvae of the Melissa blue butterfly. The Melissa blue butterfly is a specific pollinator of Applegate's milk-vetch plants (58 FR 40549). This butterfly not only feeds on the nectar from milk-vetch flowers and pollinates the plant, but also lays its eggs on various members of the pea family, including Applegate's milk-vetch. As larvae or caterpillars grow, they eat the young leaves of the host plant and are tended by ants who feed on the caterpillar's sugary secretions (see database on North American species at <http://www.butterfliesandmoths.org>, accessed for this review on September 19, 2007). The larvae of the Melissa blue butterfly have been observed defoliating Applegate's milk-vetch plants and chewing through large plant stems near their bases (Gisler and Meinke 2001). In the 1998 Recovery Plan, the Service noted as many as seven caterpillars have been collected from a single Applegate's milk-vetch individual, with plants commonly suffering complete defoliation. Further studies are needed to understand this complex relationship between Applegate's milk-vetch and the Melissa blue butterfly.

As a result of seed collection efforts, Oregon Department of Agriculture reported that the reduced seed output of Applegate's milk-vetch in 2002 appeared to be caused by pre-dispersal seed predation by insects. Most seed pods showed damage by insects and the seed collection bags were littered with the bodies of seed weevils and beetles (Gisler 2002a). Seed predation studies indicate per-plant losses of nearly 30 percent and the significance of even low levels of seed predation is enhanced by the already limited number of seeds produced by the species (USFWS 1998). Applegate's milk-vetch plants have eight to ten ovules per pod that can mature into seeds; however, it is rare that more than three do so (USFWS 1998). Limited seed production coupled with seed predation may be significantly affecting the reproductive opportunities of Applegate's milk-vetch occurrences but additional studies are needed to determine population-level effects.

The palatability of Applegate's milk-vetch to cattle was another concern identified by the Service in 1993 final rule. It was unknown at that time if cattle avoided this species. Some milk-vetch species, called "loco weeds," accumulate selenium and can be toxic to cattle; however, Applegate's milk-vetch is not one of these. Cattle are currently grazed at the Collins site and it has been documented that cattle do consume this species. At the

Collins Tact site, the species grows best under a cover of woody shrubs, such as rabbitbrush (*Ericameria nauseosus* and *E. viscidiflorus*), where it appears that it is protected from grazing. However, older photographs of this site suggest that grazing was employed in the late 1920's and grazing has been documented annually by horses and cattle at the site since the mid-1980's (DeVore, pers. comm. 2007). No information was provided on how many cows or horses currently or historically grazed this site. Although Applegate's milk-vetch was not discovered on this site until 2002, it appears that it has persisted despite of the long use of this site for grazing. However, it is unknown if this species would benefit from a reduction in this activity.

In summary, herbivory is not likely a major threat to the species, but when combined with the limited distribution and population size of Applegate's milk-vetch, habitat loss or modification due to herbivory and seed predation on this species could have a negative impact on its reproductive output and therefore recovery. Further studies are needed to quantify population-level effects.

II.D.4 Factor D. Inadequacy of existing regulatory mechanisms.

State Protections

Oregon Department of Agriculture listed *Astragalus applegatei* as "endangered" under the Oregon Endangered Species Act (ORS 564.100-564.135) and pursuant regulation (OAR 603, Division 73) on October 27, 1989. This prohibits the "take" of State-listed plants on non-Federal public lands, and on State-owned and State-leased lands only. The statute does not apply to private lands. Only plants occurring at the Klamath Wildlife Area and Klamath Falls Airport are protected by this Act. Although the airport does have plans to expand and could potentially impact the plant, according OAR 603, the airport must consult with ODA and analyze the impacts to the listed plant. If the proposed action has the potential to appreciably reduce the likelihood of survival or recovery of the species, ODA will recommend modifications or alternatives to the action and require mitigations and enhancement measures to minimize the adverse effect. The airport, ODA, and the Service are seeking ways to compensate for any future impacts to Applegate's milk-vetch at the airport.

