

Centaurium namophilum
(Spring-loving centaury)

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



Photo by Gina Glenne, U.S. Fish and Wildlife Service, May 2003

**U.S. Fish and Wildlife Service
Nevada Fish and Wildlife Office
Las Vegas, Nevada**

**Date Signed
[August 13, 2009]**

5-YEAR REVIEW

Centaurium namophilum (Spring-loving centaury)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) 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 five years. The purpose of a 5-year review is to evaluate whether or not the status of the species has changed since 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 evaluate 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.

Species Overview:

The spring-loving centaury was described by Reveal, Broome and Beatley in 1973, although Coville and Funston had collected it as early as 1891 (Reveal, Broome and Beatley 1973). The species is an upright, annual herb reaching 17.5 inches (in) (45 centimeters [cm]) in height with many flowering branches, which bear numerous flowers with corolla lobes measuring approximately 0.3 to 0.5 in (7 to 12 millimeters [mm]) in diameter (Reveal, Broome, and Beatley 1973). Flowers are deep rose-pink above and below. The throat is yellowish with five dark purple spots below the juncture of adjacent petals (Reveal, Broome and Beatley 1973). The species flowers during the summer months from July to September (Pavlic and Manning 1986). The spring-loving centaury is adapted to mesic alkaline clay soils and is endemic to the Ash Meadows area of Nye County, Nevada. The range of the spring-loving centaury encompasses the Ash Meadows National Wildlife Refuge (Refuge), and adjacent Bureau of Land Management (BLM) and private lands. Based on the literature and opinion of local botanists, centaury populations in nearby Beatty, Nevada and Death Valley, California are considered a taxonomically distinct subspecies.

Methodology Used to Complete This Review:

Following the Region 8 guidance issued in March 2008, the Service's Nevada Fish and Wildlife Offices in Las Vegas and Reno prepared this review. We used information from the Recovery Plan for the Endangered and Threatened Species of Ash Meadows, Nevada (Recovery Plan;

Service 1990), survey information from experts who have monitored various localities of this species, and the database maintained by the Nevada Natural Heritage Program. The Recovery Plan and personal communications with experts were our primary sources of information used to update the status of and threats to the species. We received no information from the public in response to our Federal Register (FR) notice initiating this 5-year review. This 5-year review contains updated information on the biology of and threats to the species, and an assessment of that information compared to that known at the time of listing. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next five years.

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Federal Register Notice Citation Announcing Initiation of This Review:

On July 7, 2005, the Service announced initiation of the 5-year review for the spring-loving centaury and asked for information from the public regarding the species' status (70 FR 39327). A second notice announcing the 5-year review and extending the request for information until January 3, 2006, was published on November 3, 2005 (70 FR 66842). We did not receive any information for this species from either solicitation.

Listing History:

Original Listing

FR Notice: October 13, 1983; 48 FR 46590

Date of Final Listing Rule: May 20, 1985; 50 FR 20777

Entity Listed: Spring-loving centaury (*Centaurium namophilum*)

Classification: Threatened

State Listing

The State of Nevada listed the spring-loving centaury as a fully protected plant species in 1982.

Associated Rulemakings:

Critical habitat was designated at the time of original listing on May 20, 1985 (50 FR 20777).

Review History:

The status of the spring-loving centaury has not been reviewed since the species was listed in 1985.

Species' Recovery Priority Number at Start of 5-Year Review:

The recovery priority number for spring-loving centaury is 14 according to the Service's 2008 Recovery Data Call for the Nevada Fish and Wildlife Office, based on a 1-18 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 the species faces a low degree of threat and has a high potential for recovery.

Recovery Plan or Outline:**Name of Plan or Outline**

Recovery Plan for the Endangered and Threatened Species of Ash Meadows, Nevada.

Date Issued

September 28, 1990.

II. REVIEW ANALYSIS**Application of the 1996 Distinct Population Segment (DPS) Policy:**

The 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 of species under the Act limits listing as distinct population segments to species of vertebrate fish or wildlife. Because the species under review is a plant, the DPS policy is not applicable, and the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status:**Species Biology and Life History**

Reveal, Broome and Beatley described the spring-loving centaury in 1973, although Coville and Funston had collected it as early as 1891 (Reveal, Broome and Beatley 1973). The species is an upright, annual herb that grows 17.5 in (45 cm) tall with many flowering branches bearing many flowers measuring approximately 0.3 to 0.5 in (7 to 12 mm) in diameter (Reveal, Broome and Beatley 1973). The spring-loving centaury flowers from July to September (Pavlik and Manning 1986). Flowers are deep rose-pink with a yellowish throat and five dark purple spots below where adjacent petals attach to the body of the flower (Reveal, Broome and Beatley 1973). Each flower develops into a narrow, linear seed capsule containing about 50 seeds (Reveal, Broome and Beatley 1973). One plant can produce thousands of seeds.

There is very little known about the reproductive biology of the species. However, like other plants, it likely has controls that delay germination allowing it to persist in the soil seed bank for long periods. Given the small size of spring-loving centaury seeds, 0.02-0.03 in (0.07-0.09 cm)

long, seed may be dispersed by small animals, wind and water. Most seed probably remains near the plant that produced it. It is unknown whether the species is self compatible or requires pollination. Based on its present distribution and population numbers pollination probably does not limit reproduction.

The biology and life history of the spring-loving centaury are consistent with a ruderal life history as described by Grime (1977, 1984). In ruderal species, weedy species adapted to disturbance, the relative proportion of energy devoted to seed production is high and these species typically recover relatively quickly from disturbance (Grime 1977).

Spatial Distribution/Abundance

The spring-loving centaury is endemic to the Ash Meadows area of Nye County, Nevada. The range of the spring-loving centaury encompasses the Refuge, and on adjacent BLM and private lands. On BLM-managed lands, the plant is within the Ash Meadows Area of Critical Environmental Concern (ACEC). A closely related species (*C. exaltatum*) in nearby Beatty, Nevada and Death Valley, California is believed taxonomically distinct (Service 2001) (see Changes in Taxonomic Classification section below).

In 1973, Reveal, Broome and Beatley noted the species was probably present in all the springs and seeps in the northern and eastern sections of the Ash Meadows area until development in the 1960s reduced the distribution to remnant patches of natural vegetation. Development from 1970 through 1980, which eventually precipitated Federal listing, restricted the distribution further. Cochrane (1981) identified 17 localities at which the spring-loving centaury had been observed (Figure 1). Knight and Clemmer (1987) reviewed the available data on the rare plants of Ash Meadows and identified general areas from which the spring-loving centaury had been reported (Figure 2). In 1998, surveys were targeted on the seven general areas identified by Knight and Clemmer (1987) and the total population was estimated to be about 175,000 plants on 522 acres (ac) (211 hectares (ha)) (BLM and Service 2000, p. 3-5). Refuge-wide surveys of listed and rare plants, including the spring-loving centaury, were begun in 2008. As a result of these surveys, the total population on the Refuge is now estimated at 4,468,571 individuals on about 800 ac (Bio-West 2008, p. 28). This increase is likely due to the fact that the recent surveys were the first comprehensive surveys undertaken for the species although some of the difference may also be due to fluctuations in the population size of this annual species and probable differences in estimation protocols.

Plants were confirmed during the 2008 surveys to occur at most previously reported locations and the distribution boundaries of the plant were often extended; in some cases, populations previously considered separate were found to be connected (Bio-West 2008, p. 28). They found the spring-loving centaury to be very widespread throughout the Refuge in habitats that included seasonally flooded wetlands to seasonally moist alkali meadows and the edges of some alkali scrub-shrub communities (Bio-West 2008, p. 26). They reported that it appeared that nearly any site on the Refuge containing surface or sub-surface¹ water at any time during the year could support the spring-loving centaury (Bio-West 2008, p. 26). They also reported that the plant

¹ We presume that by “sub-surface” water, they mean near-surface water.

populations extend beyond the Refuge boundary in a few locations (Bio-West 2008, p. 26). Additional surveys are planned for 2009.

It is interesting to note, however, that despite the recent survey reports indicating that the species is more widespread than previously thought, their map shows this conclusion to be equivocal (Bio-West 2008, p. 29). While they clearly show denser concentrations of plants in many areas, including some outside of previously known sites, there are also major areas where the plant was reported to be present by Glenne (1998) in which no plants were apparently observed in the recent surveys. In particular, Glenne (1998) mapped several areas east of Bole Spring in the southeast corner of the Refuge to the west of Scruggs Springs in the central portion of the Refuge, where the plant apparently was not observed during recent surveys.

