

## **5-Year Review: Summary and Evaluation**

**Sentry milk-vetch (*Astragalus cremnophylax* var. *cremnophylax*)**

**Current Classification:** Endangered

**U.S. Fish and Wildlife Service  
Arizona Ecological Services Field Office  
Phoenix, Arizona**

### **1.0 GENERAL INFORMATION**

#### **1.1 Reviewers:**

**Lead Regional or Headquarters Office:** Region 2 (Southwest Region)

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**Cooperating Field Offices:** Arizona Ecological Services Field Office, Phoenix

Contact: Steve L. Spangle, Field Supervisor, 602-242-0210

#### **1.2 Methodology used to complete the review:**

The U.S. Fish and Wildlife Service (FWS) conducts status reviews of species on the List of Endangered and Threatened Wildlife and Plants (50 CFR 17.12) as required by section 4(c)(2)(A) of the Endangered Species Act (Act) (16 U.S.C. 1531 *et seq.*). We provided notice of this status review via the Federal Register (72 FR 20134) requesting information on the status of the sentry milk-vetch (*Astragalus cremnophylax* var. *cremnophylax*). No comments from the public were received. This 5-year review was completed by the FWS lead biologist for the species, using the recently completed recovery plan (71 FR 56547) as the primary basis for this analysis, with updates from the most recent monitoring report on the species from Grand Canyon National Park (Busco 2008). The recovery plan was completed in 2006 and represents the most complete information on the status and threats to this species (USFWS 2006).

#### **1.3 FR Notice citation announcing initiation of this review: 72 FR 20134**

## 2.0 REVIEW ANALYSIS

### 2.1 Application of the 1996 Distinct Population Segment (DPS) Policy:

Sentry milk-vetch is a flowering plant so the DPS policy does not apply.

### 2.2 Review Summary:

Please refer to the 2006 Sentry Milk-vetch (*Astragalus cremnophylax* Barneby var. *cremnophylax* Barneby) Recovery Plan (71FR 56547), for a complete 5-factor analysis and a discussion on the species' status including biology and habitat, threats, and management efforts (USFWS 2006). Sentry milk-vetch was listed as endangered in 1990 (55 FR 50184) and currently has a recovery priority number of 6, denoting a subspecies with a high degree of threat and low recovery potential (48 FR 43098).

Sentry milk-vetch is a rare endemic plant known from only three locations on the South Rim of the Grand Canyon. All locations are within Grand Canyon National Park (GCNP) and are referred to as: Maricopa Point, Grandview, and Lollipop Point. Sentry milk-vetch is found where Kaibab limestone forms large flat platforms with shallow soils near pinyon-juniper woodlands. The species' habitat specificity, reduced number, vigor of plants, and small habitat size make it vulnerable to extinction. Given these conditions, the major threats to the species include limited number, distribution, and size of the populations; low reproduction; stochastic environmental or demographic events; and habitat destruction and modification.

The status of sentry milk-vetch has not changed significantly since the publication of the 2006 recovery plan. As of 2008, the total estimated population is 725 sentry milk-vetch plants on the South Rim of GCNP, with five to six plants known at Grandview, approximately 220 plants growing at Lollipop Point, and the remaining plants found at Maricopa Point. There are no new threats to the species. The Maricopa Point population did not continue to decline in 2007 and 2008, as it had in previous years, and some seedlings were recorded in 2008. The populations at Lollipop Point and Grandview remain stable.

The recovery criteria (see below) given in the 2006 Recovery Plan were developed to ensure population persistence. Recovery criteria address the primary threat of extinction due to small population size, coupled with decreasing population size, and low recruitment and seedling survivorship. If the recovery criteria are met, the primary threats to the species would be alleviated and recovery would be attained.

Downlisting criteria involve the provision of long-term protection for at least four viable sentry milk-vetch populations of at least 1,000 individuals each for a total of at least 4,000 individuals in the wild. Each natural population must be stable or increasing over a 10-year period. Each artificially established population must be stable or increasing over a 30-year period. Each population must be protected from threats in perpetuity.