Federal Protections - Clean Water Act

Under section 404, the U.S. Army Corps of Engineers (Corps) regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term "wetland" refers to areas meeting the Corps' criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the Clean Water Act, National Environmental Protection Act, and the Endangered Species Act. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts.

The Corps interprets “the waters of the United States” expansively to include not only traditional navigable waters and wetlands, but also other defined waters that are adjacent or hydrologically connected to traditional navigable waters. However, recent Supreme Court rulings have called into question this definition. On June 19, 2006, the U.S. Supreme Court vacated two district court judgments that upheld this interpretation as it applied to two cases involving “isolated” wetlands. Currently, Corps regulatory oversight of such wetlands (e.g., vernal pools) is in doubt because of their “isolated” nature. In response to the Supreme Court decision, the Corps and the U.S. Environmental Protection Agency (USEPA) have recently released a memorandum providing guidelines for determining jurisdiction under the Clean Water Act. The guidelines provide for a case-by-case determination of a “significant nexus” standard that may protect some, but not all, isolated wetland habitat (USEPA and USACE 2007). The overall effect of the new permit guidelines on loss of isolated wetlands is not known at this time.

The final listing rule states that some of the habitat occupied by Applegate’s milk-vetch may be regulated under section 404 of the Clean Water Act by the U.S. Army Corp of Engineers. The final rule provided an analysis of the protection of the species under this Act stating that individual or nationwide permits may not be issued where a federally listed endangered or threatened species would be affected by a proposed project without first completing a formal consultation pursuant to section 7 of the endangered Species Act. However, in light of the recent Supreme Court ruling, the resulting protections, and the presence of the species in “isolated wetlands”, the Service is uncertain if the Clean Water Act adequately protects this species.

Other Protections

The Collins Tract and Washburn Way-Railroad sites of Applegate’s milk-vetch occur on private land and there are no regulatory mechanisms to protect the species at these sites. However, the Service is exploring voluntary conservation agreement opportunities with the Collins Company to protect the plant.

One additional occurrence on private land, Ewauna Flat Preserve, is owned by The Nature Conservancy. This site is managed specifically for the benefit of the species even though there are no regulations that protect the plants at this site.

II.D.5 Factor E: Other natural or manmade factors affecting its continued existence.

Applegate’s milk-vetch habitat is not only being lost through physical landscape changes, but also by displacement through competitive exclusion from introduced weeds. Habitat colonization by non-natives could indirectly limit Applegate’s milk-vetch by increasing input of plant litter and nitrogen fixation by introduced legumes, and creating conditions favorable to secondary succession by shrubs and other herbaceous species historically restricted by harsh, bare soils (USFWS 1998). Likewise, habitat colonization by weeds, especially thatch-forming grasses, could promote greater densities of voles and other

potential plant herbivores and granivores through increased cover and protection from predators (USFWS 1998). This threat was not identified or analyzed in the final rule, but was identified in the recovery plan for the species. Thatch-forming grasses are also problematic for this species because it's difficult for seedlings to germinate and penetrate the thatch layer.

All of the extant occurrences of Applegate's milk-vetch have some non-native weeds present. *Elitrigia* or *Elytrigia repens* (creeping quackgrass), *Lactuca serriola* (prickly lettuce) and *Apera interrupta* (dense silkybent) are just a few of the weed species found at Applegate's milk-vetch sites. Creeping quackgrass is present at the Ewauna Flat Preserve, Miller Island and Washburn Way-Railroad sites. The Miller Island and Klamath Falls Airport sites are mostly dominated by planted *Thinopyrum intermedium* (intermediate wheatgrass) (ORNHIC 2007a). Non-native plants at the Klamath Falls Airport site include: *Agropyron cristatum* (crested wheatgrass), intermediate wheatgrass, *Poa bulbosa* (bulbous bluegrass) and *Holosteum umbellatum* (jagged chickweed) (ORNHIC 2007a), although these species do not occur in high densities. Low densities of weedy species have also been observed at the Collins Tract site, but of particular concern at this site is *Hordeum murinum* (mouse barley) and *Cirsium* spp. (thistles). Currently, we do not have sufficient information to evaluate the threat of competitive exclusion from non-native plants or herbivory on the species and further studies are needed to quantify population-level effects from competitive non-native plant species. However, these threats may be significant, especially when considered cumulatively with the threat of habitat loss and modification.

