§ 160.151–7 [Amended]

3. Amend § 160.151–7 by removing the words ''IMO LSA Code'' wherever they appear and adding, in their place, the words ''IMO LSA Code, as amended by Resolution MSC.293(87),''.

§ 160.151–15 [Amended]

4. Amend § 160.151–15 by removing the words ''IMO LSA Code'' wherever they appear and adding, in their place, the words ''IMO LSA Code, as amended by Resolution MSC.293(87),''.

§ 160.151–17 [Amended]

5. Amend § 160.151–17 by removing the words ''IMO LSA Code'' wherever they appear and adding, in their place, the words ''IMO LSA Code, as amended by Resolution MSC.293(87),''.

§ 160.151–21 [Amended]

6. Amend § 160.151–21 as follows:

a. Remove the words ''IMO LSA Code'' wherever they appear and add, in their place, the words ''IMO LSA Code, as amended by Resolution MSC.293(87),''; and

b. In paragraph (f), remove the words ''IMO Revised recommendation on testing'' and add, in their place, the words ''IMO Revised recommendation on testing, as amended by Resolution MSC.295(87),''.

§ 160.151–27 [Amended]

7. Amend § 160.151–27 by removing the words ''IMO Revised recommendation on testing'' wherever they appear and adding, in their place, the words ''IMO Revised recommendation on testing, as amended by Resolution MSC.295(87),''.

§ 160.151–29 [Amended]

8. Amend § 160.151–29 as follows:

a. In the introductory text, remove the words ''IMO LSA Code'' and add, in their place, the words ''IMO LSA Code, as amended by Resolution MSC.293(87),''; and

b. In the introductory text, remove the words ''IMO Revised recommendation on testing'' and add, in their place, the words ''IMO Revised recommendation on testing, as amended by Resolution MSC.295(87),''.

§ 160.151–31 [Amended]

9. Amend § 160.151–31 by removing the words ''IMO Revised recommendation on testing'' wherever they appear and adding, in their place, the words ''IMO Revised recommendation on testing, as amended by Resolution MSC.295(87),''.

§ 160.151–33 [Amended]

10. Amend § 160.151–33 by removing the words ''IMO LSA Code'' wherever they appear and adding, in their place, the words ''IMO LSA Code, as amended by Resolution MSC.293(87),''.

§ 160.151–57 [Amended]

11. Amend § 160.151–57 by removing the words ''IMO Revised recommendation on testing'' wherever they appear and adding, in their place, the words ''IMO Revised recommendation on testing, as amended by Resolution MSC.295(87),''.

Dated: September 22, 2011.

J.G. Lantz,

Director of Commercial Regulations and Standards, U.S. Coast Guard.

[FR Doc. 2011–25032 Filed 10–7–11; 8:45 am]

BILLING CODE P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R2–ES–2011–0081; MO92210–0–0008]

Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List Amoreuxia gonzalezii, Astragalus hypoxylus, and Erigeron piscaticus as Endangered or Threatened

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Notice of 12-month petition finding.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), announce a 12-month finding on a petition to list *Amoreuxia gonzalezii* (Santa Rita yellowshow), *Astragalus hypoxylus* (Huachuca milk-vetch), and *Erigeron piscaticus* (Fish Creek fleabane) as endangered or threatened with critical habitat under the Endangered Species Act of 1973, as amended (Act). After review of the best scientific and commercial information available, we find that listing *Amoreuxia gonzalezii, Astragalus hypoxylus,* and *Erigeron piscaticus* is not warranted at this time. However, we ask the public to submit to us any new information that becomes available concerning the threats to *Amoreuxia gonzalezii, Astragalus hypoxylus,* and *Erigeron piscaticus* or their habitats at any time.

DATES: The finding announced in this document was made on October 11, 2011.

ADDRESSES: This finding is available on the Internet at *http://www.regulations.gov* at Docket Number FWS–R2–ES–2011–0081. Supporting documentation we used in preparing this finding is available for public inspection, by appointment, during normal business hours by contacting the U.S. Fish and Wildlife Service, Arizona Ecological Services Field Office, 2321 W. Royal Palm Road, Suite 103, Phoenix, AZ 85021; telephone (602) 242–0210; facsimile (602) 242–2513. If you use a telecommunications device for the deaf (TDD), please call the Federal Information Relay Service (FIRS) at (800) 877–8339. Please submit any new information, comments, or questions concerning this finding to the above street address.

FOR FURTHER INFORMATION CONTACT: Steve Spangle, Field Supervisor, U.S. Fish and Wildlife Service, Arizona Ecological Services Field Office, 2321 W. Royal Palm Road, Suite 103, Phoenix, AZ 85021; telephone (602) 242–0210; facsimile (602) 242–2513. If you use a telecommunications device for the deaf (TDD), please call the Federal Information Relay Service (FIRS) at (800) 877–8339.

SUPPLEMENTARY INFORMATION:

Background

Section 4(b)(3)(B) of the Act (16 U.S.C. 1531 *et seq.*) requires that, for any petition to revise the Federal Lists of Threatened and Endangered Wildlife and Plants that contain substantial scientific or commercial information indicating that listing a species may be warranted, we make a finding within 12 months of the date of receipt of the petition. In this finding, we will determine that the petitioned action is: (a) Not warranted, (b) warranted, or (c) warranted, but immediate proposal of a regulation implementing the petitioned action is precluded by other pending proposals to determine whether species are endangered or threatened, and expeditious progress is being made to add or remove qualified species from the Lists of Endangered and Threatened Wildlife and Plants. Section 4(b)(3)(C) of the Act requires that we treat a petition for which the requested action is found to be warranted but precluded as though resubmitted on the date of such finding, that is, requiring a subsequent finding to be made within 12 months. We must publish these 12-month findings in the **Federal Register**.

Previous Federal Actions

Amoreuxia gonzalezii, Astragalus hypoxylus, and Erigeron piscaticus were formerly Category 2 candidate species, which are taxa for which information in our possession indicated that proposing to list was possibly appropriate, but for which persuasive data on biological

vulnerability and threats were not available to support a proposed listing rule (58 FR 51144; September 30, 1993). The designation of Category 2 candidate species was discontinued in 1996; therefore, these species are not currently considered candidates.

On June 25, 2007, we received a formal petition dated June 18, 2007, from Forest Guardians (now WildEarth Guardians), requesting that we do the following: (1) Consider for listing all full species in our Southwest Region ranked as G1 or G1G2 by the organization NatureServe, except those that are currently listed, proposed for listing, or candidates; and (2) list each species under the Act as either endangered or threatened and designate critical habitat. The petitioners presented two tables that collectively listed 475 species for consideration and requested that the Service incorporate all analyses, references, and documentation provided by NatureServe in its online database *http://www.natureserve.org/* into the petition. The petition clearly identified itself as a petition and included the appropriate identification information, as required in 50 CFR 424.14(a). We acknowledged the receipt of the petition in a letter to WildEarth Guardians dated July 11, 2007.

On December 16, 2009, we made a 90-day finding (74 FR 66866) that the petition presented substantial scientific information indicating that listing 67 of the 475 species may be warranted; *Amoreuxia gonzalezii, Astragalus hypoxylus,* and *Erigeron piscaticus* were in that group of 67 species. For *Amoreuxia gonzalezii,* the petition listed urban and mining development and herbivory as threats to the species and its habitat, along with competition from nonnative species. For *Astragalus hypoxylus,* the petition listed degradation of habitat from livestock grazing and impacts from recreation, as well as indirect effects to bees, which may be the primary pollinator of this species. For *Erigeron piscaticus,* the petition listed recreational impacts, poor watershed conditions, flooding, and small population size as threats to the species and its habitat. The 90-day finding initiated a status review for these three plants (74 FR 66866; December 16, 2009). This notice constitutes the 12-month finding on the June 18, 2007, petition to list *Amoreuxia gonzalezii, Astragalus hypoxylus,* and *Erigeron piscaticus* as endangered or threatened.

Evaluation of the Status of Each of the Three Plant Species

Section 4 of the Act (16 U.S.C. 1533) and implementing regulations (50 CFR part 424) set forth procedures for adding species to, removing species from, or reclassifying species on the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, a species may be determined to be endangered or threatened based on any of the following five factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

In making these findings, information pertaining to each species in relation to the five factors provided in section 4(a)(1) of the Act is discussed below. In considering what factors might constitute threats to a species, we must look beyond the exposure of the species to a particular factor to evaluate whether the species may respond to the factor in a way that causes actual impacts to the species. If there is exposure to a factor and the species responds negatively, the factor may be a threat, and during the status review, we attempt to determine how significant a threat it is. The threat is significant if it drives, or contributes to, the risk of extinction of the species such that the species warrants listing as endangered or threatened as those terms are defined by the Act. However, the identification of factors that could impact a species negatively may not be sufficient to compel a finding that the species warrants listing. The information must include evidence sufficient to suggest that the potential threat has the capacity (*i.e.,* it should be of sufficient magnitude and extent) to affect the species' status such that it meets the definition of endangered or threatened under the Act.

Evaluation of the Status of Each of the Three Plant Species

For each of the three species, we provide a description of the species and its life-history and habitat, an evaluation of threats for that species, and our finding that the petitioned action is warranted or not for that species.

Species Information for *Amoreuxia gonzalezii*

Species Description

Amoreuxia gonzalezii is an herbaceous perennial (plant living 3 or more years) in the Bixaceae family (Lipstick tree). The plant has a thickened starchy to woody rootstock, erect stems to 50 centimeters (cm) (20 inches (in)) in height, and long-petioled (long-stalked) leaves that are deeply parted into five to seven spathulate (spoon-shaped) lobes (Poppendieck 1981, p. 24). The inflorescences (clusters of flowers) are few-flowered terminal cymes (branched flower clusters) with salmon- to yellow-colored flowers with maroon marks at the base of the upper and lower petals (Hodgson 1994, p. 3). The densely silky hair of the ovary is one of two main characteristics that separate this species from its more common relative *A. palmatifida* (Hodgson 1994, p. 4). The second characteristic separating the two species is the mature fruit. The capsule in *A. gonzalezii* is ellipsoid and the seeds spherical; in *A. palmatifida,* the capsules are ovoid with reniform (kidney-shaped) seeds (Hodgson 1993, p. 27). Recent molecular work by Fulton (2011, pers. comm.) verifies that *A. gonzalezii* is a valid taxon, and we consider the species a listable entity.

Habitat and Biology

Amoreuxia gonzalezii is the farthest north-occurring species within this tropical and sub-tropical genus found primarily in South America (the primary center of diversification), Central America, and Mexico (Poppendieck 1981, p. 24). Northern Mexico is the secondary center of diversification for the genus and contains the majority of documented locations of *A. gonzalezii* (Hodgson 1994, p. 5). In Mexico, *A. gonzalezii* is found in tropical areas in foothills thornscrub and tropical deciduous forest. Rainfall amounts range from 28 cm per year (11 in) near the coast (thornscrub) to 60 cm (24 in) in tropical deciduous forest. Freezes are very uncommon, and the bulk of rainfall occurs from July through mid-September. The plants in these vegetation communities are rainfall sensitive; in other words, the shrubs and trees leaf out only when the rains begin, and drop their leaves when the rainy season ends, usually in October (Yetman and Van Devender 2002, pp. 9–12). Geology of collection sites varies from granitic, to quartz, to shale with quartz nodules and intrusives (molten igneous rock that is forced into cracks or between other layers of rocks). In the state of Sonora in Mexico, *A. gonzalezii* has been collected from the vicinity of Álamos, Choquincahui, El Oasis, Guirocoba, Magdalena, Moctezuma, Onavas, Santa Ana, Tónichi, and Yocogigua, as well as the Curea-Guadalupe Tayopa area. In the state of Sinaloa in Mexico, the plant was

described from near Choix in the north. The specimens were found on both shallow and steep hill slopes at elevations from 160 to775 meters (m) (525 to 2542 feet (ft)).

In the United States, *Amoreuxia gonzalezii* has been collected from the Devil's Cashbox area in the Santa Rita Mountains and Thomas Canyon in the Baboquivari Mountains (Southwest Environmental Information Network 2011). Both locations are in southeastern Arizona. We believe that the Arizona locations represent the northernmost distribution of this species. The Santa Rita *A. gonzalezii* plants are on lands administered by the Coronado National Forest, Nogales Ranger District. The plants occur in the foothills at an elevation of 1,311 to 1,402 m (4,300 to 4,599 ft) on steep limestone slopes and ridgetops. The habitat is described as the transition zone between Upper Sonoran desertscrub and grassland (NatureServe 2010). The collection from the granitic Baboquivari Mountains was from the sandy bank of a small drainage on private land at 1,280 to 1,371 m (4,198 to 4,497 ft) elevation. This site was described as an oak woodland and grassland (Southwest Environmental Information Network 2011).