Delisting criteria will be attained when there are eight viable sentry milk-vetch populations of 1,000 individuals each with long-term protection. Each natural population must be stable or increasing over a 10-year period and each artificially established population must be stable or increasing over a 30-year period. Each population must be protected from threats in perpetuity.

### **Five-factor analysis**

The five listing factors are briefly described below; a detailed five-factor analysis can be found in the 2006 recovery plan.

- A. *The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range:* The main population at Maricopa Point is protected by a fence that has been in place since 1990. This fence has greatly reduced the trampling associated with visitors hiking out to Maricopa Point. The populations at Grandview and Lollipop Point are not affected by trampling due to their locations away from developed trails. There are no additional threats to the populations under factor A.
- B. *Overutilization for Commercial, Recreational, Scientific, or Educational Purposes:* This factor is not relevant to this species. There have been no reports of collection for this species.
- C. *Disease and Predation:* Disease has not been a factor in the decline of this species. There have been some incidents of damage to plants from herbivores (rock squirrels and bighorn sheep are suspected), but the events have been sporadic, and the effects to the Maricopa population are not well understood. The GCNP biologists continue to monitor the situation and will provide additional protection for plants if the problems persist.
- D. *Inadequacy of Existing Regulatory Mechanisms:* The species is being protected by all applicable mechanisms (National Park Service regulations, Arizona Native Plant Law, and the Endangered Species Act).
- E. *Other Natural or Manmade Factors Affecting its Continued Existence:* This is the factor that most affects the species and the recovery criteria were developed to address the threats associated with this factor. The Maricopa Point population has decreased significantly between 2000-2006, with very low to non-existent reproduction. Drought has likely played a factor in the mortality of plants and the reduced reproduction. Research by Allphin et al. (2005) demonstrated that the Maricopa and Grandview plants have reduced genetic vigor and exhibit an extreme lack of genetic heterozygosity. The species is limited to three locations, all along the South Rim of the Grand Canyon, within Park boundaries. The populations are very vulnerable to natural catastrophes and environmental and demographic stochasticity. For these reasons, the recovery criteria are focused on protection of known locations, along with the augmentation and creation of new populations to create population stability. Once the additional populations are created, meet the density target, have

persisted for 30 years, and are permanently protected by the National Park Service, then the threats associated with limited size and quantity will be alleviated.

*Climate change:* According to the Intergovernmental Panel on Climate Change (IPCC) (2007) “Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.” For the next two decades a warming of about 0.2°C (0.4°F) per decade is projected (IPCC 2007). Afterwards, temperature projections increasingly depend on specific emission scenarios (IPCC 2007). Various emissions scenarios suggest that by the end of the 21<sup>st</sup> century, average global temperatures are expected to increase 0.6°C to 4.0°C (1.1°F to 7.2°F) with the greatest warming expected over land (IPCC 2007). Localized projections suggest the southwest may experience the greatest temperature increase of any area in the lower 48 States (IPCC 2007). The IPCC says it is very likely hot extremes, heat waves, and heavy precipitation will increase in frequency (IPCC 2007). There is also high confidence that many semi-arid areas like the western United States will suffer a decrease in water resources due to climate change (IPCC 2007). Regional projections for the Colorado Plateau indicate increases in average and extreme temperatures, likely resulting in less soil moisture and greater stress for plants. Increased evening temperatures will increase plant respiration, which may increase plant mortality (Schwinning et al. 2008). Because sentry milk-vetch occupies small areas of isolated, specialized habitat, it is vulnerable to climatic changes that could decrease suitable habitat or alter pollinator phenology. However, while it appears reasonable to assume that sentry milk-vetch may be affected, we lack sufficient certainty to know specifically how climate change will affect the subspecies.