The present distribution of the spring-loving centaury has been refined based on an improved understanding of habitat preferences as well as the likely natural recolonization of previously disturbed habitat. Currently, the spring-loving centaury is distributed in six major subpopulations with additional minor subpopulations (Bio-West 2008, p. 29). The six general sites where the plant is known to occur include:

- (1) Purgatory-Rogers-Longstreet-Five springs-North Carson Slough, Sections 10, 14-16, 20- 23, Township (T) 17 South (S) Range (R) 50 East (E);
- (2) Scruggs-Mary-Scott-Indian-School-Crystal-Marsh springs, Sections 7-10, 15-18, T17S R50E
- (3) Unmapped seep west of South Springs Meadow Road, Sections 14 and 23, T18S R50E;
- (4) Point of Rocks Springs Sections 7 and 12, T18S R51E;
- (5) Jackrabbit-Big springs, Sections 18, 19, T18S R51E and west from Big Spring extending into Sections 14, 22, 23 and 24, T18S, R50E; and
- (6) Last Chance-Bole-Brahma springs, T18S R51E sections 20, 29 and 30.

Detailed information regarding specific population trends or changes in the distribution of the species since it was listed in 1985 is not available. However, based on the life history, anecdotal observations, and assessments of biologists (C. Baldino, Ash Meadows National Wildlife Refuge, pers. comm. 2006a), it is reasonable to conclude the distribution of the spring-loving centaury has increased through colonization of previously disturbed sites since it was listed. It also, appears, however, that some areas reported as occupied by Glenne in 1998 may no longer support the species.

The ownership and management of spring-loving centaury habitat is primarily Federal, consisting within the Refuge boundary of approximately 50 percent on Service land, 45 percent on BLM land, and 5 percent on private lands. These values are likely to be more precise when the 2009 surveys have been completed. We have no accurate estimate of the amount of spring-loving centaury habitat, or the number of individuals, that occur outside the Refuge boundary within the BLM Ash Meadows ACEC.

Habitat or Ecosystem

The spring-loving centaury grows between 2,070 to 2,320 feet above mean sea level (AMSL) (630 to 707 meters AMSL) elevation within the Mojave Desert Ecoregion. The species is adapted to alkaline clay soils of the Ash Meadows area, and water availability is a limiting factor to this species' distribution (Pavlik and Manning 1986). It typically grows in wet saltgrass meadows near springs and streams and occasionally in low uplands at seeps (Reveal, Broome and Beatley 1973). The quantity of water discharged from the springs in the Ash Meadows area is stable and perennial. The amount of available habitat is expected to remain relatively constant from year to year except during high rainfall years where the number of individuals and extent of suitable habitat on drier sites would likely increase because of increased soil moisture. The most recent surveys were conducted in 2008, a year during which growing season precipitation amounted to only 66 percent of the 30-year average (Pavlik and Stanton 2008, p.6). The wet meadow ecosystem occupied by spring-loving centaury is typically dominated by saltgrass (*Distichlis spicata*) with scattered velvet ash (*Fraxinus velutina*) and screwbean mesquite trees (*Prosopis pubescens*). Other associates of the species in saltgrass meadows include the Ash Meadows gumplant (*Grindelia fraxino-pratensis*), Emory baccharis (*Baccharis emoryi*), and yerba mansa (*Anemopsis californica*). On drier sites, common associates include Ash Meadows ivesia (*Ivesia eremica*) and Tecopa bird beak (*Cordylanthus tecopensis*) (Reveal, Broome and Beatley 1973).

The primary constituent elements of designated critical habitat consist of the biological and physical attributes essential to the species' conservation within those areas. For the spring-loving centaury, primary constituent elements described in the final listing rule include moist to wet clay soils along banks of streams or in seepage areas.

Changes in Taxonomic Classification or Nomenclature

We originally proposed the spring-loving centaury under the scientific name *Centaurium namophilum* var. *namophilum* (Broome 1981). However, based on comments received following the proposed rule, we determined varietal designations for *C. namophilum* were no longer valid. Based on interviews with knowledgeable experts completed in 2001, we continue to maintain *C. namophilum* is a valid taxon without varietal restrictions that occurs only in Ash Meadows. Included below is a detailed discussion and rationale for our taxonomic treatment of this species.

The taxonomy of the spring-loving centaury was questioned during the comment period for the listing of the species in 1985. At that time, the Service reviewed all of the information available and determined that the taxon was valid without varietal distinctions. The question of whether or not the listed taxon, *C. namophilum*, occurs within the Death Valley National Park was raised in 1995 during a coordination meeting, which prompted another review of the taxonomic treatment and distribution of the species.

In Broome's (1981) paper, *A new variety of Centaurium namophilum (Gentianaceae) from the Great Basin*, she stated that plants collected from the Furnace Creek area in Death Valley closely resemble material attributed to *C. n.* var. *namophilum* from the vicinity of Shoshone and Tecopa, in Inyo County, California. However, based on certain morphological characters, Broome concluded the plants are more appropriately assigned to *C. n.* var. *nevadense*, a second variety of *C. namophilum*. *Centaurium n.* var. *namophilum* was also documented near Beatty, Nevada

(Broome 1981), although Morefield (1991) conducted an intense survey of this area and did not relocate the species. His survey instead documented several populations of *C. exaltatum* (Griseb) W. Wight ex Piper and *C. calycosum* (Buckley) Fern, which is very similar to *C. namophilum*.

The Intermountain Flora treatment combined *C. n. var. nevadense* with *C. exaltatum*, based on their sympatric distribution, with the intermediate forms perhaps being attributed to ancient hybridization with a *C. namophilum*-like ancestor (Cronquist et al. 1984). This treatment maintained that *C. namophilum* is endemic to the Death Valley-Ash Meadows region and readily distinguished from *C. exaltatum* by its shorter corolla tube and its more densely-flowered inflorescence with shorter primary and secondary peduncles (Cronquist et al. 1984).

The Jepson Manual treatment also combined *C. n. var. nevadense* with *C. exaltatum* (Hickman 1993). It states that California (not Nevada) plants that have been considered *C. n. var. namophilum*, spring-loving centaury, with denser inflorescences from the eastern Mojave Desert are apparently all *C. exaltatum*.

In 2001, the Service queried three local botanists, all of whom concur with the existing taxonomic treatment and known distribution of *C. namophilum* (Service 2001). The botanist for Death Valley National Park conducted an investigation into the *Centaureium* species that occur within the Park boundaries and adjacent areas and compared various morphological characters with those of *C. namophilum* (Service 2001). Two forms were identified, *C. exaltatum* and an unidentified species, neither of which possess characteristics attributable to *C. namophilum* (Service 2001). Dr. Noel H. Holmgren has reviewed all material housed at the New York Botanic Garden and concurs with the existing treatments for the species (Service 2001). The assertion that the distribution of *C. namophilum* extends into Death Valley National Park cannot be corroborated at this time, and the discrepancy appears to be more specific to the taxon named *C. n. var. nevadense* and its distinction from *C. exaltatum*, rather than the species endemic to Ash Meadows (Service 2001).

Based on this information, we maintain that *C. namophilum* is a valid taxon without varietal distinctions and is currently restricted to Ash Meadows. This determination is consistent with the conclusions of the initial 1985 listing action.

Genetics

Genetics studies have not been completed for this species. There are no known issues with loss of genetic variation for this species.

Species-specific Research and/or Grant-supported Activities

No specific studies or research activities are currently underway for this species.

Five-Factor Analysis:

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act. Due to threats to the entire Ash Meadows ecosystem, the five-factor threats analysis in the proposed and final listing rules for the

spring-loving centaury also included six additional plants and one insect. These consist of the Ash Meadows blazing star (*Mentzelia leucophylla*), Ash Meadows gumplant, Ash Meadows ivesia, Ash Meadows milkvetch (*Astragalus phoenix*), Ash Meadows sunray (*Enceliopsis nudicaulis*), Ash Meadows naucorid (*Ambrysus amargosus*), and the Amargosa niterwort (*Nitrophila mohavensis*).

Background

In 1983, the Service proposed to list all the Ash Meadows species as endangered. Prior to publishing the 1985 final listing rule; however, the Federal government acquired much of the land and water rights and established the Refuge. Under the final listing rule the spring-loving centaury, Ash Meadows ivesia, Ash Meadows blazing star, Ash Meadows milkvetch, Ash Meadows sunray, Ash Meadows gumplant, and Ash Meadows naucorid were listed as threatened with critical habitat and the Amargosa niterwort was listed as endangered with critical habitat because its known distribution was outside of the Refuge. Because of the type of analysis completed in the 1985 final listing rule, it is difficult to separate specific threats to the spring-loving centaury from threats to the other Ash Meadows plants and ecosystem. We have broadened our analysis to include threats not specifically mentioned for the spring-loving centaury but that are applicable to the Ash Meadows ecosystem.