Very little is known about the biology of this species. *Amoreuxia gonzalezii* has a drought avoidance adaptation and only produces stems, leaves, flowers, and fruits following monsoon rains; it remains dormant under the ground the remainder of the year (Coronado National Forest 1991, p. 3). Flowering occurs from July through September; flowers remain open only in the morning hours, closing by 11:00 a.m. (Hodgson 1994, p.7). The species is an obligate outcrosser (needs pollen from another individual to successfully produce seed) and may be pollinated by unknown species of bees (Hodgson 1994, p. 7). Fruits develop in late July and August, maturing in September to mid-October (Hodgson 1994, p. 7). Both flower and fruit production is dependent on the quantity of summer precipitation. *Amoreuxia gonzalezii* also reproduces vegetatively (asexually) from thick, tuberous or woody roots (Hodgson 2001, p. 94).

In 1987 and 1988, staff from the Desert Botanical Garden (Garden) collected 142 seeds from the Devil's Cashbox area as part of the Center for Plant Conservation National Collection program for conserving rare plants and their seeds. The Garden's purpose was to determine viability of stored seed and increase the number of plants in their living collection (Desert Botanical Garden 1991, p. 1). An additional 72 seeds were collected by Garden staff from one population in Sonora, Mexico at an unknown date prior to 1991. In greenhouse trials, the Garden had variable low rates of success, from 0 to 43 percent, in germinating 4-year-old seed stored both at room temperature and in a freezer facility. Viability of the seed bank and germination success in the wild is unknown, though Hodgson did report finding 10 seedlings in 1991 in the Devil's Cashbox area (Southwest Environmental Information Network 2011). In a greenhouse experiment, 4 plants produced 7 fruits with a total of 232 seeds (Hodgson 1994, p. 7). Assuming this may be optimum fruiting potential given ample water and greenhouse care, the small population sizes from known populations (4to 24 individuals) may produce few seeds in typical years. There are no monitoring plots or current research in any of the populations in Arizona and Mexico.

Abundance

There are virtually no population estimates for any locations in Mexico, although Hodgson (1994, p. 7) reported that one population in Mexico in 1988 had ''well over two dozen'' individuals. The information is not much better for the Arizona populations. Population estimates for the Santa Rita population ranged from 14 individuals in 1988 (Southwest Environmental Information Network, 2011), to 4 individuals in 1989 (Hodgson 1989, p. 2), and 25 individuals in 1991 (Southwest Environmental Information Network, 2011). Hodgson (1994, p. 7) reports fewer than 24 individuals from 2 micro-populations in the Santa Rita Mountains. There were an estimated six to eight individuals in the Thomas Canyon population (Toolin 2011, pers. comm.) in the 1990s. Thomas Canyon was surveyed in 2011 and 30 plants were found (M. Baker 2011, pers. comm.).

In summary, there is very little ecological information available regarding *Amoreuxia gonzalezii.* The species is found in Mexico, and the United States, where the Arizona locations seem to represent the northernmost locations for this species. The best available scientific information does not indicate that this species was more widespread or that known populations have been extirpated. Both populations in Arizona seem to support a few individuals that are widely scattered over appropriate habitat. The species' growth is tied to the summer rains (monsoon), and in the fall, the plants become dormant. It seems likely that this species is more abundant in Mexico, and may be more closely tied with the thornscrub and tropical deciduous forest plant communities, which are more humid, and where many plant species grow in response to summer rainfall.

Five-Factor Evaluation for *Amoreuxia gonzalezii*

In making this finding, information pertaining to *Amoreuxia gonzalezii* in relation to the five factors provided in section 4(a)(1) of the Act is discussed below.

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Potential factors that may affect the habitat or range of *Amoreuxia gonzalezii* are discussed in this section, including: (1) Nonnative, invasive species; (2) fire; (3) development; (4) mining; (5) watershed degradation; (6) drought; and (7) climate change.

Nonnative, Invasive Species

Throughout the Sonoran Desert ecosystem, invasions of the introduced *Pennisetum ciliare* (buffelgrass), *Bromus rubens* (red brome), *Eragrostis lehmanniana* (Lehmann lovegrass), *Schismus barbatus* (Mediterranean grass), and *Pennisetum setaceum* (crimson fountaingrass) have altered nutrient regimes; species composition and structure; and fire frequency, duration, intensity, and magnitude (Brooks and Pyke 2001, p. 5). Although most of these species were intentionally introduced as forage for livestock, erosion control, or as ornamentals, each is now considered invasive and a threat to this ecosystem. Species such as *P. ciliare* are expected to increase their range even with continued and predicted drought events (Ward *et al.* 2006, p. 724). It is generally thought that invasion by exotic annual grasses will continue unchecked in the Sonoran Desert ecosystem in the future, reducing native biodiversity through direct competition and alteration of nutrient and disturbance regimes (Franklin and Molina-Freaner 2010, p. 1671).

Although exotic grasses are reported to threaten *Amoreuxia gonzalezii* (Hodgson 1989, p. 3), no exotic grasses were noted within the Devil's Cashbox habitat during field surveys in May 2011 (Service 2011a, p. 1). We have reviewed the best available scientific information on exotic plants in or near populations of *A. gonzalezii* in Thomas Canyon and in Mexico. In order to verify the identification and location of plants, specimens are collected, pressed and placed on sheets that are stored in herbaria. The labels on herbarium sheets often note associated plant species that

are found in association with the collected specimen. There are no exotic species noted as associates on any of the 12 specimen herbarium sheets located at the Arizona State University, University of Arizona, or the Sonoran University Herbarium collections, nor were any exotics noted in the Devil's Cashbox and Sonora *A. gonzalezii* habitat descriptions in Hodgson 1994 (pp. 5–6). Therefore, the best available information does not provide evidence that nonnative invasive species are a threat to the continued existence of *A. gonzalezii* or are likely to become so.

Fire

There has been no scientific study on the impacts of fire on *Amoreuxia gonzalezii.* This species is present aboveground in July through October, and is dormant the remainder of the year. Because fires in Arizona usually burn in the premonsoon season (May–June), it seems unlikely that fire would affect this species (Alford *et al.* 2005, p. 453). In addition, the plant has a large starchy root, which is protected underground. It is possible that the root would be protected from surface fire, allowing the plant to resprout after fire. In summary, given the limited available information about the effect of fire on *A. gonzalezii,* we have determined that fire is not a threat to the continued existence of *A. gonzalezii,* or is likely to become so.

Development

The Santa Rita *Amoreuxia gonzalezii* population is located below the Smithsonian Fred Whipple Observatory, located on Mt. Hopkins. There is a visitor center for the observatory located at the base of Mt. Hopkins, and Hodgson (1989, p. 4) noted that during the construction of the visitor center, disturbance came very close to some *A. gonzalezii* plants on the Devil's Cashbox ridge, but none of the plants were harmed during construction. Hodgson (1994, p. 9) noted that communication is vital among researchers, land managers, and potential developers in regards to development near populations of *A. gonzalezii.* Available information does not indicate any other development planned for this area, and the area is fairly remote. In addition, the population is on National Forest land, where development is not likely to occur. There is also no information indicating any development near the Thomas canyon site, nor any development near *Amoreuxia* populations in Mexico. We have evaluated and determined, on the basis of the best available scientific and commercial data, that development is not a threat to the continued existence of *A. gonzalezii,* nor is it likely to become so.

Mining

NatureServe (2010) reports mining as a threat to this species, perhaps due to the proximity of two active mining claims to the south of the Devil's Cashbox plants (Ahern 2011, pers. comm.). There are currently no known direct impacts of active or proposed mines on any known population of *Amoreuxia gonzalezii* in the United States; these impacts are unknown for populations in Mexico. Hodgson (2001, p. 93) notes that *A. gonzalezii* tubers were collected frequently by native peoples from ''a graphite mine site'' in Mexico, implying no negative impact on the plant from this particular mine. It is unknown if the mine was active or inactive at the times of harvesting. In summary, based upon our review of the best available information, we conclude that mining is not a threat to the continued existence of *A. gonzalezii,* nor is it likely to become so.

Watershed Degradation

Improper livestock grazing can lead to habitat degradation and watershed degradation. Overgrazing removes the vegetative cover which can lead to erosion. The Santa Rita population is located within the Agua Caliente grazing allotment on the Nogales Ranger District. Degradation of habitat due to livestock grazing was noted as a threat by NatureServe (2010) to *Amoreuxia gonzalezii,* although this was not evident in a 2011 visit to the Devil's Cashbox area (Service 2011a, p. 1). The area that was assessed during that visit had no signs of livestock trailing, or sign of livestock. The Forest Service reports that this allotment, comprised of one pasture, is permitted for a 110 cow-calf operation (Lockwood 2011, pers. comm.). The grazing season is May to November, but only 40 cows are presently grazing due to drought conditions (Lockwood 2011, pers. comm.). The ridges where the plants are located are quite steep, and it is unlikely that cattle graze in these locations. The status of livestock grazing with regard to the Thomas Canyon population is unknown, and no information is available regarding livestock grazing near *Amoreuxia* populations in Mexico. After reviewing the best available scientific information, we have determined that watershed degradation as a result of livestock grazing is not a threat to the continued existence of this species, nor is it likely to become so.

Drought

Amoreuxia gonzalezii is dependent upon monsoon rains both for growth and the production of flowers and fruits (Hodgson 1989, p. 3). Hodgson (2001, p. 94) states that, ''With little precipitation, few fruits are produced from very depauperate plants.'' The Thomas Canyon location experienced less than average monsoon precipitation in 27 of 49 recorded years (July to August, period of record for average was 1961–2010, Kit Peak Weather Station, WRCC 2011). Similarly, the Devil's Cashbox area has had less than average monsoon precipitation during 33 of 63 recorded years (period of record for average was 1946–2010, Tumacacori National Historic Park (NHP) Weather Station, WRCC 2011). In both locations, monsoon patterns varied yearly, with periods of below-average precipitation never exceeding 7 consecutive years (Tumacacori NHP 1998–2004), thus giving *A. gonzalezii* periods of recovery.

The climate pattern in the vicinity of Álamos at the southern end of the *Amoreuxia gonzalezii* range in Sonora is very similar to Arizona, with the Álamos-El Veranito weather station reporting below-average monsoon precipitation in 14 of 28 recorded years (July to August, period of record for average was 1977–2009, Comisión Nacional del Agua (CNA), 2011). At the near center of *A. gonzalezii*'s Sonora range, the Carbo Weather station reported below average monsoon precipitation in 30 of 50 recorded years, 10 of which were consecutive from 1960–1969 (July to August, period of record for average was 1960–2009, CNA, 2011).

It is not known whether *Amoreuxia gonzalezii* is drought-tolerant, but the observation that plants are still present in sites that have experienced reduced summer precipitation leads us to conclude that the species is at least adapted to drought conditions. *A. gonzalezii* has fleshy underground tubers, which can store food and water, and that is an adaptation for dealing with drought. The best available information does not indicate that drought is a threat to the continued existence of *A. gonzalezii,* and the plant may have some adaptations for dealing with drought; therefore, we conclude that drought is not a threat to this species, or is likely to become so.

Climate Change

''Climate'' refers to an area's long-term average weather statistics (typically for at least 20- or 30-year periods), including the mean and variation of surface variables such as temperature,

precipitation, and wind; ''climate change'' refers to a change in the mean or variability of climate properties that persists for an extended period (typically decades or longer), whether due to natural processes or human activity (Intergovernmental Panel on Climate Change (IPCC) 2007a, p. 78). Although changes in climate occur continuously over geological time, changes are now occurring at an accelerated rate. For example, at continental, regional and ocean basin scales, recent observed changes in long-term trends include: a substantial increase in precipitation in eastern parts of North American and South America, northern Europe, and northern and central Asia, and an increase in intense tropical cyclone activity in the North Atlantic since about 1970 (IPCC 2007a, p. 30); and an increase in annual average temperature of more than 2 °F (1.1°C) across the U.S. since 1960 (Global Climate Change Impacts in the United States (GCCIUS) 2009, p. 27). Examples of observed changes in the physical environment include: an increase in global average sea level, and declines in mountain glaciers and average snow cover in both the northern and southern hemispheres (IPCC 2007a, p. 30); substantial and accelerating reductions in Arctic sea-ice (*e.g.,* Comiso *et al.* 2008, p. 1), and a variety of changes in ecosystem processes, the distribution of species, and the timing of seasonal events (*e.g.,* GCCIUS 2009, pp. 79–88).