### **Progress on Recovery Criteria Implementation**

Soon after the recovery plan was finalized, the GCNP started implementing recovery actions. The GCNP has been active in obtaining funding and has received internal (local and National) monetary support for their recovery efforts. Monitoring the plant localities annually by GCNP staff, along with a FWS botanist, is planned into the future, using established survey methods. In 2009, GCNP will allocate funds to analyze past monitoring data to detect demographic trends and redesign the monitoring plan to address specific questions. Pollinators of the sentry milk-vetch are not known. The plant may be an obligate out-crosser, but with populations at least 10 miles apart, pollen likely is not shared among localities. A pollinator study will be initiated by GCNP in the summer of 2009 that will identify pollinators and investigate causes that possibly impede the plant’s reproductive success.

Since 2006, GCNP staff has completed actions leading to the creation of an additional population of sentry milk-vetch. The Arboretum at Flagstaff, a partner in recovery planning for this species, received a section 6 grant from FWS to collect sentry milk-vetch seed from plants at the Maricopa and Lollipop Point locations, and to establish an *ex situ* population of the species for additional seed production. As of 2007, 166 plants

were in cultivation at the Arboretum. The Arboretum also created an informational sign to inform visitors to the Arboretum of the biology of the sentry milk-vetch, its status, and efforts to recover the species.

In 2007, GCNP hired a horticulturist to be responsible for the sentry milk-vetch recovery project. The GCNP received funding in 2008 (section 6 grant) and purchased a small greenhouse to start germination experiments and establish another *ex situ* population of sentry milk-vetch at GCNP in conjunction with the work being done at the Arboretum. The GCNP staff collected sentry milk-vetch seed from the Maricopa and Lollipop populations in 2008, which will be used for germination trials in their greenhouse. The Arboretum and GCNP have been working with FWS to develop a protocol for growing sentry milk-vetch plants in order to proceed with a planned augmentation/reintroduction effort at Maricopa Point.

In 2008, GCNP staff removed a parking lot in conjunction with road work along the South Rim. Rehabilitation of the parking lot, which is directly adjacent to the Maricopa Point population, has begun. This rehabilitated site is designated as a pilot site for testing edaphic and planting/seeding protocols for sentry milk-vetch beginning in summer 2009. The site will be the first location for experimentation with sentry milk-vetch seed and plant trials for population introductions. Other sites suitable for sentry milk-vetch have been delineated and, depending on the results of the pilot project, will be used as sites for future introduction efforts.

In summary, SENTRY milk-vetch is an endemic habitat specialist with a very limited distribution, making it highly vulnerable to extinction from localized stochastic events. There was a significant decline in the main population at Maricopa Point (nearly 50 percent) between 2000-2006; likely due to drought conditions. GCNP staff continues to monitor and protect the known populations of SENTRY milk-vetch. To date none of the recovery criteria have been met. The recovery plan has only been in place since 2006, but GCNP is actively working on recovery actions outlined in the plan.

In consideration of all of the above, we maintain that sentry milk-vetch remains in danger of extinction throughout its small distribution and recommend its status remain as endangered.

### 3.0 RESULTS

#### 3.1. Recommended Classification:

- Downlist to Threatened**
- Uplist to Endangered**
- Delist** (*Indicate reasons for delisting per 50 CFR 424.11*):
  - Extinction*
  - Recovery*
  - Original data for classification in error*
- No change is needed**

**3.2. New Recovery Priority Number:** No change; remains as 6.

**Brief Rationale:** Sentry milk-vetch is under a high degree of threat because it is an endemic habitat specialist with a very limited distribution, making it highly vulnerable to extinction from localized stochastic events. There are only two known viable populations and in order for the species to be considered for downlisting two additional populations must be discovered or created. There must be a total of at least 4,000 individuals within those four populations and currently there are less than 750 known plants. The techniques for propagating, augmenting, and establishing new populations are experimental and will take considerable time and effort to implement. For these reasons, the recovery potential is considered low.