Threats to the spring-loving centaury, other Ash Meadows plants, and ecosystem described in the final listing rule are summarized below:

Factor A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

- Groundwater withdrawal is a threat to the entire Ash Meadows ecosystem.

Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

- Over-collection is not a known threat to the seven listed Ash Meadows plants.

Factor C: Disease or Predation

- Grazing by cattle and wild horses is a threat to the spring-loving centaury.

Factor D: Inadequacy of Existing Regulatory Mechanisms

- The absence of adequate regulatory mechanisms is a threat to all the Ash Meadows species.

Factor E: Other Natural or Manmade Factors Affecting Continued Existence

- Trampling by wild horses is a threat to all the listed Ash Meadows plants.

Potential threats to the spring-loving centaury recently identified and not included in the final rule include:

Under Factor A:

- Surface mining, identified in the original listing as a threat to two other listed plant species, the Ash Meadows gumplant and the Ash Meadows milkvetch, also poses a threat to the spring-loving centaury which co-occurs in many places with the Ash Meadows gumplant.
- Weedy, non-native plant species are a potential threat to the spring-loving centaury because they can compete with and displace the listed species from occupied habitat.

Under Factor E:

- Species with restricted ranges or small populations are potentially vulnerable to stochastic events.
- Climate change is a potential threat.

To understand threats to the spring-loving centaury it is important to understand the period over which they would be expected to operate. The principal difference between an “endangered” and a “threatened” species under the Act is whether the species is currently in danger of extinction (the definition of endangered), or if it is likely to become so “within the foreseeable future” (the definition of threatened). The Act does not define the term foreseeable future. The spring-loving centaury is currently listed as a threatened species. For the purposes of this review, we used “foreseeable future” to define the period over which the threats to the listed Ash Meadows plants and their habitat are like to operate under current and future management conditions. While the management approach for the listed Ash Meadows focuses on the entire ecosystem, the foreseeable future for the spring-loving centaury is unique to its life history, population status, trend, and the threats that it faces. The Service has issued draft guidance that states that, when we do not have sufficient information to reliably assess the effects of threats on a species over a clear timeframe, we will:

- a. Use the metric of “the longer of 10 years or 3 generations” to define foreseeable future;
- b. Use the International Union for Conservation of Nature (IUCN) guidelines which define “generation length” as the average age of the parents of the current cohort, which is greater than the age at first breeding and less than the age of the oldest breeding individual (Standards and Petitions Working Group 2006, p. 19); and
- c. Modify this measure to meet the specific circumstances of individual species where information is convincing that the above approach would be inappropriate for a particular species

Because the spring-loving centaury is an annual plant that depends on a supply of surface or near-surface water, we believe that 10 years is an appropriate measure of the foreseeable future for this species.

Factor A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

The spring-loving centaury faces three threats under listing Factor A. The 1985 final listing rule describes groundwater pumping as a threat. We also consider surface mining, described in the final listing rule as a threat to the Ash Meadows gumplant and Ash Meadows ivesia, to be relevant to the spring-loving centaury because it shares many of the same habitat characteristics with these two other species. Since the listing rule was published, non-native species have been identified as a threat to the spring-loving centaury and other listed Ash Meadows plants.

Habitat Loss or Degradation from Groundwater Pumping. At the time of listing, groundwater development was a major threat to the entire Ash Meadows ecosystem. Prior to listing, local groundwater pumping within Ash Meadows was responsible for declines in the wetlands in this area. The spring-loving centaury depends on the outflow of springs and near-surface water for its survival (see Species Biology and Life History discussion above); it is, therefore reasonable to conclude adverse impacts to the ecosystem from groundwater pumping would also negatively affect many populations of this species.

Numerous measures have been implemented that, in part, address this threat. A 1976 Supreme Court decision established a minimum water level in Devils Hole, a 40-ac disjunct unit of Death Valley National Park that occurs within the boundaries of the Refuge, to protect the endangered Devils Hole pupfish (*Cyprinodon diabolis*); as a result of this decision water levels in Devils Hole are carefully monitored. The Service has established water rights for 16,376 acre-feet (ac-ft) (2,020 hectare-meters (ha-m) of annual spring discharge (Mayer 2000, pp. 2-3). This constitutes approximately 96 percent of the 17,025 ac-ft (2,100 ha-m) annual discharge by the springs and seeps at Ash Meadows (Mayer 2000, pp. 2-3). A groundwater level and spring discharge monitoring program developed by the Service and the U.S. Geological Survey in 1998 has been implemented as part of a larger monitoring program for the Amargosa Desert hydrographic basin, which supports the Ash Meadows region.

On July 16, 2007, the Nevada State Engineer issued Ruling 5750 denying numerous water rights applications in the Amargosa Valley, and finding that the groundwater basin is over-appropriated (State of Nevada 2007, p. 22). On November 4, 2008, the Nevada State Engineer issued Order 1197 further stipulating that any new applications for water rights in the Amargosa Valley will be denied and that change applications that seek to move pumping more than 0.5 mi (0.8 km) closer to Devils Hole will also be denied (State of Nevada 2008, p. 1). Order 1197, however, provides several exceptions including provisions to allow: 1) a change in the place of diversion of less than 0.5 mi (0.8 km) as long as the place of use remains the same; 2) applications for less than 2.0 ac-ft (0.2 ha-m) per year; and, 3) a process for considering the net impact of changes to multiple existing rights, which could permit changes that are the same or less than the impacts to Devils Hole base rights as long as no new diversions are within 10 mi (16 km) of Devils Hole.

Water levels in Devils Hole stabilized after groundwater pumping on the properties that ultimately became the Refuge stopped in 1975; however, the water level in Devils Hole declined 2.76 inches (7 centimeters) between 1988 and 2004 (NPS 2004). The water level subsequently increased in 2005 following an extremely wet year. Mayer (2006, pp. 19 and 28) indicates groundwater monitoring wells and spring discharges on the Refuge are currently stable to

slightly declining. After groundwater pumping was ceased on the Refuge, it began to increase in the Amargosa Valley, located about 10 mi (16 km) northwest of the Refuge. In 1987, groundwater pumping in the Amargosa Valley was estimated to be 5,670 ac-ft (699 ha-m) per year (USGS 2005). In 2003, groundwater pumping was estimated to have increased to 13,518 ac-ft (1,667 ha-m) per year (USGS 2005). Most groundwater monitoring wells in the Amargosa Valley have shown a significant decline in water levels since 1992 (USGS 2003), and groundwater pumping is currently occurring in some areas of the basin at about twice the rate predicted to be sustainable (USGS 2005).

Water right acquisition by the Refuge, the 1976 Supreme Court order protecting the water level in Devils Hole, and the recent ruling and order by the Nevada State Engineer have all reduced the imminence and the magnitude of the threat that groundwater pumping poses to the aquatic ecosystems at the Refuge, and species such as spring-loving centaury, that depend upon them. They have not, however, totally eliminated this threat and the significance of the remaining threat posed by groundwater pumping must be evaluated with respect to each of these measures.

The Supreme Court ruling applies specifically to the water level in the Devils Hole, which is the highest hydrological point within the Refuge. It remains uncertain, however, to what extent maintenance of the court stipulated water level in Devils Hole affords protection to other spring-fed habitats within the Refuge, many of which originate to the north and west of Devils Hole and could potentially be affected by either local groundwater pumping on the few remaining inholdings within the Refuge or by the incremental effects of groundwater pumping in the Amargosa Valley. While the Nevada State Engineer's ruling and order preclude new water right applications within the Amargosa Valley and place constraints on change applications, exceptions are included for applications for less than 2.0 ac-ft (0.2 ha-m) per year and for applications that do not change the place of use. These exceptions, while seemingly minor, could have cumulative effects that result in lowering the groundwater table within the Refuge. While the State Engineer's Order 1197 identifies a process for identifying the net effect of changes to multiple existing rights, the analytical process for evaluating the effects of these changes has not been specified.