The IPCC used Atmosphere-Ocean General Circulation Models and various greenhouse gas emissions scenarios to make projections of climate change globally and for broad regions through the 21st century (Meehl *et al.* 2007, p. 753; Randall *et al.* 2007, pp. 596–599), and reported these projections using a framework for characterizing certainty (Solomon *et al.* 2007, pp. 22–23). Examples include: (1) It is virtually certain there will be warmer and more frequent hot days and nights over most of the earth's land areas; (2) it is very likely there will be increased frequency of warm spells and heat waves over most land areas, and the frequency of heavy precipitation events will increase over most areas; and (3) it is likely that increases will occur in the incidence of extreme high sea level (excludes tsunamis), intense tropical cyclone activity, and the area affected by droughts (IPCC 2007b, p. 8, Table SPM.2). More recent analyses using a different global model and comparing other emissions scenarios resulted in similar projections of global temperature change across the different approaches (Prinn *et al.* 2011, pp. 527, 529).

All models (not just those involving climate change) have some uncertainty associated with projections due to assumptions used, data available, and features of the models; with regard to climate change this includes factors such as assumptions related to emissions scenarios, internal climate variability and differences among models. Despite this, however, under all global models and emissions scenarios, the overall projected trajectory of surface air temperature is one of increased warming compared to current conditions (Meehl *et al.* 2007, p. 762; Prinn *et al.* 2011, p. 527). Climate models, emissions scenarios, and associated assumptions, data, and analytical techniques will continue to be refined, as will interpretations of projections, as more information becomes available. For instance, some changes in conditions are occurring more rapidly than initially projected, such as melting of Arctic sea ice (Comiso *et al.* 2008, p. 1; Polyak *et al.* 2010, p. 1797), and since 2000, the observed emissions of greenhouse gases, which are a key influence on climate change, have been occurring at the mid- to higher levels of the various emissions scenarios developed in the late 1990s and used by the IPCC for making projections (*e.g.,* Raupach *et al.* 2007, Figure 1, p. 10289; Manning *et al.* 2010, Figure 1, p. 377; Pielke *et al.* 2008, entire). Also, the best scientific and commercial data available indicates that average global surface air temperature is increasing and several climate-related changes are occurring and will continue for many decades even if emissions are stabilized soon (*e.g.* Meehl *et al.* 2007, pp. 822–829; Church *et al.* 2010, pp. 411–412; Gillett *et al.* 2011, entire).

Changes in climate can have a variety of direct and indirect impacts on species, and can exacerbate the effects of other threats. Rather than assessing ''climate change'' as a single threat in and of itself, we examine the potential consequences to species and their habitats that arise from changes in environmental conditions associated with various aspects of climate change. For example, climate-related changes to habitats, predator-prey relationships, disease and disease vectors, or conditions that exceed the physiological tolerances of a species, occurring individually or in combination, may affect the status of a species. Vulnerability to climate change impacts is a function of sensitivity to those changes, exposure to those changes, and adaptive capacity (IPCC 2007, p. 89; Glick *et al* 2011, pp. 19–22). As described above, in evaluating the status of a species, the Service uses the best scientific and commercial data available, and this includes consideration of direct and indirect effects of climate change. As is the case with all potential threats, if a species is currently affected or is expected to be affected by one or more climate-related impacts, this does not necessarily mean the species is an endangered or threatened species as defined under the Act. If a species is listed as endangered or threatened, this knowledge regarding its vulnerability to, and impacts from, climate-associated changes in environmental conditions can be used to help devise appropriate strategies for its recovery.

While projections from global climate model simulations are informative and in some cases are the only or the best scientific information available, various downscaling methods are being used to provide higher-resolution projections that are more relevant to the spatial scales used to assess impacts to a given species (see Glick *et al,* 2011, pp. 58–61).

Regional landscapes can be examined by analyzing climate models that operate at small spatial scales; however, this approach involves some uncertainty. The uncertainty arises due to various factors related to difficulty in applying climate modeling to a smaller scale or unknown information, including regional weather patterns, local physiographic conditions, and fine-scale weather factors. Also, climate models do not model biological responses, such as life stages of individual species, generation time of species, and species' reactions to changing carbon dioxide levels not being included in the models. Most climate models do not incorporate a variety of plant-related factors that could be informative in determining how climate change could affect plant species (*e.g.,* effect of elevated carbon dioxide on plant water-use efficiency, the physiological effects on species of exceeding the assumed (modeled) bioclimatic limit, the life stage at which the limit affects the species (seedling versus adult), the lifespan of the species, and the movement of other organisms into the species' range) (Shafer *et al.* 2001, p. 207).

For southern Arizona, the most current downscaled climate projections are available with ⅛ degree resolution (approximately 12 km x 12 km) from the Coupled Model Intercomparision Project (Maurer *et al.* 2007, entire). A West-Wide Climate Risk Assessment (Bureau of Reclamation 2011) has been completed, but the focus of this study

was downscaled surface water projections for major river systems in the West. As such, it is less useful for predicting upland effects from future climate change scenarios, although stream flow is highly correlated with precipitation and temperature, which also affect upland ecosystems. Downscaled climate projections represent a consensus of multiple climate models, but climate models alone are not able to account for the myriad of biological processes that may affect a species that only inhabits a narrow range, as local effects may reduce or amplify the large-scale patterns that are projected over the larger spatial resolution of the global climate models (Ray *et al.* 2010, p. 24). In summary, global and regional climate models can play an important role in characterizing general changes to climate, which is a major determinant of species distributions, so that the potential impacts on natural systems can be assessed (Shafer *et al.* 2001, p. 213). However, they are less able to assess local impacts to species with a limited range, such as the three plants discussed in this finding.

Climate change is likely to affect the long-term survival and distribution of native species, such as *Amoreuxia gonzalezii,* through changes in temperature and precipitation. Hot extremes, heat waves, and heavy precipitation will increase in frequency, with the Southwest experiencing the greatest temperature increase in the continental United States (Karl *et al.* 2009, pp. 28, 129). In the southwestern United States, average temperatures increased approximately 1.5 °F (0.8 °C) compared to a 1960 to 1979 baseline (Karl *et al.* 2009, p. 129). By the end of this century, temperatures are expected to warm a total of 4 to 10 °F (2 to 5 °C) in the Southwest (Karl *et al.* 2009, p. 129).

Annual mean precipitation levels are expected to decrease in western North America and especially the southwestern States by midcentury (IPCC 2007, p. 8; Seager *et al.* 2007, p. 1181). The levels of aridity of recent drought conditions and perhaps those of the 1950s drought years will become the new climatology for the southwestern United States (Seager *et al.* 2007, p. 1181). As mentioned previously, southern Arizona is currently experiencing drought conditions, and there has been a decline in winter precipitation over the last 34 years.

Atmospheric levels of carbon dioxide are expected to double before the end of the 21st century, which may increase the dominance of invasive grasses leading to increased fire frequency and severity across western North America (Brooks and Pyke 2002, p. 3; IPCC 2002, p. 32; Walther *et al.* 2002, p. 391). Elevated levels of carbon dioxide lead to increased invasive annual plant biomass, invasive seed production, and pest outbreaks (Smith *et al.* 2000, pp. 80–81; IPCC 2002, pp. 18, 32; Ziska *et al.* 2005, p. 1328) and will put additional stressors on rare plants already suffering from the effects of elevated temperatures and drought.

In summary, climate change is affecting and will affect temperature and precipitation events in the future. We expect that *Amoreuxia gonzalezii* may be negatively affected by climate change with respect to drought or alteration in summer precipitation. However, we believe that *A. gonzalezii* is adapted to arid conditions, and the species has survived previous periods of low summer rainfall in Arizona. Although we believe climate change will impact plants in the future, the best available information does not allow us to determine the magnitude and scope of the potential effects on a local scale to *A. gonzalezii,* and therefore, we conclude that climate change is not a threat to the continued existence of this species, nor is it likely to become so.

Summary of Factor A

In conclusion, based on our review of the best available scientific and commercial information, we have determined that nonnative invasive species, fire, development, mining, and watershed degradation are not threats to *Amoreuxia gonzalezii.* Nonnative invasive species are not present in or near *A. gonzalezii* populations; therefore, they are not a threat to the species. The best available information does not indicate that fire, development, mining, or watershed degradation are threats to the species. Drought may influence the population structure of *A. gonzalezii,* but we conclude that drought is not a threat to the species because the species has some adaptations for living in arid environments and has survived periods of reduced summer precipitation. We acknowledge that climate change, particularly the predictions of less frequent, but perhaps more intense, summer precipitation, and increasing temperatures in the Southwest, will affect individuals populations of *A. gonzalezii.* However, the species is adapted to arid conditions, and therefore we have determined that climate change is not a threat to *A. gonzalezii.* Thus, the present or threatened destruction, modification, or curtailment of its habitat or range is not a threat to *A. gonzalezii.*

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

Hodgson (2001, p. 91) notes that roots, young leaves, fruits, and seeds of *Amoreuxia gonzalezii* are edible. She says that, historically, the plant had been collected in great amounts and was ''once an important food source to various southwestern people.'' For example, the Onavas Pimas Tribe historically harvested this species frequently, although more recently, harvest is only incidental (Hodgson 2001, p. 92). The tubers are collected and roasted by the Seri Indians on Tiburon Island, and by residents of Baja California. Evidently, the tubers of this species can be broken up and new plants will grow from the tuber pieces. In 1959, the noted anthropologist Homer Aschmann (Hodgson 2001, p. 94) observed with the similar and sympatric species *Amoreuxia palmatifida* that ''when the larger aboriginal population [native peoples of Mexico] exploited more regularly the flats where they grow, a larger yield of roots may have been maintained,'' implying that local peoples who relied on *Amoreuxia* for food may have enhanced populations by disturbing the soil and cutting roots. He stated that areas that were visited more regularly looked as if they had been plowed; the more disturbance, the more *A. palmatifida* grew. Both *A. palmatifida* and *A. gonzalezii* were historically, and continue to be, used by native peoples in a similar fashion, although we are unaware of this type of harvesting in Arizona. In summary, *A. gonzalezii* plants and roots have been used historically in parts of Mexico. There is no information regarding the current use of this species in Mexico, or its use in Arizona. Therefore, based on our review of the best available information, we have determined that collection of the plants or the roots is not a threat to *A. gonzalezii,* or is likely to become so.

Amoreuxia gonzalezii is not a plant of horticultural interest. There is no documentation of any instances where *A. gonzalezii* was collected from the wild other than as voucher specimens to document occurrences (*http://ag.arizona.edu/herbarium*) or seed collection for the purposes of conserving the species. Therefore, based on the best available information, we have determined that collection is not a threat to the continued existence of the species, or is likely to become so.

Factor C. Disease or Predation

There is no information indicating that disease affects *Amoreuxia*

gonzalezii. However, *A. gonzalezii* is very palatable to cattle and other ungulates (Hodgson 2001, p. 94). While some of the known locations in Arizona occur on steep limestone cliffs largely precluding cattle herbivory, plants in other locations are more susceptible. Hodgson (1989, p. 2) noted finding *Amoreuxia* plants in the Devil's Cashbox area with inflorescences (flowers) eaten. She was unable to ascertain if these plants were *A. gonzalezii,* or the more common *A. palmatifida* because the plants had no fruit (Hodgson 1989, p. 2). She also noted 13 missing plants from the Devil's Cashbox area just weeks after a previous site visit in 1990 (Hodgson 1989, p. 7). It is unknown how susceptible populations in Mexico are to grazing pressure. During a 1988 visit to a population of *A. gonzalezii* outside of Moctezuma, Sonora, Hodgson (1989, p. 2) noted that most plants had been browsed or grazed. Grazing precludes sexual reproduction and, if it occurs on a frequent basis, may lead to reduced seed production (Hodgson 1994, p. 9). However, *A. gonzalezii* also reproduces asexually; hence, the populations are not totally dependent on seed production for reproduction (Hodgson 2001, p. 94). Our review of the best available information did not produce any evidence that the long-term viability of *A. gonzalezii* populations in Arizona and Mexico has been affected by grazing, and therefore, we conclude that grazing is not a threat to this species.

It has been suggested that javelinas (hoofed mammals in the peccary family) dig up the roots of *Amoreuxia gonzalezii* and that this may constitute a threat to the species (NatureServe 2010). The Service (2011a, p. 1) saw no evidence of this during the 2011 site visit, and there is no information available on how often javelina dig up the plants, or on what the long-term effects are to the populations. In addition, if the plants respond to digging by producing more plants, javelinas rooting in the soil may promote asexual reproduction. Therefore, after review of the best available information, we conclude that javelina digging up the plants and eating the roots of *A. gonzalezii* is not a threat to the species.