The final rule for Applegate's milk-vetch states that with the small number of occurrences, and small number of individual plants for each occurrence, there is an increased potential for extinction from stochastic events such as flood or fire. No floods have occurred at any of the Applegate's milk-vetch sites since the final rule was published in 1993. Part of the Miller Island site was found during an investigation of an accidental fire at the site (Gisler 2002b). On September 2, 1998, a human-caused grass fire occurred near the Ewauna Flat site. Klamath Falls Fish and Wildlife Office staff were on site to insure that fire personnel knew where the endangered plants were located and to assist with the development of suppression tactics to minimize impacts to the species (Laye, pers. comm. 2007). The fire crews successfully stopped the spread of the fire before it reached the portion of the site that supports this species (Laye, pers. comm. 2007).

Additionally, the final rule states that the limited gene pool may depress reproductive vigor or a single human-caused or natural environmental disturbance could destroy many of the individuals of this species. There is no information available about the genetic diversity of the few occurrences of this species.

Another necessary recovery action identified in the Recovery Plan (USFWS 1998) is seed banking. To date, seeds are banked at the Berry Botanical Garden in Portland, Oregon, from the Ewauna Flat, Washburn Way-Railroad and Miller Island occurrences only. No seeds have been banked from the Collins Tract or the Klamath Falls Airport occurrences.

More seed collection and banking needs to be done to insure that the banked seeds represent the existing gene pool and that propagation efforts are conducted with seeds from diverse sources.

II.E Synthesis

Investigations of pre-settlement vegetation and soil surveys indicate that Applegate's milk-vetch was believed to be found throughout the Klamath Basin. Changes in land use as a result of agricultural and urban development have resulted in widespread depletion, fragmentation, and modification of Applegate's milk-vetch habitat. Additionally, Applegate's milk-vetch habitat is also being lost by displacement through competitive exclusion from introduced weeds. These changes to the physical landscape represent the most significant threat to the species. There have been no changes to measurably reduce this threat. The Service does not anticipate that threats from development will lessen in the future because the human population in the Klamath Falls area is growing and development of open space continues to occur to support this growth.

At the time of listing in 1993, Applegate's milk-vetch was known from two extant sites and had been extirpated from one historical site in Keno. At the time the recovery plan was published in 1998, there were three known extant occurrences of Applegate's milk-vetch at Ewauna Flat Preserve, Miller Island, and Worden and two extirpated sites (Keno and Klamath Falls).

The Worden site is privately owned and only 9 plants were located in 2008. This site is likely a remnant of a larger historic occurrence. The Miller Island site has approximately 100 plants and population trend data is unknown for the site. Low numbers at the site may be due to competition with weeds and herbivory but there is no available information to quantify this threat. Seedlings were observed at one of the two patches at this site in 2008 (USFWS 2008). Outplanting efforts have not been successful in increasing the occurrence abundance and distribution. The low number of plants at the site and the lack of success with supplementing the occurrence makes it unlikely that this occurrence can be increased. Therefore, it is unlikely that viable occurrence can be secured at either the Worden or Miller Island sites over the next ten years.