#### **4.0. RECOMMENDATIONS FOR FUTURE ACTIONS**

Sentry milk-vetch is a FWS Region 2 Spotlight Species. As such, an action plan that outlines recovery actions to be completed in the next five years that will move the species towards recovery will be finalized in 2009. The following are prioritized actions, described in the 2006 recovery plan, that are planned for implementation between 2010 and 2014.

1. *Conduct systematic surveys in GCNP.* Systematic surveys for this species have not been undertaken at the GCNP. To date, surveys have been project-driven. The GCNP will consolidate and summarize all the surveys to date (including surveyed areas with negative results), and delineate other areas that seem suitable for the species (i.e., areas along the South Rim west of Hermit's Rest). The GCNP anticipates surveying an additional 30 miles during this five-year period. Newly discovered populations will reduce the need to establish populations.
2. *Public education.* The GCNP is committed to increasing the visibility and educating the public about the conservation needs of sentry milk-vetch. A new sign will be designed and placed near the Maricopa Point population, with additional educational material (artwork, brochures, and bulletins) displayed in the visitor center and on the GCNP's website.
3. *Increase the number of individuals and the amount of occupied habitat at all sites to the carrying capacity of the habitat.* Grand Canyon National Park will focus their efforts on the Maricopa Point population by conducting seed and plant trials in the old parking lot site and within the Maricopa Point enclosure.
4. *Establish new populations as necessary.* Grand Canyon National Park will move forward with creation of new populations depending on the results of the experimental work at Maricopa Point.

5. *Study the ecology of the species.* This work will occur in parallel with the population establishment and augmentation work. The Arboretum at Flagstaff is investigating the soil/mycorrhizal interactions with the plant and how that may influence seedling establishment. Soil analyses will be conducted to assure that locations proposed for population creation will support the species and seed dispersal will be investigated. Also, the GCNP will conduct a pollinator study in 2009 (starting in the summer) to identify pollinators and investigate causes possibly impeding the plant's reproductive success.

## 5.0 REFERENCES

- Allphin, L., N. Brian, T. Matheson. 2005. Reproductive success and genetic divergence among varieties of the rare and endangered *Astragalus cemonophylax* var. *cremnophylax* (Fabaceae) from Arizona, USA. *Conservation Genetics* 6: 803-821.
- Arboretum at Flagstaff. 2007. Annual report for activities conducted under permit TE009792-2. Unpublished report submitted to U.S. Fish and Wildlife Service, Tucson, Arizona. 3 pp.
- Busco, J. 2008. Sentry milk-vetch (*Astragalus cremnophylax* var. *cremnophylax*) 2007-2008 Monitoring Report. Unpublished report submitted to AESO (Phoenix office). 24 pp.
- Intergovernmental Panel on Climate Change. 2007. Fourth Assessment Report Climate Change 2007: Synthesis Report Summary for Policymakers. Released on 17 November 2007. Available at: [http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4\\_syr\\_spm.pdf](http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf)
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- U.S. Fish and Wildlife Service. 2006. Sentry Milk-vetch (*Astragalus cremnophylax* Barneby var. *cremnophylax* Barneby) Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. i-vi +44 pp.



**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of *Astragalus cremnophlyax* var. *cremnophylax***

**Current Classification:** Endangered.

**Recommendation resulting from the 5-Year Review:**


- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

**Appropriate Listing/Reclassification Priority Number, if applicable:** Not applicable

**Review Conducted By:** Mima Falk, Plant Ecologist, Arizona Ecological Services Tucson Sub-Office.

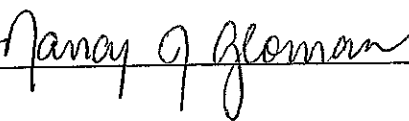
**FIELD OFFICE APPROVAL:**

**Lead Field Supervisor, U.S. Fish and Wildlife Service**

Approve  Date April 10, 2009  
/s/ Steven L. Spangle

**REGIONAL OFFICE APPROVAL:**

**Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Region 2**

Approve  Date 4/22/09