Based on the best available information, we have determined that disease and predation are not threats to the continued existence of *Amoreuxia gonzalezii,* nor are they likely to become so.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Amoreuxia gonzalezii is not protected by Arizona Native Plant Law (Arizona Revised Statutes, Chapter 7 1993, entire). It does not appear under any of the law's four categories of protection, although previously it was given consideration to be included for protection within the ''Salvage Restricted Protected Native Plants'' (Hodgson 1994, p. 9), a level of protection that Hodgson considered inadequate. It was, however, never placed on this list (Hodgson 2011, pers. comm.). This means that the populations that occur on private land in Arizona have no protections. However, regardless of any protection under the Arizona Native Plant Law, our five-factor analysis suggests that *A. gonzalezii* populations are not subject to negative impacts at such a level that would place the species at risk. Evidence of this can be found in the Thomas Canyon population, which is on private property, and remains intact, as evidenced by surveys completed this year. Although *A. palmatifida* and *A. wrightii* are on the list of protected animals and plants for Mexico, *A. gonzalezii* is not listed and therefore receives no management considerations within its Mexican range (SEMARNAT 2008). Even so, we have determined that populations in Mexico are not subject to negative impacts at a level that would place the species overall at risk.

Amoreuxia gonzalezii is considered by the Forest Service to be a ''sensitive species'' in the Coronado National Forest. A sensitive species is defined as one not yet warranting listing as endangered or threatened, but which is sufficiently rare that its future survival is of concern (Forest Service Manual (FSM) 2670). The management of sensitive species is described in FSM 2670, and the management objectives are to develop and implement management practices to ensure that species do not become endangered or threatened because of Forest Service actions; maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands; and develop and implement management objectives for populations or habitat of sensitive species or both.

In addition, the Forest Service has to consider the effects of their actions on the viability of sensitive species through the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et. seq.*) process. As defined by Forest Service policy, actions must not result in loss of species viability or create significant trends toward the need for Federal listing. *A. gonzalezii* receives these protective measures through NEPA on Coronado National Forest land.

In summary, *Amoreuxia gonzalezii* populations in the Coronado National Forest are protected by their status as sensitive species. We believe that the requirement to consider the species' long-term viability in the NEPA planning process provides adequate protection for the populations of *A. gonzalezii* in the Coronado National Forest. Any one factor in our analysis may constitute a threat; however, it is the combined analysis of all the potential threats to the species that determine whether a species warrants listing as an endangered or threatened species under the Act. In this case, there is no indication of actions or potential threats to the species on private land or in Mexico that rise to a level such that listing is warranted. As such, we conclude that the best available information indicates that *A. gonzalezii* is not threatened by inadequate existing regulatory mechanisms.

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

Amoreuxia gonzalezii has been classified as the global rank of G1, Critically Imperiled, by NatureServe (2010) due to the small number of small populations globally, palatability to cattle, and threat of exotic annual grasses. Even though there are only 2 occurrences in the United States, there seem to be at least 12 occurrences in Mexico. There have been no systematic surveys in Mexico, and very few population estimates.

Information on a species' rarity is relevant to the conservation status of a species. Generally speaking, a species that has a geographically restricted range is likely to be more susceptible to environmental threats (*e.g.,* fire, flood, drought, human land use), should they occur, than a species that is not rare, because one fire or flood could affect a larger total percentage of the range of a rare species than of a widespread species. However, there is no available information in this case to evaluate whether any environmental threats are currently acting upon this potentially rare species in a negative way, or are reasonably likely to act on it in the future. The fact that a rare species is potentially vulnerable to stochastic processes does not necessarily mean that it is reasonably likely to experience, or have its status affected by, a given

stochastic process within timescales that are meaningful under the Act.

A species that has always been rare, yet continues to survive, could be well-equipped to continue to exist into the future. Many naturally rare species have persisted for long periods within small geographic areas, and many naturally rare species exhibit traits that allow them to persist despite their small population sizes. Consequently, the fact that a species is rare does not necessarily indicate that it may be in danger of extinction in the foreseeable future.

The best available information provides no evidence that effects often associated with small populations that were not naturally rare, such as inbreeding depression or genetic drift, may be occurring in *A. gonzalezii* populations. There is also no evidence that potential effects to the species or its habitat may be more significant than historically present such that a naturally rare species, such as *A. gonzalezii,* would be at risk. Therefore, we conclude that overall rarity and small population size are not a threat to *A. gonzalezii,* nor are they likely to become so.

Finding for *Amoreuxia gonzalezii*

As required by the Act, we evaluated the five factors in assessing whether *Amoreuxia gonzalezii* is endangered or threatened throughout all or a significant portion of its range. We examined the best scientific and commercial information available regarding the past, present, and future threats faced by *A. gonzalezii.* We reviewed the petition, information available in our files, other available published and unpublished information, and we consulted with recognized species experts.

There are no obvious threats to *Amoreuxia gonzalezii* or its habitat. The species has been used historically as a food source by indigenous people, but we have no information that collection and use of the plants and tubers are currently a threat to the species or likely to become so. Long-term drought and reduced summer rainfall will likely affect individual plants and populations. However, the plants are tolerant of moderate disturbance, and the species is adapted to arid condition, as evidenced by the plants' survival during recent periods of reduced summer rainfall. Based on the limited information available, we conclude that drought is not threat to this species or likely to become so. Climate change will likely affect the status of A. *gonzalezii* in the future; however, the limited information available that can be applied at a local scale does not suggest that climate change is likely to threaten the species. Regarding other factors potentially affecting *A. gonzalezii,* including nonnative, invasive species; fire; development; mining; and watershed degradation, the best available scientific information provides no evidence indicating that they are currently threatening the species or likely to do so in the future. Similarly, there is no evidence that overutilization, disease, or predation are affecting this species. In addition, we have determined that small population size is also not a threat to the species because the species appears to be naturally rare and there are no potential threats acting on the species above historical levels. Further, because we have determined there are no threats on the species, and none likely, existing regulatory mechanisms are adequate.

Based on our review of the best available scientific and commercial information pertaining to the five factors, we find that the potential threats are not of sufficient imminence, intensity, or magnitude to indicate that *Amoreuxia gonzalezii* is in danger of extinction (endangered) or likely to become endangered within the foreseeable future (threatened), throughout all of its range.

Significant Portion of the Range

Having determined that *Amoreuxia gonzalezii* is not in danger of extinction, or likely to become so, throughout all of its range, we must next consider whether there are any significant portions of the range where *A. gonzalezii* is in danger of extinction or is likely to become endangered in the foreseeable future.

The Act defines an endangered species as one ''in danger of extinction throughout all or a significant portion of its range,'' and a threatened species as one ''likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' The term ''significant portion of its range'' is not defined by the statute. For the purposes of this finding, a portion of a species' range is ''significant'' if it is part of the current range of the species, and it provides a crucial contribution to the representation, resiliency, or redundancy of the species. For the contribution to be crucial, it must be at a level such that, without that portion, the species would be in danger of extinction. We also considered the historical range of the species, and have determined that the current range is no different from the historical range. Therefore, there has been no loss of the historical range, and no further analysis of the historical range is required.

In determining whether *Amoreuxia gonzalezii* is endangered or threatened in a significant portion of its range, we considered status first to determine if any threats or potential threats acting individually or collectively endanger or threaten the species in a portion of its current range. We evaluated the current range of *A. gonzalezii* to determine if there is any apparent geographic concentration of the primary stressors potentially affecting the species including nonnative, invasive plants; fire; development; mining; watershed degradation; and drought. We have analyzed the stressors to the degree possible, and determined that they are essentially uniform throughout the species' range. We also found the stressors are not of sufficient imminence, intensity, magnitude, or geographically concentrated such that it warrants evaluating whether a portion of the range is significant under the Act. We do not find that *A. gonzalezii* is in danger of extinction now, nor is likely to become endangered within the foreseeable future, throughout all or a significant portion of its range. Therefore, listing *A. gonzalezii* as an endangered or threatened species under the Act is not warranted at this time.

We request that you submit any new information concerning the distribution and status of, or threats to, *Amoreuxia gonzalezii* to our U.S. Fish and Wildlife Service Office (see **ADDRESSES** section) whenever it becomes available. New information will help us monitor *A. gonzalezii* and encourage its conservation. If an emergency situation develops for *A. gonzalezii,* or any other species, we will act to provide immediate protection.

Species Information for *Astragalus hypoxylus*

Species Description

Barneby (1964, pp. 1028–1029) and Warren *et al.* (1991, pp. 3–4) describe *Astragalus hypoxylus* as an herbaceous perennial, in the Fabaceae (Pea) family. The species forms a compact mat of stems that typically lay flat against the ground, although the outer ends of the stems may turn up. The mat can be up to 15 cm (6 in) in diameter. The species forms a tap root that is dense and fibrous. The alternate leaves are compound with 11 to 13 ovate leaflets that are each 2 to 4.5 millimeters (mm) (0.1 to 0.2 in) long. The leaflets are bicolored; the undersides are gray with sparse tiny hairs; the tops of the leaflets are yellowish-green, smooth, and

hairless. The leaflets have a distinct fold along the midrib.

The inflorescence is very compact and ball-shaped, approximately 1 cm (0.4 in) in diameter and 1 to 1.5 cm (0.4 to 0.6 in) long and looks somewhat like clover flowers. The flowers are approximately 6 mm (0.2 in) long with petals that are whitish, with light purple tips. The flower stalks are erect above the vegetative mat. Fruits are small, oval pods 7 to 9 mm (0.3 to 0.35 in) long and 2 to 2.5 mm (0.1 to 0.16 in) diameter. The pods are yellowish at the base and purplish towards the tip when ripe. The pods do not split open, but drop whole from the plant (Warren *et al.* 1991, pp. 3–4).

Astragalus hypoxylus most closely resembles *A. parvus* (no common name) and *A. nothoxys* (sheep milkvetch). *Astragalus parvus* is only known from Mexico, but *A. nothoxys* may be found with *A. hypoxylus* (Johnson *et al.* 1992, p. 3). There are field characteristics that differentiate the two species. *A. nothoxys* has much longer flowering stalks, and the inflorescence is spread out along the flowering stems, unlike the compact, clover-like flowers of *A. hypoxylus.* The seed pods of *A. nothoxyus* are longer, narrower, three-sided, and green when fully ripe, while those of *A. hypoxylus* are oval and yellowish-purple when ripe. There has never been any disagreement in the scientific literature regarding the taxonomy of this species; thus we consider *A. hypoxylus* to be a valid taxon and a listable entity.

Habitat and Biology

Levin (1987, pp. 170–171) described the habitat that supports *Astragalus hypoxylus* as ''stony openings in pine-oak juniper woodland, restricted to limestone derived soils.'' Van Devender (1986, pers. comm.) noted the same type of habitat, on a south-to-southwest exposure. Warren *et al.* (1991, p. 7) observed that *A. hypoxylus* is found in open, rocky clearings in woodlands comprised of *Quercus emoryi* (Emory oak), *Q. oblongifolia* (Mexican blue oak), *Juniperus deppeana* (alligator juniper), and *Pinus cembroides* (Mexican pinyon). The ground is characterized by loosely consolidated, gravelly soil composed of limestone and weathered rock. The plants are found at an elevation of approximately 1,676 m (5,500 ft) (Warren *et al.* 1991, p. 7). This habitat type is referred to as oak-savannah and is relatively common in the mountains of southeastern Arizona between elevations of 1,370 to 1,830 m (4,494 to 6,000 ft) (Brown 1982, p. 59).

Astragalus hypoxylus produces flowers in the spring (April-May), with fruits maturing approximately 3 weeks after the onset of flowering (Johnson *et al.* 1992, p. 5). Pollination studies on different species of *Astragalus* (Karron 1988, p. 332; Sugden 1985, pp. 303–304; Green and Bohart 1975, pp. 383–384; Geer *et al.* 1995, p. 23) reported that several bee species in the genera *Bombus, Osmia,* and *Anthophora* were the primary pollinators. However, there have been no studies on the pollinators for *A. hypoxylus.*

The pods of *Astragalus hypoxylus* do not split open when ripe and usually fall to the ground near the parent plant. However, the pods are light and may be blown to other locations by the wind (Johnson *et al.* 1992, p. 6). Seedlings are often detected in open places away from the parent plants; however, nothing is known regarding seed dispersal of this species (Falk, 2011, pers. obs.).