To achieve the recovery criteria for downlisting to threatened, two self-sustaining occurrences of 1,500 plants per site must be preserved at these three recovery areas and there needs to be a minimum of 4,500 reproductive plants per recovery area. These recovery criteria are outdated and do not reflect the discovery of three new sites since 1998 when the recovery plan was published. However, Ewauna Flat Preserve currently meets the definition of a self-sustaining population. TNC has monitored the occurrence at the Ewauna Flat site since 1988. The highest number of plants recorded at the site was 30,000 plants in 1991. Since 1991, there have been two major reductions in this occurrence that reduced the occurrence by approximately half. Overall trend data for the site show a declining population and the current numbers are around 2,000 plants in 2008. The occurrence at Ewauna Flat has only met target recovery criteria numbers of 4,500 reproductive plants in six of the last ten years. Past hydrologic alteration in concert with recent creeping quack grass colonization appears to be converting what was observed to be open alkali prairie in 1988 to a dense grass-covered meadow (Borgias and

Sullivan 2007). These changes are coincident with the decline in the occurrence in the monitored area (Borgias and Sullivan 2007).

Since the publication of the recovery plan in 1998, three additional Applegate's milk-vetch sites have been discovered. The first, Washburn Way-Railroad site, is less than 0.25 acre in size, privately owned, and has approximately 300 plants. This site is likely a remnant of larger historic occurrence, but areas around this are now developed. Given the small size and number of plants at this site, this site is not likely to support a viable population.

The second site, the Collins Tract, is privately owned. This site was surveyed comprehensively in 2008 and 10,143 plants were observed (USFWS 2008). No baseline information existed for this prior to 2008, so there are no population trend data for this site. This site is currently leased for cattle and horse grazing. Grazing first began in the mid-1980's and there have been no significant changes of use documented at this site since then. Although Applegate's milk-vetch was not discovered on this site until 2002, it is not unreasonable to assume that Applegate's milk-vetch has persisted on this site despite its use for grazing. The Collins Company has no plans for the site other than its current use (DeVore, pers. comm. 2007). The Service is exploring conservation agreement opportunities with the Collins Company to protect the plant.

The third site discovered since 1998 is the located at the Klamath Falls Airport which is owned by the City of Klamath Falls. A comprehensive survey was conducted in 2008 and 21,049 plants were observed (USFWS 2008). The airport is currently filling wetlands around the perimeter of the property where the milk-vetch occurs to reduce bird-air traffic collisions. Additionally, the airport has plans to expand and develop the area supporting the largest known occurrence of Applegate's milk-vetch is currently found. The airport, Oregon Department of Agriculture, and the Service are seeking ways to work together to identify measures to reduce future impacts to Applegate's milk-vetch.

The Collins Tract and Klamath Falls Airport have high enough numbers of Applegate's milk-vetch plants to meet the definition of a self-sustaining population according to the definition in the 1998 recovery plan. However, these locations are not specifically secured and managed for the benefit of the species, which is also a requirement of the downlisting criteria. Additionally, the Service does not have population trend data for these and other sites to know if the occurrences are stable or increasing in size, except at Ewauna Flat Preserve which has a declining population trend. The recovery criteria must be modified to include these occurrences as recovery areas.

There has been no reduction in the magnitude of the threats to the species from habitat loss or modification. Agricultural and urban development continues to limit the amount of habitat currently available to the species. Currently, the Service does not have sufficient information to evaluate the threat of competitive exclusion from non-native plants or herbivory on the species. However, these threats may be significant, especially when considered cumulatively with the threat of habitat loss and modification.

Given the general downward population trend at Ewauna Flat Preserve, the extirpation of the Klamath Falls site, the small number of plants at the Worden site, the lack of currently viable

occurrences at the Washburn Way-Railroad and Miller Island sites, the potential loss of individuals at the Klamath Airport due to future development, the limited information on threats to the species other than habitat modification, the unsuccessful attempt to propagate and outplant the species, and that only the Ewauna Flat Preserve and Miller Island sites are secured and managed for the benefit of the species, the Service concludes that this species should remain classified as endangered.