Numerous active applications for solar energy projects in the Amargosa Valley north of the Refuge have been received by BLM (BLM 2009). The Service (2008a, pp. 1-3) has expressed concern to BLM over the potential amount of water that would be required, which could be as much as 50,000 ac-ft (6,168 ha-m) per year if projects that use wet-cooled concentrating solar thermal technology or other water-use intensive technologies are approved and implemented. The Amargosa Valley has recently been selected as a Solar Energy Study Area to be fully evaluated for its environmental and resource suitability for large-scale solar energy production (Department of Interior 2009, p. 1). The objective is to provide landscape-scale planning and zoning for solar projects on BLM lands in the West, allowing a more efficient process for permitting and siting responsible solar development. If selected, the Amargosa Valley would be available for projects capable of producing 10 or more megawatts of electricity for distribution to customers through the transmission grid system. Companies that propose projects on that scale in areas already approved for this type of development would be eligible for priority processing. BLM may also decide to use alternative competitive or non-competitive procedures in processing new solar applications for selected areas.

Since Order 1197 precludes the issuing of new water rights in the basin, developers of these projects are expected to purchase existing rights and file applications to change the manner of use, place of use, and/or the location of pumping. It also remains uncertain whether all existing water rights are currently being fully exercised. If they are not, the full utilization of all existing water rights in this over-appropriated basin may lead to a lowering of the groundwater table that affects spring-discharge within the Refuge. Industrial uses may also lead to a reduction in return flows when compared to the current agricultural uses of water in the Amargosa Valley.

Although the Service has established water rights to 96 percent of the spring discharge within the Refuge, the Service will have to demonstrate through analyses that the net impact of any change applications will have a negative effect on Ash Meadows. To the extent that the Service is unsuccessful in demonstrating net negative impacts in at least some of these cases, additional incremental declines in spring discharge may occur at Ash Meadows. Such incremental declines could be difficult to attribute to any particular cause or causes after the fact and, therefore, would be difficult to remedy.

Because of the uncertainties that exist regarding the potential effects of the full exercise of existing water rights in the Amargosa Valley, the incremental effects of additional pumping or changes in the manner or place of use or location of pumping, and the specifics of the process that the Nevada State Engineer will use to evaluate the net effects of such changes, we are unable to conclude at this time that the threat that groundwater pumping poses to spring-loving centaury is no longer significant.

Habitat Loss or Degradation from Surface Mining. Mining for clay minerals occurs in the Ash Meadows area. The playa sediments covering much of the Ash Meadows area contain clays and other minerals, which may be considered “uncommon varieties,” and therefore could potentially be classified as “locatable minerals” under existing mining laws. Specific specialty clays located in the area include bentonite, sepiolite and saponite; zeolite has also been mined from deposits on lands south of the Refuge and commercial deposits likely occur within the Refuge (Wallace 1999, pp. 15-17). Mineral entry on Federal lands is authorized by the Mining Act of 1872; the program is administered by BLM. Under this program, surface disturbance and impacts to rare species that do not have Federal protection are permissible as long as operations comply with all pertinent Federal and State laws. Currently, there are no active mines or mineral claims within known spring-loving centaury habitat (BLM 2007). New mineral claims and subsequent mining could cause direct loss of spring-loving centaury habitat, as well as indirect impacts by diverting or draining water away from occupied habitat.

Establishment of the Refuge and BLM ACEC has significantly diminished the threat posed by surface mining. The ACEC is now temporarily closed to new mineral claims while BLM processes an application/petition to withdraw mineral entry. We do not have accurate estimates of either the total acres or population sizes of any spring-loving centaury occurrences within the ACEC. Within the Refuge, the Service owns mineral rights on approximately 19 percent of the acres on which the spring-loving centaury was known to occur prior to 2008. During the 2008 surveys, substantial extensions of known populations into areas with Service-owned minerals were documented (BLM and Service 2000, pp. 4-2, A-7; Bio-West 2008, p. 25). Precise figures are not available but the total habitat acreage on lands with Service-owned minerals may

approach 50 percent. Mineral entry on these lands is unlikely because obtaining the necessary authorizations would require the project proponent to commit to an extended process that would include a Refuge compatibility analysis. It is unlikely that surface mining would be found compatible with the Refuge's purpose. We estimate that about 5 percent of the habitat acreage is on private land. The remaining estimated 45 percent of spring-loving centaury habitat acres within the Refuge occur either on BLM lands open to public mineral claims or on Service land with public minerals.

Overall, about 50 percent of the known occurrences of spring-loving centaury within the Refuge are open to mineral entry. A mineral withdrawal would not interfere with valid existing mineral rights. Existing mineral claims for specialty clays exist both within and outside of the Refuge and BLM ACEC (BLM and Service 2000, p. A-6; D. Fanning, BLM, in litteris. 2007). These existing claims do not occur near any of the large known concentrations of the spring-loving centaury and, therefore, do not constitute a significant threat. The significance of the threat posed by mineral entry on BLM or Service lands with public minerals is difficult to assess because there is no available information on the actual occurrence or potential value of minerals on these specific parcels of land. Most of these lands, however, remain open to mineral entry nearly a decade after they were petitioned for withdrawal, so some degree of threat remains.

Non-native Species. Approximately 42 percent of all federally listed species in the United States (U.S.) are threatened by non-native species (Pimental et al. 2005). Non-native plants directly compete with rare species for water, nutrients, and sunlight. Non-native plants can also indirectly affect rare species by altering ecosystem processes such as nutrient cycling and fire regimes (Brooks et al. 2004). Over 100 non-native species, approximately 16 percent of the total flora, occur on the Refuge (Service 2006). Of these, salt cedar (*Tamarix ramosissima*), Russian knapweed (*Acroptilon repens*), five hook bassia (*Bassia hyssopifolia*), Malta star thistle (*Centaurea melitensis*), yellow star thistle (*Centaurea solstitialis*), and hoary cress (*Cardaria draba*) are noxious weeds that could potentially threaten the spring-loving centaury (Service 2006).

The wet meadows and old agricultural fields that support the spring-loving centaury, Ash Meadows gumplant, and Ash Meadows ivesia are a favorable environment for non-native, weedy species. There are an estimated 4,460 ac (1,805 ha) of former agricultural fields on the Refuge (Service 2006). Some of these fields are now largely monocultures of non-native plants.

To determine the amount of spring-loving centaury habitat presently threatened by non-native plant species, we overlaid recent Geographic Information System weed mapping with known, occupied spring-loving centaury habitat. Where these coverages overlapped, we determined the spring-loving centaury habitat to be at risk (Figure 3). Through this analysis, we identified approximately 315 ac (127 ha) or roughly 10 percent of the spring-loving centaury habitat to be threatened by non-native plant species. Almost all the habitat identified to be at risk is old agricultural fields that have been left fallow since 1985. Anecdotal observations suggest that in some areas, these non-native plants may have expanded into surrounding wet meadows that support the spring-loving centaury (Service 2006). However, without a formal study, it is difficult to determine if the weeds are expanding beyond the agricultural fields, or if this degraded habitat itself was colonized by the spring-loving centaury.

The Service is addressing the potential threat posed by non-native plant species in two ways. First, the Refuge recently completed an Integrated Pest Management (IPM) Plan (Service 2006) and Geomorphic and Biological Assessment for the Refuge (Otis Bay 2006). Second, the Refuge is treating weeds through a grant funded by the Southern Nevada Public Land Management Act (SNPLMA). The IPM Plan is the Refuge's long-term approach for managing all invasive species on the Refuge and includes mapping, monitoring, and restoration planning. Under this plan, in 2005 the Service began comprehensive vegetation mapping of the Refuge, these efforts continue today. The Geomorphic and Biological Assessment for the Refuge (Otis Bay 2006) describes targets for hydrologic and biologic functioning, and provides a framework for restoring and managing the abandoned agricultural infrastructure that supports weed populations, which threaten the spring-loving centaury. In 2005, the Refuge received funds through the SNPLMA to remove salt cedar over a three-year period. In 2007, the Refuge was successful in removing salt cedar trees on 75 percent of the Refuge (Service 2008). The Refuge completed the initial treatment and removal in 2008, with follow-up treatments to continue. The removal of salt cedar trees is anticipated to create new habitat for the spring-loving centaury.

Non-native plant species will continue to be a potential threat to the spring-loving centaury and the entire Ash Meadows ecosystem; however, there is no evidence at this time to suggest that they currently pose a significant threat to spring-loving centaury. The potential for this threat to increase over the foreseeable future, however, is real but its significance is not easily assessed. The Refuge has clearly had some recent success combating weeds, notably salt cedar. Continued success in controlling the spread of weeds is contingent on continued sufficient funding.

Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization is not a threat to the spring-loving centaury.

Factor C: Disease or Predation

The final listing rule describes grazing by cattle and wild horses as a threat to the spring-loving centaury. After the Refuge was established, cattle were removed. In 1995, wild horses were excluded by construction of roughly 16 mi (25.7 km) of fencing on the perimeter of the Refuge. Because of these positive management practices, we conclude that grazing by cattle and wild horses are no longer threats to the spring-loving centaury.

Factor D: Inadequacy of Existing Regulatory Mechanisms

When the final listing rule was published, the spring-loving centaury was included on the State of Nevada list of critically endangered plants. At that time, the Nevada law was interpreted as simply providing recognition of the species' status, but no legal protection was afforded the individual plants or their habitats. The State of Nevada has since implemented regulations that clarify the Nevada Revised Statutes (NRS) and provide increased protection for State listed species and their habitat. Presently, the spring-loving centaury is listed as critically endangered under NRS 527.260 *et seq.* Under this law, no member of its kind may be removed or destroyed at any time by any means except under special permit issued by the State Forester. The State of Nevada will continue to manage these plant species under the NRS independent of protection

under the Act.

The spring-loving centaur is designated a BLM Special Status Species. Special Status Species are managed to “ensure that actions authorized, funded, or carried out do not contribute to the need for the species to become listed” (BLM Manual 6840.06C). Under recent revisions to BLM Manual 6840, since the spring-loving centaur is State listed, State laws protecting it would apply to all BLM programs and actions to the extent that they are consistent with the Federal Land Policy and Management Act of 1976 (FLPMA; Public Law 94-579, 43 U.S.C. 1701). Protection offered within the BLM ACEC will continue independent of protection under the Act (BLM Manual 6840.06D).

Establishment of the Refuge and BLM Ash Meadows ACEC added new layers of Federal protection not present at the time the final listing rule was published. The Service manages National Wildlife Refuges in accordance to the National Wildlife Refuge System Improvement Act of 1997. This act establishes the protection of biodiversity as the primary purpose of the National Wildlife Refuge System. Lands within the National Wildlife Refuge System are different from other multiple use public lands in that they are closed to all public uses unless specifically and legally opened. Activities that are specifically and legally opened by the Service on National Wildlife Refuges are determined by the purpose for which the particular refuge was established and the Compatibility Policy (603 FW 2), which includes guidelines for determining if a use proposed on a National Wildlife Refuge is compatible with the purposes for which the refuge was established. According to the Service’s 1984 Environmental Assessment: Proposed Acquisition to Establish Ash Meadows National Wildlife Refuge, the purpose of the acquisition was “...to protect the endemic, endangered, and rare organisms (plants and animals) found in Ash Meadows...” Continued protection and management of the spring-loving centaur are central to the Refuge mission and will continue independent of protection under the Act.

In 1998, BLM established the approximately 27,870-acre (11,279-hectare) Ash Meadows ACEC on public lands surrounding the Refuge. BLM’s Las Vegas District Resource Management Plan (RMP) guides management of the ACEC. Management directions for the ACEC include closing the area to livestock grazing; limiting vehicles to existing roads and trails; closing the area to locatable, salable, and leasable minerals; and closing the area to geothermal prospecting and leasing (BLM 1998). The area has also been designated a right-of-way avoidance area except within designated corridors. BLM has closed the area to livestock and limits vehicles to existing roads and trails.

Because the primary distribution of the spring-loving centaur is on Federal lands, additional regulations that provide partial conservation benefit include the National Environmental Policy Act (NEPA, 42 U.S.C. 4321-4347) and FLPMA. NEPA requires Federal agencies, such as BLM and the Service, to describe the proposed action, consider alternatives, identify and disclose potential environmental impacts of each alternative, and involve the public in the decision making process. FLPMA requires BLM “to establish public land policy; to establish guidelines for its administration; to provide for the management, protection, development and enhancement of the public lands; and for other purposes.” Section 102(c) of FLPMA states that the Secretary shall “give priority to the designation and protection of areas of critical environmental concern” in the development of plans for public lands. Although BLM has a multiple-use mandate under the FLPMA, which allows for grazing, mining, and off-highway vehicle (OHV) use, it may also

establish and implement special management areas such as ACECs, wilderness, and research areas, that can reduce or eliminate actions that adversely affect species of concern. The partial protection afforded these species under NEPA and FLPMA will continue independent of protection under the Act.

In 2000, BLM and the Service completed an Environmental Assessment on a proposal to withdraw lands and minerals on approximately 5,360 ac (2,169 ha) within the Refuge boundary from mining for 20 years and 9,460 ac (3,828 ha) of public lands from mineral entry and mining for 20 years (BLM and Service 2000, p. 1-5). As part of the withdrawal process, these lands were temporarily segregated from mineral entry for a two-year period. Although the NEPA process was completed, no decision document has been issued. The withdrawal package for the lands and minerals within the Refuge boundary was transmitted to BLM's Nevada State Office (State Office) in 2008. The State Office has the responsibility to take those reviews, findings, and recommendations, and if they concur, prepare a transmittal of same, or modifications, to the BLM Washington Office. If, after further review, the State Office submission is found acceptable, the case file and a draft public land order (PLO) are transmitted to the Assistant Secretary for Land and Minerals Management at the Department of the Interior. If approved by the Assistant Secretary, the PLO is forwarded to the Federal Register for publication (BLM and Service 2000, p. 1-8).

The withdrawal becomes effective on the publication date of the PLO. Section 204(c)(1) of FLPMA limits withdrawals of 5,000 ac (2,023 ha) or more to a period of no more than 20 years. However, upon review by the Secretary of Interior (Secretary) toward the end of the withdrawal period, the withdrawal may be extended for a period of time no longer than the original withdrawal period if the Secretary determines that the purpose for which the withdrawal was first made requires the extension (Section 204(f) of FLPMA).

The Clark County Public Land and Natural Resource Act of 2002 (Public Law 107-282, November 6, 2002) included a mineral withdrawal of all ACECs identified in BLM's Las Vegas Field Office RMP for a five-year period. A subsequent two-year extension of this temporary segregation was published on November 1, 2007, that included the Ash Meadows ACEC (72 FR 61898). The process for formal withdrawal of these lands is the same as that described above for the withdrawal of lands and minerals within the Refuge boundary.

In summary, since the final listing rule was published, existing regulations have been strengthened and new regulatory mechanisms have been developed to protect and conserve the spring-loving centaury. These measures will continue independent of protection under the Act. The process for the withdrawal of lands and minerals within the Refuge, is ongoing, but not yet complete. Until the PLO is approved and published in the Federal Register, 14,820 ac (5,795 ha), about 63 percent of the public land with the Refuge boundary, remains open to mineral entry. In the meantime, land within the adjacent ACEC is temporarily segregated until November 1, 2009 (72 FR 61898). Unless a PLO is published prior to that date, or a temporary segregation is again published, these lands will also again be open to mineral entry. Neither withdrawal will affect valid existing mining claims. A complete analysis of the significance of the threat posed by surface mining to spring-loving centaury is provided in the Factor A discussion above. Because of the uncertainties that exist regarding the actual publication of a

PLO withdrawing lands within the Refuge and ACEC from mineral entry, the timing of any withdrawals and the likelihood that surface mining would be proposed in either of these areas, regulatory mechanisms to protect spring-loving centaury and its habitat are currently inadequate.

Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

Trampling by Wild Horses. The final listing rule described trampling by wild horses as a threat to the spring-loving centaury and other listed Ash Meadows plants. Fencing on the perimeter of the Refuge stopped or limited wild horse presence on the Refuge (see Factor C discussion above). Accordingly, trampling by wild horses is no longer a threat to the spring-loving centaury.

Vulnerability to Environmental Uncertainty. Small populations like the spring-loving centaury have a higher risk of extinction due to environmental stochasticity (Shaffer 1981, 1987; Gilpin and Soulé 1986). The environment at Ash Meadows is stable; however, extreme flash flooding is a potential environmental event that could affect the spring-loving centaury. The spring-loving centaury is distributed over multiple major and minor subpopulations in the area. This distribution creates population redundancy. Because of this redundancy, we do not consider the spring-loving centaury to be vulnerable to a catastrophic flash flood; therefore, we do not consider the spring-loving centaury threatened by environmental stochasticity.