Germination studies of *Astragalus hypoxylus* were carried out by the Desert Botanical Garden (Garden) as part of the Center for Plant Conservation National Collection program for conserving rare plants and their germplasm. Seeds were collected from the Harshaw and Bear Canyon populations in 1991 and 1992. During the seed collection trips, the biologists noted that ''plants were frequent along disturbed areas (erosion cuts, dirt roads)'' (Pritchett-Kozak and Ecker 1992, p. 20). Two germination tests were done in 1992, with germination rates of 66 and 76 percent (Pritchett-Kozak and Ecker 1992, p. 20). Tests done in 1991 with fresh seed and previously frozen seed were used, and the germination rates were high for both sets of seeds, indicating that freezing does not interfere with seed viability. Germination took place during an average daytime temperature range of 73 to 86 °F (23 to 30 °C) (Ecker 1991, p. 1). These warm daytime temperatures may indicate that the seeds germinate in the summer, in response to summer rainfall, rather than in the winter. Also, the seeds readily germinated in August, indicating that there is no summer dormancy for these seeds (Ecker 1991, p. 1). Currently, there are approximately 14,000 seeds in frozen storage at the Garden and the National Seed Storage Lab in Ft. Collins, Colorado (*http://www.centerforplantconservation.org*). These seeds are available for re-introduction efforts or augmentation of existing populations.

In 1993, plants produced from collected seed were initiating floral buds in the greenhouse by February 20. These were plants that were produced from previous seedling experiments. On March 16, the plants were placed outside on the grounds of the Garden, underneath native trees. The plants began flowering profusely by early April. Open pollination (plants were left in the open and pollination occurred naturally) was successful, and the plants were producing numerous fruits by April 20. There was no indication of pollinators in the area. Plants that had been previously left in the greenhouse had not produced seed, probably due to a lack of pollinators in the greenhouse. Controlled cross-pollination of two plants (two flowers per plant) was conducted on April 13, which resulted in two fruits per plant (Pritchett-Kozak 1993, p. 20). Earlier attempts at self-pollination failed, but the technique (use of a small paintbrush to transfer the pollen) may not have been optimal (Pritchett-Kozak and Ecker 1992, p. 21). The results of the open pollination and the controlled cross-pollination experiment likely indicate that *Astragalus hypoxylus* is an obligate outcrosser (Pritchett-Kozak 1993, p. 20).

In conclusion, there is not a great deal of information on the biology and ecology of this species. The pollinators of the species are unknown; it is surmised that the plants are obligate outcrossers, and that pollination takes place in the field because fruit and seeds are produced. It is not known how seed is dispersed. Based on the germination experiments conducted by the Desert Botanical Garden, the best available information suggests that plants germinate in response to summer rainfall. Also, there is some anecdotal information that these plants occupy disturbed areas and may be tolerant of moderate disturbance.

Distribution, Abundance, and Trends

Astragalus hypoxylus was first collected by J. G. Lemmon in 1882 in Cochise County, Arizona, at a location described as ''Mahoney's Ranch, near Ft. Huachuca.'' (Johnson *et al.* 1992, p. 4). This site description proved to be so vague that this area was never able to be located again (Johnson *et al.* 1992, p. 4). The species was not detected again until 1986, when it was collected in the Patagonia Mountains, approximately 4.5 kilometers (km) (2.8 miles (mi)) south of Harshaw on the road to Washington Camp, in the Coronado National Forest (Levin 1987, pp. 170–171). Later in 1986, botanists visited this same location and counted approximately 107 plants in the area, again noting that the plants were ''common in grassy openings in oak woodland on relatively steep slopes with coarse sandy soils'' (Van Devender 1986, pers. comm.; Kennedy 1986, pers. comm.). In 1991, Malusa *et al.* (1992, p. 25) found two additional populations in the Patagonia

Mountains, near the Harshaw site. Approximately 180 plants were found in adjacent canyons. These populations are within a couple of miles of the Harshaw site and, for the purposes of this finding, will be referred to as the Harshaw2 populations.

In addition, many surveys were undertaken by staff at the Nature Conservancy and other botanical contractors to the Coronado National Forest, and populations of *Astragalus hypoxylus* were found in the Huachuca Mountains in Scotia, Bear, and Sycamore canyons, and in Collins Canyon in the Canelo Hills (Warren *et al.* 1989, p 30; Gori *et al.* 1990, p. 36; Gori *et al.* 1991, p. 45; Fishbein and Warren 1994, pp. 6–7). Populations in Bear, Sycamore, and Scotia canyons are dispersed over a wide area and composed of several sub-populations, but, for the purposes of this finding, will be referred to as individual populations. All of these locations are on the Sierra Vista Ranger District of the Coronado National Forest. In addition, suitable habitat on Ft. Huachuca and in Sonora, Mexico was searched, but plants were not found (Warren *et al.* 1991, pp. 5–6; Johnson *et al.* 1992, pp. 4–5; Warren and Reichenbacher 1991, p. 26; Fishbein and Warren 1994, pp. 6–7; Malusa 1995, p. 1). Therefore, the current distribution encompasses only plants that occur along Harshaw Road in the Patagonia Mountains, in Bear, Scotia, and Sycamore canyons in the Huachuca Mountains, and in Collins Canyon in the Canelo Hills.

The Nature Conservancy established monitoring plots for *Astragalus hypoxylus* in several of the populations (Warren *et al.* 1991, p. 8). Two plots were established to monitor growth, reproduction, and mortality of individual plants in the Harshaw population. These plots were established in 1988, but one plot was abandoned in 1989 because the site was steep and the survey was causing damage to the plants within the monitoring plot. The remaining plot was monitored annually, from 1989–1991 and in 1993. Another plot was established at the Bear Creek population in 1989, and data were collected from this plot in the same years as the Harshaw plot. All plots were monitored in late April or May, when the plants flower and set fruit. Neither monitoring plot has been evaluated since 1993. However, some occupied sites were visited in 1995, in 2010, and in 2011, and population estimates were made, although no other data were collected in the monitoring plots. Table 1 presents population estimates for the known locations.

TABLE 1—POPULATION COUNTS AND ESTIMATES FOR ASTRAGALUS HYPOXYLUS

Population (year of discovery)	Estimated number of individuals (year)
Harshaw (1986)	100–200 (1986)
** plants in both monitoring plots	109 (1988) **
* plants in remaining monitoring plot	112 (1989) *
	70 (1990) *
	139 (1991) *
	114 (1993) *
	22 (2011)
Bear Canyon (1988)	110 (1989) *
* plants in the monitoring plot	60 (1990) *
	85 (1991) *
	61 (1993) *
	154 (1995) *
	0 (2010) *
Bear Canyon (1990)	50 (1990)
(plants found outside the monitoring plot and in other areas of Bear Canyon).	346 (1995)
	100 (2010)
Scotia Canyon (1990)	600–700 (1990)
	1058 (1995)
	500–600 (2010)
Harshaw2 (1991)	180 (1991)
	0 (2011)
Sycamore Canyon (1993)	320 (1993)
	70–80 (1994) (not all sub-populations visited)
	65–80 (1994) (not all sub-populations visited)
	12 (1995) (not all sub-populations visited)
Canelo Hills (1993)	No estimate given in 1993; presence of ''small population'' was noted.

Based on the surveys and monitoring data, there have been some declines in the numbers of individuals found in the monitoring plots and in additional occupied locations. The Harshaw population appeared relatively stable throughout the monitoring period, with some fluctuations in the overall numbers. For the period 1991–1993, survivorship was 40 percent, with 64 recruits in 1993, which represented 56 percent of the population in the plot. It is unfortunate that the Harshaw site as not visited again until May 2011 (Service 2011b, pp. 1–4). During this visit, 5 healthy plants, which had flowered, were found in the cutbank of the road, and 14 additional plants were found nearby, slightly north of the road. The area where the original Harshaw monitoring plot was thought to have been was searched thoroughly and only three plants were found. These plants were very small compared to those near and in the cutbank of the road. The entire site was described as very dry, and the native grasses ''crunched beneath our feet'' (Service 2011b, p. 2). It is possible that the plants near the road were getting additional moisture due to their downslope location and their proximity to the road. Additional searches were conducted near the described locations for the Harshaw2 populations, but no plants were found. Given the 18-year gap in monitoring or visiting this site, we are unable to determine the long-term trend for this population.

The situation is similar for the Bear Canyon monitoring plot. Overall numbers fluctuated, but as of 1995,

there were more plants in the plot than there had been when the plot was established. Fifteen years passed before the next visit, which occurred in October 2010 (Service 2010, p. 1). This is not the ideal time of year for a visit, but the plants are usually visible if there has been summer rainfall. In this case, based on the growth of the perennial grasses in the surrounding area, it seemed as if there had been summer precipitation (Falk 2011, pers. obs.). No plants were found in the monitoring plot, but there were plants to the east and south of the plot. The plants were widely scattered over the area. There was no evidence of flowering or fruits.

Additional surveys were conducted that day (Service 2010, p. 1) along Forest Service Road 61, near Sycamore Canyon. Plants were scattered in several different locations adjacent to the road, including some areas that had been recently disturbed by vehicle traffic. The majority of the plants observed were healthy. Many of these plants looked like juveniles produced during the summer of 2010. The last site visited was Scotia Canyon (Service 2010, p. 1). Many plants were observed below the uppermost pond on the former Peterson ranch property (now part of the Coronado National Forest) and immediately downslope of that. Some of the largest plants were in the roadbed, associated with eroded portions of the road. The observations of these plants growing in disturbed areas (road cuts and eroded banks) may indicate that this species is adapted to and may tolerate moderate disturbance. We were unable to determine long-term trends for these populations based on inconsistent monitoring efforts.

Another type of disturbance to the plant's habitat is fire. There is no information on the plant's adaptation to fire, but the habitat where the species grows is subject to fire on a periodic basis (Kaib *et al.* 1996, p. 261). The observation that *Astragalus hypoxylus* is tolerant of moderate disturbance may indicate that the species is fire adapted, and may need periodic fire to reduce competition from grasses and remove overstory vegetation that may increase understory competition and shading.

Some of the fluctuation in population size may be attributable to variation in climate. During dry years, there was increased mortality of plants, and larger plants died in association with consecutive dry years (Johnson *et al.* 1992, p. 7). Recruitment and survival may also be correlated with winter precipitation as evidenced by the number of recruits that were counted in 1993 in the Bear Canyon plot; more than 72 percent of the individuals counted that year were seedlings (Falk and Warren 1994, p. 36). Coincidentally, 1992 was an El Niño year, with above-average precipitation for southern Arizona.

There are some observations from the monitoring efforts that may shed light on the ecology of this species. Population size and flower production appear to fluctuate greatly from year to year. There seems to be a correlation with winter rainfall. That is, when winter precipitation is good, the plants are larger and they produce more flowers and fruit (Warren *et al.* 1991, p. 9; Johnson *et al.* 1992, pp. 7–8). *Astragalus hypoxylus* has a taproot, and individual plants may be dormant (no above-ground biomass visible) during dry years, but produce growth again when there is rain (Falk 2011, pers. obs.). Consequently, the reduction in numbers across almost all of the populations may be in response to the on-going drought in southern Arizona. Winter rainfall has been declining steadily for the last 34 years, and most noticeably in the period from 1998 to the present (McPhee *et al.* 2004, p. 2). Although the correlation between population size and climate is not a formal test of this hypothesis, the sharp decline noted for most of these populations may be the result of prolonged drought.

Five-Factor Evaluation for *Astragalus hypoxylus*

In making this finding, information pertaining to *Astragalus hypoxylus* in relation to the five factors provided in section 4(a)(1) of the Act is discussed below.

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Potential factors that may affect the habitat or range of *Astragalus hypoxylus* are discussed in this section, including: (1) Recreation; (2) watershed degradation resulting from improper livestock grazing; (3) nonnative invasive species; (4) fuel wood harvesting; (5) fire; (6) road maintenance; (7) drought; and (8) climate change.

Recreation

All known populations of this species occur on the Sierra Vista Ranger District, on the Coronado National Forest. There is no special management for the populations on Forest Service lands. The populations at Harshaw do not appear to be affected by any recreational activities (Johnson *et al.* 1992, p. 12). There was no sign of recreational activity or impacts during the 2011 site visit (Service 2011b, entire). The same is true for the populations scattered along Forest Service Road 61, near Sycamore Canyon and in Scotia Canyon. In 2010, neither of these populations showed evidence of trampling or associated effects from recreational activities.

The only population that has been identified as being impacted by recreational activity has been the upper Bear Canyon population. This population has been impacted by an informal parking lot near the turnoff to Wakefield Camp, which allows for access to Bear Creek, and is a very popular area for dispersed camping and hiking (Warren *et al.* 1991, p. 10; Gori *et al.* 1991, p. 45). In 2000, the Forest Service blocked off the informal parking area, created a formal parking in a less sensitive area, and restricted access to the Bear Creek riparian area (Frederick 2011, pers. comm.). This site has not been evaluated to determine if these changes reduced the impacts from recreational activity on *Astragalus hypoxylus.* At any rate, this population is relatively small (50 plants were estimated at the time of discovery in 1990) (Gori *et al.* 1991, p. 45) and represents less than 10 percent of the current population. In conclusion, recreational impacts may have affected only one of the sub-populations in the entire range of the species, and corrective actions were taken to reduce the impacts. Review of the best available scientific information revealed no further evidence that recreation is negatively affecting other *A. hypoxylus* populations; therefore, we determined that recreation is not a threat to the continued existence of the species, nor is it likely to become so.