III. RESULTS

III.A. Recommended Classification:

Downlist to Threatened

Delist

No change is needed

III.B. New Recovery Priority Number 5

No change is recommended in the recovery priority number assigned to Applegate's milk-vetch. Based on the preceding analysis, Applegate's milk-vetch continues to face a high magnitude of threat primarily due to loss of habitat from urban and agricultural development and from competitive exclusion by non-native invasive weeds. Despite a relatively clear understanding of the threats to the species' existence, there is low potential of recovery because of the limited habitat currently available for the species and the lack of information about whether intensive management (e.g., weed control, outplanting) of the extant occurrences would successfully increase distribution and abundance of this species.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

Three recovery areas are identified in the recovery plan for this species (Miller Island, Ewauna Flat, and Worden occurrences), which were the three known extant occurrences in 1998 when the recovery plan was finalized. Since the recovery plan was published, three new occurrences of Applegate's milk-vetch have been found (Collins Tract, Klamath Falls Airport, and Washburn Way-Railroad occurrences). The recovery criteria need to be re-examined and modified to include opportunities to achieve self-sustaining occurrences and downlisting thresholds at the newly discovered sites. Additionally, a re-evaluation of recovery actions is necessary to determine if additional actions are needed in light of the discovery of new sites.

In 2008, a complete census was done for all of the sites where Applegate's milk-vetch occurs to establish a baseline at these sites to monitor future population trends. Monitoring of these sites needs to continue for the next 5 years to determine population trends.

The first recovery action item described in the recovery plan is to inventory for undiscovered occurrences. One future management action recommended by Borgias and Sullivan (2007) is to conduct a Geographic Information System (GIS) analysis of potential remaining and potentially restorable habitat. This study would utilize the results of soils analysis and soil survey work done by TNC in 1999, pre-settlement vegetation studies currently being done by J. Christy of the Oregon Natural Heritage Program, and current vegetative community information from sites

where Applegate's milk-vetch occurs, which still needs to be compiled. This GIS analysis would be used to identify potential restoration and establishment sites, survey for new occurrences of Applegate's milk-vetch, examine land use patterns and future land use plans, and to help identify areas where the Service could pursue opportunities to protect the species through conservation agreements or land acquisitions.

Another important recovery action listed in the recovery plan is to establish introduced Applegate's milk-vetch occurrences and augment known occurrences through cultivation and outplanting. Outplanting studies have been conducted with limited success. Research needs to continue to determine why these attempts have not been successful and attempts to continue to propagate and outplant the species should occur. Additionally, while seeds are collected for propagation studies, seed banking efforts should be continued. Seeds need to be collected from the Collins Tract and Klamath Falls Airport and sent to the Berry Botanical Garden in Portland for storage.

All of the information concerning herbivory and competitive non-native species effects on Applegate's milk-vetch plants has been anecdotal. There have been no comprehensive studies to quantify the effects of herbivory or competitive non-natives on Applegate's milk-vetch. Studies to quantify these effects are important to determine the magnitude of this threat to the species.

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Personal Communications and Observations

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Perchemlides, K. Ecologist, The Nature Conservancy, Medford, Oregon. Email correspondence with Trisha Roninger, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service, Klamath Falls, Oregon on September 18 and 19, 2008. Subject: history of Applegate's milk-vetch site data collection at Ewauna Flat Preserve and 2007 and 2008 data collection results.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW
Astragalus applegatei (Applegate's Milk-vetch)

Current Classification Endangered

Recommendation resulting from the 5-Year Review

Downlist to Threatened

Delist

No change is needed

Appropriate Listing/Reclassification Priority Number 5

Review Conducted By _____

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve James R. Sada Date 1/7/2009

REGIONAL OFFICE APPROVAL:

Lead Assistant Regional Director, Fish and Wildlife Service, Region 8

Approve Michelle Date 2-4-09