Climate Change. The spring-loving centaury is a wetland dependent species. Current climatic modeling predicts the southwestern U.S. is likely to experience increased frequency of regional drought in response to elevated levels of atmospheric carbon dioxide (Seager et al. 2007). The springs and surface streams that support the spring-loving centaury are perennial and they originate from a regional aquifer that includes runoff from the Spring Mountains approximately 100 mi (161 km) to the northeast (USGS 2005). This aquifer is recharged from precipitation within the same area. Other climate predictions suggest the intensity of precipitation events may increase in response to elevated levels of atmospheric carbon dioxide (IPCC 2007). Whether or not increased precipitation associated with more intense events would offset a decrease in the frequency in precipitation events is unknown. Therefore, at this time the potential effects of climate change to the regional aquifer that supports the Ash Meadows ecosystem are unknown. However, we do not believe that climate change is likely to affect spring-loving centaury over the 10-year period of this analysis. Continued groundwater monitoring of the Ash Meadows ecosystem (see Factor A discussion above) is important to identify climate change as a potential threat.

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery

approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management. Assessing a species' degree of recovery is likewise an adaptive process that may or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

The Service completed the Recovery Plan in 1990 using the best available information (Service 1990). The primary objective of the Recovery Plan was to restore the 12 listed species to a non-listed status, with the exception of the Devils Hole pupfish (the Recovery Plan concluded that complete recovery and delisting of the Devils Hole pupfish are unlikely due to its extremely restricted habitat requirements, population size, and threats that will never be eliminated). Recovery of the spring-loving centaury and other Ash Meadows listed species is addressed through an ecosystem approach with the intent of either reclassifying or delisting them simultaneously.

Eight of the recovery objectives in the Recovery Plan apply to the spring-loving centaury. Four of the eight are derived from downlisting criteria for the Ash Meadows endangered species. These objectives address major threats to the entire Ash Meadows ecosystem. Delisting objective number 1 for the seven threatened species, including the spring-loving centaury, requires major threats to the ecosystem be addressed before delisting of the seven threatened species can be realized. The remaining objectives are concerned with reestablishing the historic range of the species.

Downlisting Objectives from the Recovery Plan that apply to Spring-loving Centaury

1. All non-native animals and plant species must be eradicated for essential habitat. These non-native species currently include sailfin mollies, mosquito fish, largemouth bass, black bullheads, bullfrogs, crayfish, turban snails, wild horses, salt cedar, and Russian olive.
2. Secure and protect the Ash Meadows aquifer so that all spring flows return to historic discharge rates, and the water level in Devils Hole is maintained at a minimum level of 1.4 feet below the copper washer.
3. Reestablish water to historic springbrook channels, which are free of barriers that eliminate genetic exchange between populations by preventing movement of native fishes throughout their historic range.
4. The essential habitat must be secure from detrimental human disturbance including mining, OHVs, and the introduction of non-native species.

Delisting Objectives from the Recovery Plan that apply to Spring-loving Centaury

1. Criteria shown above for downlisting from endangered to threatened.
2. Secure, protect, and maintain in natural vegetation, corridors, and adjacent buffer areas for gene flow and dispersal of listed plant species within the essential habitat.
3. Native plant communities and aquatic communities have been reestablished to historic structure and composition within all essential habitats.
6. All of the listed plant species and the candidate plant species are present in all the sites that they have historically occupied as identified in Appendix A Table XV of the Recovery Plan. Within each critical habitat unit, the listed plant has a frequency value equal to or greater than the frequency value determined by Task 644 needed as an indicator of a self-sustaining plant population.

Downlisting objective 1 requires the management of non-native species that could compete with or alter habitat for the listed plants and the removal of wild horses that could graze or trample these species. The threat posed by non-native species (see Factor A discussion above) can never be completely removed; however, the Refuge has made significant progress toward addressing this threat, including the removal of salt cedar on more than 75 percent of the Refuge and by developing and implementing an IPM Plan (see Factor A discussion above). In our threats analysis we conclude that non-native species do not currently pose a significant threat to the spring-loving centaury (see Factor A discussion above); therefore, we determine this recovery objective has been achieved. Downlisting objective 1 also requires the removal of wild horses from the Refuge. This issue has been resolved and grazing and/or trampling from wild horses and livestock is no longer a threat to the spring-loving centaury and the six other listed Ash Meadows plants (see Factor C and E discussions above). Based on this information, we conclude downlisting objective 1 is complete.

Downlisting objectives 2 and 3 require the Ash Meadows ecosystem hydrology be protected and secure. Due to the uncertainties that remain regarding the full exercise of existing water rights in the Amargosa Valley and its potential effects on spring flow and groundwater levels within the Refuge, we conclude that objectives 2 and 3 have not been met.

Downlisting objective 4 requires the range and habitat of these species be protected from OHV activities, mining, and the introduction of non-native species. The Refuge is closed to OHV recreation and OHV activity and within the BLM ACEC is limited to existing roads, trails, and dry washes. As discussed under Factors A and D, while the Service owns some mineral rights and surface estates, about 62 percent of the public lands within the Refuge remain open to land and mineral entry. Public land within the ACEC is under a temporary segregation which expires on November 1, 2009. Valid existing mining claims would not be affected by either withdrawal action. Because of the uncertainties that exist regarding the actual publication of a PLO withdrawing lands within the Refuge and ACEC from mineral entry, the timing of any

withdrawals, and the likelihood that surface mining would be proposed in either of these areas, we conclude that regulatory mechanisms to protect spring-loving centaury and its habitat currently remain inadequate.

As additionally discussed under Factor A, weeds threaten only a small portion (less than 10 percent) of the spring-loving centaury distribution, and the Refuge has taken significant steps to manage non-native plant species. These steps include the development of an IPM Plan and the near complete removal of salt cedar from the Refuge. We do not consider weeds to be a significant threat at this time to the spring-loving centaury (see Factor A discussion above).

Delisting objective 2 requires habitat for the seven listed plant species be protected and viable. At the time of listing, a large portion of Ash Meadows was privately owned; however, the Service has since actively acquired most of the in holdings within the Refuge. Habitat for the spring-loving centaury is now almost entirely protected from development within the Refuge boundary and surrounding BLM ACEC (see Factor A discussion above). Our understanding of the range and distribution of the spring-loving centaury has also changed. At the time of listing the spring-loving centaury and other Ash Meadows' plants were only known from a few limited occurrences; consequently, long-term population viability was thought to be a concern. We now know the range and distribution of the spring-loving centaury to be much larger. In addition, it appears that through natural recovery the distribution of the spring-loving centaury has increased since listing (see Spatial Distribution/Abundance discussion above). Based on this information, we conclude delisting objective 2 has now been achieved.

Delisting objectives 3 and 6 require the habitat structure and composition (objective 3) and range and distribution (objective 6) of the spring-loving centaury be returned to historic conditions. It is likely not feasible to recreate the historic distribution of the spring-loving centaury due to the severe disturbance that occurred prior to listing. The conversion of spring-loving centaury habitat into agricultural fields and sites for development may have altered the soils and hydrology needed to support the spring-loving centaury. In some areas, tilling and the addition of sand, and organic matter, to make these sites suitable for agriculture, likely destroyed the unique soils that the species requires. Grading and tilling has locally destroyed the surface drainage patterns characteristic of spring-loving centaury habitat. Given the biology and life history of the spring-loving centaury, it is likely most of the locations that historically supported the species and are presently able to support the species are occupied. Based on this information, establishing the spring-loving centaury in all historic sites as required by the Plan is no longer practical and we believe that the emphasis of recovery should be on ensuring and maintaining the viability of the species.

Some specific recovery tasks under both objectives 3 and 6 have not been achieved because they are no longer feasible, relevant, or practical. For example, Task 644, under delisting objective 6, calls for monitoring plots to be established to determine reference conditions and to track vegetation change on recovered sites. Since most of the recovery to date has been through natural succession and 23 years have elapsed, this type of data can no longer be collected to determine recovery. Based on the present distribution of the spring-loving centaury and the level of natural recovery that has taken place to date, we conclude the intent of delisting objectives 3 and 6 has been achieved.

In summary, the ecosystem approach outlined in the Recovery Plan allows for a broad range of activities to be conducted, which directly or indirectly benefit all of the listed and sensitive species on the Refuge. Recovery Plan objectives that address some of the major anthropogenic threats (such as, cattle and wild horse trampling and grazing, and OHV activity) have been addressed or are currently being managed in such a way they no longer pose a significant threat to the spring-loving centaury. However, uncertainties remain about the significance of the threats posed by groundwater pumping and surface mining.