Livestock Grazing

All of the *Astragalus hypoxylus* populations occur with Forest Service grazing allotments. The Harshaw populations are within the Bender allotment, and all of the other populations are located within the Lone Mountain allotment. The following information is from the Service's biological opinion on the Continuation of Livestock Grazing on the Coronado National Forest (2–21–98–F–399–R1) and additional details can be found in that document. The Bender allotment is 1,287 hectares (ha) (3,180 acres (ac)) and supports a 14-cow-and-calf operation. Grazing is allowed year-round and there is only one pasture. The allotment is reported to be in moderately good condition. The Lone Mountain allotment is 15,435 ha (38,140 ac), divided into 27 pastures. It supports a 1,346-cow-and-calf operation. The allotment is reported to be on an

upward trend, with 75 percent of the allotment classified as being in moderately high range condition. Both the Bender and Lone Mountain allotments are reported to be in moderately high range condition, and watershed degradation is not likely to be a problem in allotments that are maintained in good to high range conditions.

The Coronado National Forest has a drought policy which directs grazing permittees to work with the Forest when rainfall for the water year (beginning October 1) is less than 75 percent of normal by March 1 and the long-range forecast is for less than normal precipitation. In addition, critical habitat for *Liliaeopsis schaffneriana* var. *recurva* (Huachuca water umbel) is within the Lone Mountain allotment. As such, there are additional restrictions placed on the grazing practices in this allotment to protect occupied areas and critical habitat. Several areas within this allotment receive special protections, such as the Peterson pasture, which contains Scotia, Sycamore and Bear canyons. The pastures are grazed in winter (November–March) and only when winter rains are sufficient to provide adequate water throughout the pasture to encourage livestock dispersal away from the canyon bottom. Utilization of upland browse is not permitted to exceed 35–45 percent. These restrictions benefit *Astragalus hypoxylus* because they reduce impacts from livestock grazing and limit use of the upland areas during drought periods, when overgrazing and trampling of habitat are more likely to occur.

There were a few observations of trampling on *Astragalus hypoxylus* habitat in the Bear Creek population (Johnson *et al.* 1992, p. 12). Warren *et al.* (1991, p. 10) notes that livestock grazing, although present in the area, does not seem to pose a direct threat. Livestock trampling may disturb the soil and disrupt seedling establishment. Population visits in 2001 and 2011 (Service 2010, p. 1; Service 2011b, p. 2) did not note the presence of livestock or trailing through the populations.

Livestock have not been observed to eat *Astragalus hypoxylus.* Many species of *Astragalus* contain poisonous compounds, known as nitro-toxins, which are highly toxic to livestock (Williams and Barneby 1977, p. 310). *A. nothoxys,* which sometimes grows near and in proximity to *A. hypoxylus* populations, has been tested and does contain nitro-toxins (Johnson *et al.* 1992, p. 3). Livestock have been observed to graze on *A. nothoxys,* primarily when forage is lacking (Schmutz *et. al.* 1968, pp. 26–27). The Forest Service has not indicated that this species has caused any problems with livestock in the Forest. Any eradication program to eliminate *A. nothoxys* could possibly harm adjacent *A. hypoxylus;* however, there is no evidence of any efforts to eradicate *A. nothoxys. A. hypoxylus* has not been tested for nitro-toxins, but many species in the Leptocarpa section of *Astragalus* (*A. hypoxylus* is classified in this section) contain these chemicals. At any rate, the limited distribution of *A. hypoxylus* and the lack of observation of cattle eating this plant indicates that the potential poisoning of livestock is unlikely.

In summary, all populations of *Astragalus hypoxylus* occur in grazing allotments. Those grazing allotments are being managed in ways that promote healthy watershed and good range condition. The Lone Mountain allotment has additional grazing practices that protect riparian and upland habitat, resulting in improved watershed health, which benefits upland species, including *A. hypoxylus.* The best available information does not provide further evidence that livestock grazing is negatively affecting populations of *A. hypoxylus;* therefore, we have determined that livestock grazing is not a threat to the continued existence of the species now, nor is it likely to become so.

Nonnative, Invasive Species

Nonnative species can have negative effects on the ecology of native plant communities, as well as individual species (Brooks *et al.* 2004, p. 677; Alvarez and Cushman 2002, p. 1434; Mooney and Cleland 2001, p. 5446). However, there are no nonnative species that have been detected in the populations of *Astragalus hypoxylus.* The only nonnative grass that occurs in the vicinity of these populations is *Eragrostis lehmanniana* (Lehmann lovegrass), but this grass has not been seen in the monitoring plots or growing in the populations (Falk 2011, pers. obs.). *Eragrostis lehmanniana* can form dense stands, increasing fine fuels and fire danger (Anable *et al.* 1992, pp. 186–187), but there are no continuous stands near any of the *A. hypoxylus* populations (Falk 2011, pers. obs.). The best available scientific information does not suggest that nonnative invasive species are a threat to the continued existence of *A. hypoxylus,* nor are they likely to become so.

Fuel Wood Harvesting

The Coronado National Forest did allow fuel wood harvesting in the past near the known populations. It is unknown if these past activities affected *Astragalus hypoxylus* populations. The collection of dead and down wood was also allowed, with a permit, but this practice was stopped in 1990 (Johnson *et al.* 1992, p. 12). Fuel wood harvesting is no longer allowed in these areas (Frederick 2011, pers. comm.). The best available information does not provide evidence that fuel wood harvesting is currently affecting *A. hypoxylus* populations; therefore, we have determined that fuel wood harvesting is not a threat to *A. hypoxylus,* nor is it likely to become so.

Fire

As mentioned under *Habitat and Biology,* there is no information on *Astragalus hypoxylus* and fire effects. The Forest Service's Fire Effects Information System (*http://www.fs.fed.us/database/feis/*) contains information on 7 species of *Astragalus* in the United States, some of which are adapted to fire, and may even require fire, to complete one of their life cycles (*i.e.,* seeds need to be scarified by fire before germinating). It is unknown if this is the case for *A. hypoxylus,* but we hypothesize that this species may be tolerant of fire because of the plant community where it grows and its tolerance for moderate disturbance, including fire. Also, fire may be important in maintaining habitat for *A. hypoxylus* by removing the overstory, thus reducing competition and shading. In summary, given the limited available information about the effect of fire on *A. hypoxylus,* we determine that fire, or lack thereof, is most likely not a threat to the continued existence of *A. hypoxylus.*

Road Maintenance

Portions of a few of the *Astragalus hypoxylus* populations are near roads, and may be threatened by road maintenance activities, such as blading (clearing and smoothing the road with a large piece of equipment). However, the species appears to be tolerant of moderate disturbance. In 2010, *A. hypoxylus* were observed near the road going through Scotia Canyon. Portions of the road were well eroded, resulting in rills (portions of the road that are washed out, forming small gullies). There were 10–20 plants growing in the roadbed, on top of the erosion rills. These were some of the largest and healthiest plants observed in Scotia Canyon (Service 2010, p. 1). As mentioned previously, in 2011, Service biologists found 19 plants at Harshaw that were growing in the cutbank of the road, and these plants were larger and

healthier than the plants upslope in the area of the monitoring plot (Service 2011b, p. 1). This may indicate that plants are receiving supplemental water due to the proximity of the road and concentrated rainwater runoff, which may be why the plants are larger in the road cuts.

Disturbed areas often afford the plants which grow on them reduced competition for physical resources, such as water, and reduced competition from other plants. However, these potential positive effects of disturbance on *Astragalus hypoxylus* are unknown because there have been no such studies. Regardless, there are only a few portions of the populations that may be subject to Forest road maintenance activities, and they represent a very small portion of the total amount of occupied habitat. In addition, road maintenance activities take place on a periodic basis, so the effects are likely to be short-term and widely spaced over time. In conclusion, *A. hypoxylus* seems to tolerate moderate disturbance, and the best available information does not provide evidence that road maintenance activities are a threat to the continued existence of the species, nor are they likely to become so.

Drought

Data collected from the monitoring plots indicates that there is a likely correlation between rainfall and the population dynamics of *Astragalus hypoxylus.* As stated earlier, results from the Bear Canyon monitoring effort indicate that seedling recruitment and establishment was high when rainfall was high. We believe, based on data from the monitoring plots, that winter rainfall affects the survivorship of the seedlings. Summer rainfall may be important for germination, but without winter rainfall, the seedlings would not survive. The information provided in the following section was derived from data accessed on the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center Web site (*http://www.ncdc.noaa.gov*). Rainfall totals for Arizona (Division 7), which includes all of the *A. hypoxylus* populations, for the months November through March, indicates a severe decline over the past 34 years. Another way to illustrate the decline is to use the Palmer Drought Severity Index (PDSI). The PDSI ''attempts to measure the duration and intensity of the long-term drought-inducing circulation patterns.'' It is an index used to gauge the severity of drought conditions by using a water balance equation to track water supply and demand. When the historical PDSI values are displayed for the years 1996–2011, 12 out of the 16 years were classified as moderate to severe drought. In comparison, the PDSI values for the same months during 1950–1960 (which is a well-documented drought period in Arizona) classified 8 out of 10 years as moderate to severe drought. There are significant differences between the two drought periods; mainly that the current drought is much warmer than the 1950s drought. On average, temperatures in the Four Corners region of the Southwest were about 2 to 7 °F (1 to 4 °C) warmer than in the 1950s (Weiss 2009, pp. 5920–5921). Drought with higher temperatures creates tough growing conditions for plants because warmer temperatures make the air drier, and drier air absorbs more moisture from the soils, vegetation, and reservoirs. Thus, not only is there less precipitation, but there is less moisture available in the soil for plant growth.

It is difficult to predict how *Astragalus hypoxylus* populations will fare with these drought conditions. The species apparently persisted and survived the 1950s drought; however, this information is of limited value as we evaluate potential conditions. The long-term trend for these populations is unknown; it is possible that the populations that are currently in decline will rebound when there is sufficient moisture. Despite drought conditions, *A. hypoxylus* populations in Scotia and Bear canyons seem stable, relative to the previous population estimates presented in Table 1. The largely circumstantial evidence available indicates that rainfall influences population dynamics for *A. hypoxylus,* and drought likely contributes to population declines. However, it is not known how the magnitude and intensity of drought will affect the long-term status of this species. Loss of individual plants, especially young plants, will likely occur during drought years. Dry conditions will likely reduce seed germination and survival. Population numbers of *A. hypoxylus* will fluctuate as observed during the period of data collection in the monitoring plots. However, this species is likely adapted to arid conditions. The ability to remain dormant during dry periods, and regrow when rainfall starts, is an adaptation for coping with arid conditions. Further, *A. hypoxylus* populations survived the 1950s drought, indicating the species has developed traits to survive during dry periods. Therefore, based on the best available information, we determine that drought is most likely not a threat to the continued existence of *A. hypoxylus.*

Climate Change

No further specific information is available regarding the effects of climate change on *A. hypoxylus;* therefore, please refer to the ''Climate Change'' discussion under Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range in the Five-Factor Evaluation for *Amoreuxia gonzalezii* Section.

As discussed in the previous sections above, *Astragalus hypoxylus* seedling establishment is likely correlated with rainfall; therefore, reduced precipitation may reduce seedling establishment. Additionally, the localized distribution of *A. hypoxylus* may make this species more susceptible to landscape-level stochastic events, such as regional drought. Despite these potential vulnerabilities, *A. hypoxylus* appears well-adapted to a dry climate and tolerates moderate disturbance. Plants growing in high-stress landscapes are adapted to stress, and drought-adapted species may experience lower mortality during severe droughts (Gitlin *et al.* 2006, pp. 1477, 1484).