IV. SYNTHESIS

The status of the spring-loving centaury has dramatically improved since it was petitioned for listing in 1983. When it was listed, spring-loving centaury was known from 17 occurrences in the Ash Meadows area, all threatened by on-going and proposed agriculture, urban development, and groundwater pumping. Presently the species is known to occupy at least 3,000 ac (1,214 ha) and the population was estimated to exceed 4,000,000 individuals in 2008. Nearly all spring-loving centaury habitat and the surface water rights that support it are now under Service and BLM ownership and are managed as special resource areas, including the Refuge and BLM Ash Meadows ACEC. Both groundwater pumping and surface mining remain a threat of uncertain significance to spring-loving centaury in the foreseeable future.

Non-native species are managed in such a way they no longer threaten the spring-loving centaury. Managing invasive species is a priority for the National Wildlife Refuge System and, in recent years, the Refuge has made significant strides in addressing and managing this potential threat. We expect these positive management practices to continue. The distribution of the spring-loving centaury occurs across a broad enough area and in a diverse range of conditions that the species is not threatened by environmental stochasticity. The perennial nature and underlying geology of the aquifer that sustains the spring-loving centaury and Ash Meadows ecosystem is such that the potential effects of climate change are unknown; however, continued groundwater monitoring will identify if it becomes a threat in the future.

Many recovery objectives described in the Recovery Plan for this species have largely been achieved or are no longer relevant. However, because of the remaining uncertainties regarding the potential significance of groundwater pumping and surface mining in the foreseeable future, we conclude that the spring-loving centaury continues to meet the definition of a threatened species.

V. RESULTS

Recommended Listing Action:

- Downlist to Threatened
- Uplist to Endangered
- Delist (indicate reason for delisting according to 50 CFR 424.11):
 - Extinction*
 - Recovery*
 - Original data for classification in error*
- No Change

New Recovery Priority Number and Brief Rationale:

We are changing the recovery priority number from 18 to 14. Previously spring-loving centaury was considered to face a low degree of threat and have a low recovery potential. We now believe that the species still faces significant low magnitude threats from surface mining and groundwater withdrawal, but it has a high recovery potential.

Listing and Reclassification Priority Number and Brief Rationale:

N/A

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT FIVE YEARS

Over the next five years, the Service should focus on clarifying or resolving the uncertainties regarding the significance of the remaining threats to spring-loving centaury, i.e., groundwater pumping and surface mining.

We anticipate that major issues with respect to the significance of the threat posed by groundwater pumping will become clear over the next five years. Specifically, we expect that the Nevada State Engineer will clarify how Order 1197 will be implemented. In addition, environmental analyses will likely be completed on the anticipated effects of at least some of the proposed solar energy projects, and these should include detailed assessments of the potential effects of any groundwater development requirements on the regional and local aquifers, including potential effects on the springs and groundwater table within the Refuge. The Service should participate in the review of these analyses to ensure that they adequately disclose all potential impacts that could affect spring-loving centaury. The Service will also continue its participation in interagency monitoring, modeling, and assessment of the Death Valley Groundwater Flow System.

The Service and BLM should continue to work toward the completion of the land and mineral withdrawals for public lands within the Refuge and the ACEC. This will likely require that, once the withdrawal packages have been forwarded by the Nevada State Director of BLM to BLM's Washington Office, that briefings be scheduled with the Service Washington Office staff to ensure that the importance of this withdrawal to all of the listed species at Ash Meadows is recognized.

Finally, research on the role of fire in maintaining habitat for spring-loving centaury is needed, including both wild fire and prescribed burning.

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VIII. PERSONAL COMMUNICATIONS, PERSONAL OBSERVATIONS, AND *IN LITTERIS* REFERENCES CITED

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**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW**

Centaurium namophilum (Spring-loving centaury)

Current Classification:

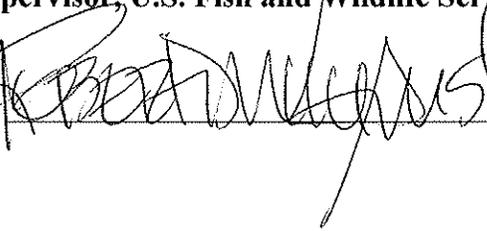
Recommendation Resulting from the 5-Year Review:

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

Review Conducted By: Steve Caicco, Nevada Fish and Wildlife Office

FIELD OFFICE APPROVAL

State Supervisor, U.S. Fish and Wildlife Service

Approve  Date 8/13/09

Figures

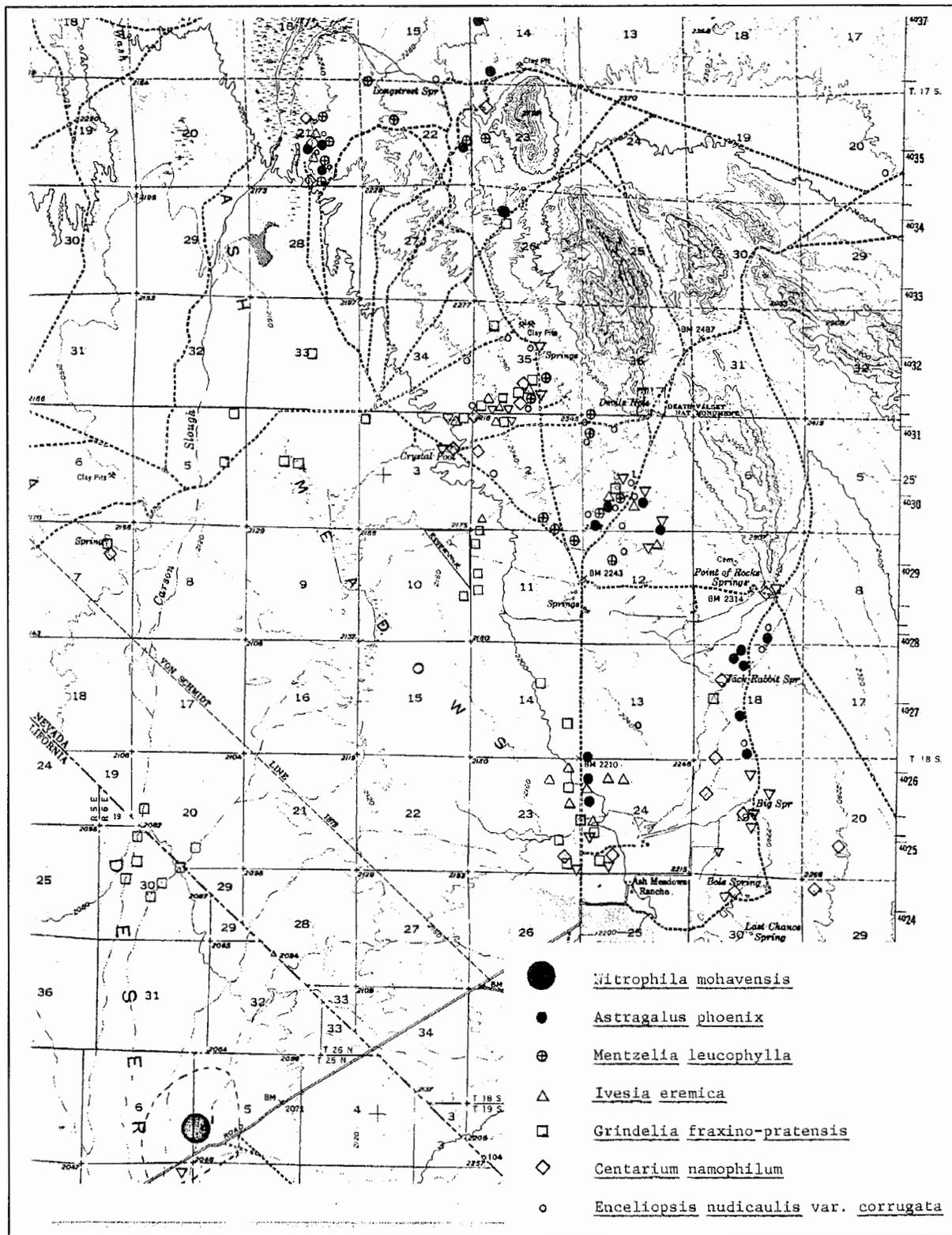


Figure 1. Map of Rare and Endangered Plants of Ash Meadows Nye County, Nevada. Compiled by Susan Cochrane, February 24, 1981, based on personal observations and fieldwork 1977-1980 and from "Endangered (and Threatened) Plant Species of the Nevada Test Site, Ash Meadows and Central-Southern Nevada" by Janice C. Beatley, February 1977. Updated November 4, 1981 from July, August and October 1981 fieldwork.