In summary, climate change is affecting and will affect temperature and precipitation events. We expect that *Astragalus hypoxylus,* like other narrow endemics, may be negatively affected by drought associated with climate change. However, *A. hypoxylus* appears to be adapted to arid conditions, and has survived a previous long-term drought in the 1950s. Although climate change will likely affect plants in the future, the limited available information does not suggest that the effect on the status of the species will be significant. Therefore, based on the best available information, we have determined that climate change is not a threat to the continued existence of *A. hypoxylus.*

Summary of Factor A

In conclusion, based on the best available information, we have determined that recreation; livestock grazing; nonnative, invasive species; fuel wood harvesting; fire; road maintenance; or drought do not threaten the continued existence of *Astragalus hypoxylus.* Recreational impacts were associated with one population, and the Forest Service has taken corrective action to reduce those effects. The remaining populations are not affected by recreational activities. The best available information does not provide evidence that livestock grazing is a threat to this species. The plant is not eaten by livestock, both of the grazing allotments are in good range condition, and measures are in place to ensure

protection of upland and riparian areas. Nonnative, invasive species are not present in or near *A. hypoxylus* populations; therefore, we have determined that they are not a threat to the species. Fuel wood harvesting is not allowed in the areas where *A. hypoxylus* is located; therefore, we determined that this activity is not a threat to the species. Given the limited available information, we have determined that presence or absence of fire is most likely not a threat to the species. Road maintenance activities may affect small portions of *A. hypoxylus* populations, but we determined that these activities are not a threat to the continued existence of the species because the effects are short-term and the plants appear tolerant of moderate disturbance. Drought influences the population structure of *A. hypoxylus,* but the species has survived a previous long-term drought and appears to have adaptations for dealing with drought, therefore, we have determined that drought is not a threat to the continued existence of the species. We acknowledge that climate change, particularly the predictions of reduced precipitation and increasing temperatures in the Southwest, will affect individuals and populations of *A. hypoxylus.* However, the plant is adapted to arid conditions, and the limited available that can be applied at a local scale does not suggest that climate change is likely to threaten *A. hypoxylus.* Thus, the present or threatened destruction, modification, or curtailment of its habitat or range is not a threat to the continued existence of *A. hypoxylus,* nor is it likely to become so.

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

Astragalus hypoxylus is not a plant of horticultural interest. There is no evidence of any instances where *A. hypoxylus* was collected from the wild other than as voucher specimens to document occurrences (*http://ag.arizona.edu/herbarium*) or seed collection for the purposes of banking seed for future conservation efforts. Therefore, we have determined that overutilization is not a threat to the continued existence of the species, nor is it likely to become so.

Factor C. Disease or Predation

There is no information indicating that disease affects *Astragalus hypoxylus.* There are no observations or evidence that *A. hypoxylus* is browsed by livestock (see Factor A, Livestock grazing). Data were collected on *A. hypoxylus* seed predation by small wasps in 1988, but it is unknown how this predation affected the *A. hypoxylus* population or how often seed predation occurs (Johnson *et al.* 1992, p. 13). Based on the best available information, we have determined that *A. hypoxylus* is not threatened by disease or predation, nor is it likely to become so.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

The Act requires us to examine the adequacy of existing regulatory mechanisms with respect to threats that may place *Astragalus hypoxylus* in danger of extinction or likely to become so in the future. Existing regulatory mechanisms that could have an effect on potential threats to *A. hypoxylus* include (1) Local land use laws, processes, and ordinances; (2) State laws and regulations; and (3) Federal laws and regulations. *A. hypoxylus* occurs entirely on Federal land under the jurisdiction of the Coronado National Forest; therefore, the discussion below focuses on Federal laws.

Astragalus hypoxylus is listed as a sensitive species in the Coronado National Forest. The management of sensitive species is described in Forest Service Manual (FSM) 2670, and the management objectives are to develop and implement management practices to ensure that species do not become endangered or threatened because of Forest Service actions; maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands; and develop and implement management objectives for populations or habitat of sensitive species or both. In addition, the Forest has to consider the effects of their actions on the viability of sensitive species through the NEPA process. As defined by Forest Service policy, actions must not result in loss of species viability or create significant trends toward the need for Federal listing. *A. hypoxylus* receives these protective measures in the Coronado National Forest, and the designation has resulted in measures to reduce impacts from recreation on the Bear Canyon *A. hypoxylus* population, and the consideration of the species' needs in the NEPA planning process for the Bender and Lone Mountain grazing allotments.

Summary of Factor D

We examined the existing regulatory mechanisms that protect *Astragalus hypoxylus.* We have determined that the Forest Service sensitive species designation adequately protects *A. hypoxylus* and its habitat, and, thus, there is no evidence of impacts to *A. hypoxylus* from inadequate existing regulatory mechanisms. We conclude that the best available information indicates that *A. hypoxylus* is not threatened by inadequate existing regulatory mechanisms.

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

A threat identified by the petition was indirect effects to pollinators, mainly bees. Johnson *et al.* (1992, p. 13) noted that the use of pesticides to control insects, such as grasshoppers, may be harmful to bees. The Coronado National Forest has not sprayed pesticides for grasshopper control, and has no plans to do so. As mentioned previously, the pollinators for *Astragalus hypoxylus* have not been identified. As such, there is no evidence of activities that may harm the potential pollinators of this species; therefore, we have determined that the loss of pollinators from pesticide spraying is not a threat to the species.

We are not aware of any other potential threats related to this factor, such as small population size and overall rarity. Therefore, we find that *Astragalus hypoxylus* is not threatened by small population size and overall rarity, or is likely to become so.

Finding for *Astragalus hypoxylus*

As required by the Act, we evaluated the five factors in assessing whether *Astragalus hypoxylus* is endangered or threatened throughout all or a significant portion of its range. We examined the best scientific and commercial information available regarding the past, present, and future threats faced by *A. hypoxylus.* We reviewed the petition, information available in our files, other available published and unpublished information, and we consulted with recognized plant experts and Forest Service biologists.

Astragalus hypoxylus populations are primarily affected by drought; however, we determined that drought is not a threat to this species. The plants are tolerant of moderate disturbance, and are adapted to arid conditions, as evidenced by their survival during the 1950s drought. Climate change will likely impact the status of *A. hypoxylus* in the future; however, the limited available information suggests that climate change will not threaten the continued existence of the species. Other factors potentially affecting *A. hypoxylus*—including recreation;

livestock grazing; nonnative, invasive species; fuel wood harvesting; fire; and effects to potential pollinators—are either limited in scope, or available evidence is lacking to indicate that they adversely impact the species. There is no evidence that overutilization, disease, or predation is affecting this species. In addition, we find that the existing regulatory mechanisms are not a threat to the species.

Based on our review of the best available scientific and commercial information pertaining to the five factors, we find that the threats are not of sufficient imminence, intensity, or magnitude to indicate that *Astragalus hypoxylus* is in danger of extinction (endangered), or likely to become endangered within the foreseeable future (threatened), throughout all of its range.

Significant Portion of the Range

Having determined that *Astragalus hypoxylus* is not in danger of extinction, or likely to become so, throughout all of its range, we must next consider whether there are any significant portions of the range where *A. hypoxylus* is in danger of extinction or is likely to become endangered in the foreseeable future. We also considered the historical range of the species, and have determined that the current range is no different from the historical range. Therefore, there has been no loss of the historical range, and no further analysis of the historical range is required.

The Act defines an endangered species as one ''in danger of extinction throughout all or a significant portion of its range,'' and a threatened species as one ''likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' The term ''significant portion of its range'' is not defined by the statute. For the purposes of this finding, a portion of a species' range is ''significant'' if it is part of the current range of the species, and it provides a crucial contribution to the representation, resiliency, or redundancy of the species. For the contribution to be crucial it must be at a level such that, without that portion, the species would be in danger of extinction.

In determining whether *Astragalus hypoxylus* is endangered or threatened in a significant portion of its range, we considered status first to determine if any threats or potential threats acting individually or collectively threaten or endanger the species in a portion of its range. We evaluated the current range of *A. hypoxylus* to determine if there is any apparent geographic concentration of the primary stressors potentially affecting the species including recreation; livestock grazing; nonnative, invasive plants; fuel wood harvesting; fire; road maintenance; and drought. We have analyzed the stressors to the degree possible, and determined that they are essentially uniform throughout the species' range. We also found the stressors are not of sufficient imminence, intensity, magnitude, or geographically concentrated such that it warrants evaluating whether a portion of the range is significant under the Act. We do not find that *A. hypoxylus* is in danger of extinction now, nor is likely to become endangered within the foreseeable future, throughout all or a significant portion of its range. Therefore, listing *A. hypoxylus* as an endangered or threatened species under the Act is not warranted at this time.

We request that you submit any new information concerning the distribution and status of, or threats to, *Astragalus hypoxylus* to our U.S. Fish and Wildlife Service Office (see **ADDRESSES** section) whenever it becomes available. New information will help us monitor *A. hypoxylus* and encourage its conservation. If an emergency situation develops for *A. hypoxylus,* or any other species, we will act to provide immediate protection.

Species Information for *Erigeron piscaticus*

Species Description

Erigeron piscaticus is a herbaceous annual (a plant that completes its life-cycle in one year) in the Asteraceae (Sunflower) family. The plant is typically 15 to 40 cm (6 to 16 in) in height, multi-branched, procumbent or ascending—decumbent (trailing or lying on the ground), and densely pubescent (covered with hair) with coarse, stiff hair. One to 4 flower heads are produced per plant, each 5 to 7 mm (0.2 to 0.3 in) across with a white corolla (ray and disk flowers), and producing tan-colored achenes (fruit) to 1 mm (0.04 in) in length. The very small flower heads, coupled with entire (toothless) leaves are key factors distinguishing this species from close relatives (Nesom 1989, p. 306).

Habitat and Biology

Oak Grove Canyon, where the plant has been most recently located, is a narrow slot canyon with intermittent stream flow and a riparian gallery forest of sycamore, alder, and black walnut (Gori 1992, p. 2). Occurring at 1,000-m (3,300-ft) elevation, its steep (91 to 122 m) (300 to 400 ft)) canyon walls and northeast aspect provide for significantly cooler temperatures than the semidesert grasslands in the adjacent uplands (Haberstich 2011, pers. comm.). The plants are found on sandy terraces just above the floodplain and are subject to larger flood events; there is little associated understory (Gori 1992, p. 2). A single collection from Turkey Creek refers to a ''riparian woodland'' habitat, while the specimen from Fish Creek has no habitat information recorded. The collection from near Tucson refers to the plant being found ''in rock adjacent to stream.'' (Southwest Environmental Information Network 2011)

Erigeron piscaticus germinates following either winter or summer rains (Arizona Game and Fish Department (AZGD) Heritage Data Management 2001, p. 2), grows quickly, and has a long flowering period from May through October (Gori 1992, p. 2) or possibly through December (Southwest Environmental Information Network, 2011). Pollination has not been studied in this species, though other *Erigeron* species are typically pollinated by bees and wasps (Tepedino 2011, pers. comm.). Seed is dispersed by both wind and water; this species may also depend on flooding events to create suitable early-successional habitat (Gori 1992, p. 2). Seed bank longevity has not been studied in *E. piscaticus.*

Soil moisture is necessary for most annual plants to germinate and flower; therefore, seed production in most annuals is equally limited by soil moisture. Following this theory, Gori (1992, p. 3) suggested that *Erigeron piscaticus* populations would increase or decrease in sequential years of above- or below-average moisture. In the case of data collected at Oak Grove Canyon, this theory held in 1993, a wet year, when both 1994 and 1995 had high population numbers (79 and 68 respectively). However, the theory did not hold in 2002, a dry year, when 23 plants were found in 2003 followed by 64 plants in 2004. It is likely that this species instead responded to flooding that occurred in 1993 and not to precipitation. There is not sufficient data available to determine the ecological factors that influence the germination of this species.

Distribution, Abundance, and Trends

Erigeron piscaticus is ranked by NatureServe as G1S1 (Global and State Critically Imperiled). The species is known from two confirmed areas: Fish Creek Canyon and the Aravaipa Canyon Preserve of south-central Arizona. There are three populations in the Aravaipa Canyon Preserve; one is located in Turkey Creek Canyon, and the

remaining two populations are in Oak Grove Canyon. An additional site is currently under investigation in the mountains near Tucson. The herbarium specimen location for this third site states ''Box Canyon southwestern corner of Santa Catalina Mountains;'' the specimen was verified by Guy Nesom, the botanist who described the species (Southwest Environmental Information Network 2011). There have been discussions among botanists, however, that this location may be incorrect and Box Canyon could refer to either the Rincon or Santa Rita Mountains. It is also possible that the specimen was misidentified and the location is correct. The specimen currently resides at the New York Botanic Garden Herbarium and a loan has been requested by Shelley McMahon of the University of Arizona Herbarium for reverification. Surveys for the species are planned in 2012 (Crawford 2011, pers. comm.).