Spring-loving Centaury (*Centaureum namophilum*) Distribution and Critical Habitat

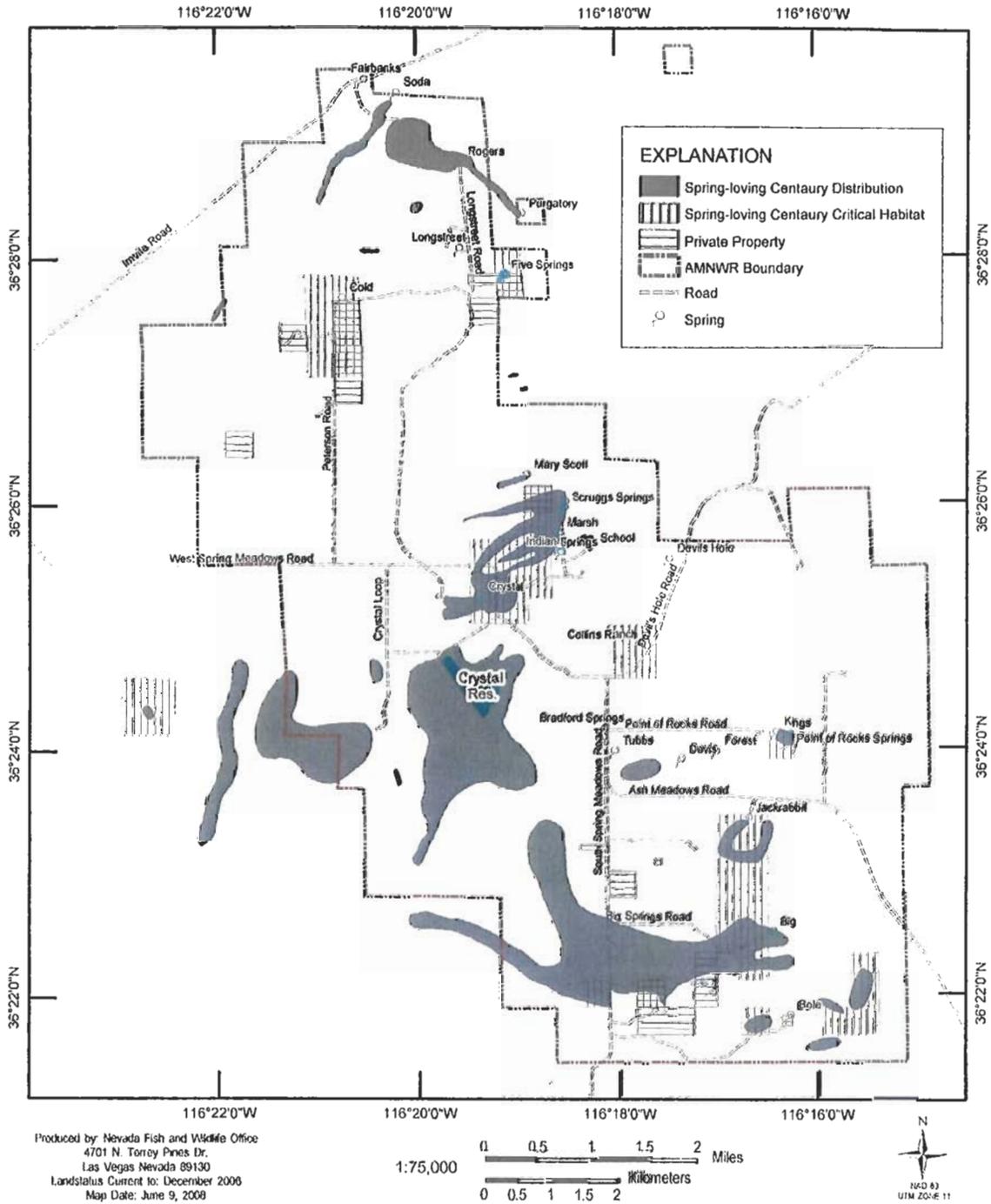


Figure 2. General sites identified by Knight and Clemmer (1987) where the spring-loving centaury (*Centaureum namophilum*) occurs; polygon boundaries are based on Glenne 1998. Areas designated as critical habitat at the time of listing are also shown. Map prepared by the U.S. Fish and Wildlife Service June 2008.



U.S. Fish & Wildlife Service
Ash Meadows National Wildlife Refuge
 Nye County, Nevada

Spring-loving Centaury (*Centaureum namophilum*) Habitat Threatened by Non-Native Plants

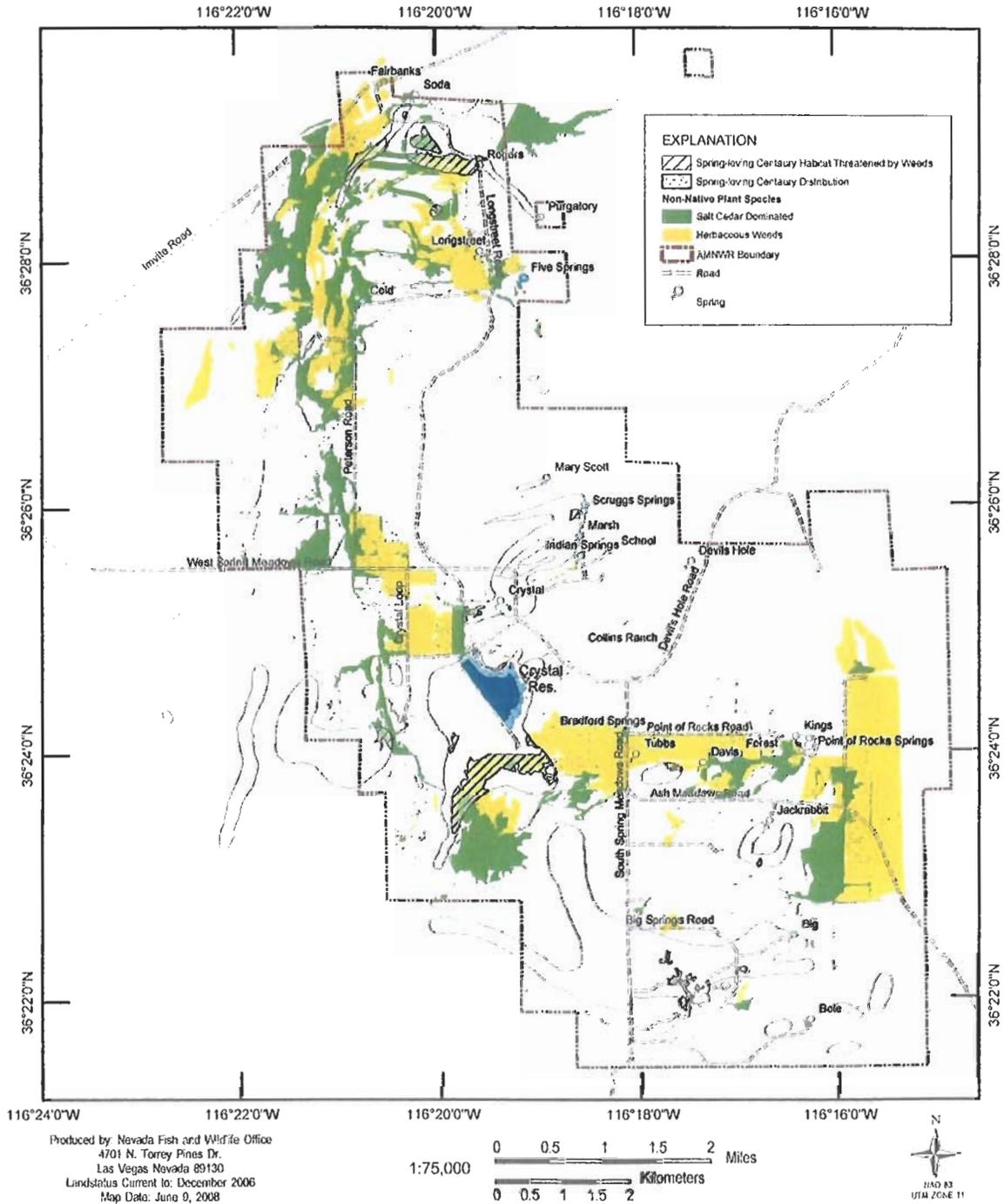


Figure 3. Vulnerability of spring-loving centaury (*Centaureum namophilum*) habitat to non-native plants. Map prepared by U.S. Fish and Wildlife Service June 2008.