The species was first collected on the Tonto National Forest in Fish Creek Canyon in October 1929 by Eastwood, then again in 1931 by Peebles and Eaton (Nesom 1989, p. 305). *Erigeron piscaticus* was not collected again until 1976 in Turkey Creek then in 1979 in Oak Grove Canyon by Anderson and Warren (Southwest Environmental Information Network 2011). In 2002, a second group of plants was located in Oak Grove Canyon and those plants are counted as part of an annual census for the canyon as a whole (Haberstich and Killeen 2002, p. 1). Both Turkey Creek and Oak Grove Canyon are within the Aravaipa Canyon Preserve on Bureau of Land Management land managed jointly with The Nature Conservancy. The two locations within Oak Grove Canyon are approximately 0.8 km (0.5 mi) apart by air and the Oak Grove populations are approximately 3.7 air km (2.3 air mi) from the collection site in Turkey Creek. The Fish Creek locations are approximately 129 air km (80 air mi) from those in Aravaipa Preserve. There are many canyons supporting what seems to be suitable habitat between the known locations in Fish Creek and the Aravaipa Canyon Preserve. Several surveys have been completed, and no additional populations have been located (Gori 1991, p. 2).

Attempts were made in 1990 to locate the populations in both Fish Creek and Turkey Creek again, but none were found (Gori and Malusa 1991, p. 2). The Arizona Game and Fish Department reports 11 plants were located in Turkey Creek in 1992, although no other records indicate the plant has been found in Turkey Creek since its first collection in 1976. A letter in the files from Dave Gori to Dan Godec of the Arizona Game and Fish Department dated June 12, 1998 stated that *E. piscaticus* has not been relocated in Fish Creek Canyon or Turkey Creek Canyon. He related that, to his knowledge, there were ''no other extant locations for this plant except Oak Grove Canyon.'' It is unknown how many plants originally occurred at collection sites in Fish Creek or Turkey Creek Canyons. As these populations have not been detected again, it is unknown if they are extant or what the current population sizes are. Annual monitoring of plants in Oak Grove Canyon took place between 1992 and 2008 and is scheduled to occur in the summer of 2011 (Haberstich 2011, pers. comm.). These efforts show plant numbers fluctuating annually, ranging from 87 individuals in 1992, to 4 individuals in 2002, and back to 81 individuals in 2008.

To summarize, there is very little biological and ecological information known about this species. There are three known locations, but plants have not been seen in the original location, Fish Creek, since the 1930s. Today, plants are known from two locations, Oak Creek Canyon and Turkey Creek on the Aravaipa Canyon Preserve. There may be another location in the Santa Catalina Mountains, near Tucson, but it has not been verified. The species seem to be associated with floodplain terraces in riparian areas, but that is based on their current locations in the Aravaipa Canyon Preserve. The species may respond to rainfall, or germination may be triggered by flooding, or the apt combination of rainfall and flooding.

Five-Factor Evaluation for *Erigeron piscaticus*

In making this finding, information pertaining to *Erigeron piscaticus* in relation to the five factors provided in section 4(a)(1) of the Act is discussed below.

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Potential factors that may affect the habitat or range of *Erigeron piscaticus* are discussed in this section, including: (1) Flooding; (2) recreation; (3) watershed degradation; and (4) climate change.

Flooding

Many annual and short-lived perennial plant species have a high rate of seed production and the ability to thrive following disturbance. Annual plants in the southwestern United States often increase in richness and cover following the disturbance of large flood events (Bagstad *et al.* 2005, p. 219). These events reduce competition with perennial plants, increase understory light, remove litter accumulation from overstory tree species, redistribute seed banks, and create nutrient-rich sediment beds for seed germination. Plants found above the inundation zones on high flood-plain surfaces respond most to the increased rainfall that led to flooding, while those in inundation zones respond most to the physical disturbance of flooding (Bagstad *et al.* 2005, p. 219, 221). *Erigeron piscaticus* is an annual riparian species that occurs above the inundation zone on shallow terraces that are subject to larger flooding events.

Census data for this species were collected on a nearly annual basis between 1992 and 2008, in one of two locations within the Aravaipa Canyon Preserve, in southeastern Arizona. Plant census data were compared against regional precipitation data during this time period, and no correlation was observed. In other words, population peaks varied between wet (1991 through 1995) and dry (2004 and 2008) years (NOAA 2011; Haberstich and Walker 2008, p. 1; Haberstich 2005, p. 1; Haberstich and Killeen 2004, p. 1; 2003, p. 1; 2002, p. 1; Haberstich 2011, pers. comm.). Aravaipa Creek has experienced significant flooding on four occasions (1979, 1984, 1993, and 2006) since stream flow gage records were first kept in 1932 (USGS, 2011). *Erigeron piscaticus* may be more closely associated with the physical scouring from flooding than with precipitation. *E. piscaticus* populations peaked following both the 1993 and 2006 floods.

Although periodic flooding events remove individual plants and seeds, total *Erigeron piscaticus* population numbers were very similar during the 2008 monitoring (81) to numbers the first time the species was monitored in 1992 (87). There is, however, great year-to-year variability in the census data, both in terms of population numbers (as low as 4 plants in 2002, and as high as 87 plants in 1992) and population locations (lower, middle, and upper sections of the canyon). The species seems to establish, increase and decrease; disperse via water or wind; and move to different locations within the canyon, which may explain the new location discovered downstream from known sites in 2002. In addition, in particularly dry years, plants may not germinate. This may explain why certain populations, like Fish Creek, have never been found again. If the populations are not present every year, and the location may move within the canyon based on flooding, it is easy to

understand why populations need regular and consistent monitoring.

Erigeron piscaticus seems to be well adapted to its environment and may require periodic flooding for survival. Too many large floods, however, could deplete the seed bank; too few large floods could lead to competition with perennial plants and litter accumulation (Gori 1992, p 3). We are making this conclusion based on the behavior of one population; however, this population may not be representative of the species. We conclude that *E. piscaticus* is tolerant of moderate disturbance and may need periodic flooding for successful seed germination. Therefore, based on the best available information, we determined that flooding is not a threat to the continued existence of *E. piscaticus,* nor is it likely to become so.

Recreation

Erigeron piscaticus plants are located near hiking and game trails in Oak Grove Canyon. Hiking and other forms of recreation, including all-terrain vehicle (ATV) use, occur frequently in the Aravaipa Canyon Preserve (Haberstich 2005, p. 1; Haberstich and Killeen 2004, p. 1). As stated above, this species seems to tolerate moderate levels of disturbance. The populations in Oak Grove Canyon seem to be persisting despite the levels of traffic, both human and ATV, that occur adjacent to and through the populations. There are also observations (Haberstich 2005, p. 1; Haberstich and Killeen 2004, p. 1) that *E. piscaticus* plants were found in various stages of germination and growth on an actively eroding site, another indication that the species tolerates disturbance. Impacts from recreation may have contributed to the loss of the Turkey Creek population in the Aravaipa Canyon Preserve, as the site was used as a casual camping site (AZGF Heritage Data Management 2001, p. 3). However, there is no documentary evidence that that is the case, and because no one has surveyed that area since the 1990s, there is no conclusive evidence that the population has been extirpated. In summary, *E. piscaticus* seems to tolerate disturbance, and, based on the best available information, we find that recreation is not a threat to the continued existence of this species, nor is it likely to become so.

Watershed Degradation

The Aravaipa Canyon watershed has a history of intense grazing by cattle, horses, and goats. This grazing occurred from the 1850s until the 1980s when grazing was removed from portions of the area and a pasture rotation system was initiated in other areas (Gori 1992, p. 4). By 1997, the entire area, including Oak Grove and Turkey Creek Canyons, was free of domestic grazing activity (Haberstich 2011, pers. comm.). The years of intense grazing, coupled with fire suppression, significantly altered plant species composition and abundance, and led to a degraded condition of the upland vegetation of the area (Gori 1992, pp. 3–4). By the 1980s, this upland semidesert grassland was described as being largely comprised of shrubs and annual grasses, an unnatural condition that reduces water infiltration and can cause more intense sheet flow during storm events (Gori 1999, pp. 41–42). Great strides have been made in recent decades to correct this problem. Preserve Manager Mark Haberstich reports that the uplands are fairly healthy with increases in native perennial grasses, thus reducing runoff and erosion (Haberstich 2011, pers. comm.). There is no evidence that watershed degradation is affecting *E. piscaticus* populations in the Aravaipa Canyon Preserve. Therefore, based on our review of the best available information, we conclude that watershed degradation is not a threat to the continued existence of this species, nor is it likely to become so.

Climate Change

For general background information on climate change, please refer to the first paragraphs of ''Climate Change'' under Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range in the Five-Factor Evaluation for *Amoreuxia gonzalezii* section.

It has been suggested that this species may be a relict of the last ice age due to its very restricted habitat of cool, shady, narrow, and steep slot canyons in perennial stream bottoms (Haberstich 2011, pers. comm.). If this is the case, recent and projected increases in regional daily temperatures and decreases in winter precipitation could negatively impact *Erigeron piscaticus.* Direct impacts due to rising temperature are unknown for this plant, although heat stress in plants in general is known to impact germination, photosynthesis, respiration, and a myriad of other functions (Wahid *et al.* 2007, p. 199). A reduction in precipitation or increase in temperature-related stress could preclude recruitment and therefore seed set in this annual species. Seed bank longevity for *E. piscaticus* has not been determined, although Bagstad *et al.* (2005, p. 219) state that ''many of the annual plant species found in southwestern riparian areas have long-lived seeds that are widely distributed in soil seed banks across the flood plain, enabling them to establish opportunistically when suitable germination sites develop.'' Similarly, other *Erigeron* seeds have been reported to last roughly 10 years with no refrigeration (Murray 2011, pers. comm.).

The information related to the effects of climate change on *Erigeron piscaticus* at a local scale is limited. Predicted changes in rainfall, temperature, and flooding frequency may all affect *E. piscaticus.* However, based on the species' life history and observed tolerances, it appears that the effects of climate change may be limited. In conclusion, based on the best available information, we have determined that climate change is not a threat to the continued existence of *E. piscaticus.*

Summary of Factor A

Based on the best available information, we have determined that flooding, recreation, watershed degradation, and climate change do not threaten *Erigeron piscaticus,* nor are they likely to do so. Flooding seems to play an important role in the germination and survival of *E. piscaticus* populations. As such, the species seems to tolerate moderate levels of disturbance, making the populations less vulnerable to impacts from recreation, such as hiking and ATV use. The watershed condition of Aravaipa Canyon has recovered from past grazing, and there is no evidence that *E. piscaticus* populations have been affected by watershed degradation. We acknowledge that climate change, particularly the predictions of reduced precipitation and increasing temperatures in the Southwest, may affect populations of *E. piscaticus;* however, the limited available information at the local scale suggests that a climate change will likely not be a threat to the continued existence of the species. Thus, the present or threatened destruction, modification, or curtailment of the habitat or range is not a threat to the continued existence of *E. piscaticus,* nor is it likely to become so.

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

Erigeron piscaticus is not a plant of horticultural interest. There is no evidence of any instances in which *E. piscaticus* was collected from the wild other than as voucher specimens to document occurrences (*http://ag.arizona.edu/herbarium*). Therefore, we conclude, based on the best available information, that overutilization is not a threat to the continued existence of the species, nor is it likely to become so.

Factor C. Disease or Predation

There is no indication that any disease affects *Erigeron piscaticus.* There is no livestock grazing in Oak Grove Canyon and Turkey Creek on the Aravaipa Canyon Preserve, and there is no information about any other source of predation on the species. Therefore, we have determined that disease or predation is not a threat to this species' continued existence, nor is it likely to become so.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

The Act requires us to examine the adequacy of existing regulatory mechanisms with respect to threats that may place *Erigeron piscaticus* in danger of extinction or likely to become so in the future. Existing regulatory mechanisms that could have an effect on potential threats to *E. piscaticus* include (1) Local land use laws, processes, and ordinances; (2) State laws and regulations; and (3) Federal laws and regulations. *E. piscaticus* occurs entirely on Federal land under the jurisdiction of the Bureau of Land Management (BLM) and the Tonto National Forest; therefore, the discussion below focuses on Federal laws.

Erigeron piscaticus is listed as a BLM sensitive species (BLM, 2010). The management of sensitive species is described in the BLM Manual Section 6840, which states that the BLM will focus sensitive species management on maintaining species habitat in functional ecosystems, ensuring the species is considered in land management decisions, and prioritizing conservation that emphasizes habitat needs for the species, thereby preventing the need to list the species under the Act.

Erigeron piscaticus is also listed as a sensitive species in the Tonto National Forest (Tonto National Forest 2004, entire). The management of sensitive species is described in U.S. Forest Service Manual (FSM) 2670, and the management objectives are to develop and implement management practices to ensure that species do not become endangered or threatened because of Forest Service actions; maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands; and develop and implement management objectives for populations or habitat of sensitive species, or both. In addition, the Forest has to consider the effects of their actions on the viability of sensitive species through the NEPA process. As defined by Forest Service policy, actions must not result in loss of species viability or create significant trends toward the need for Federal listing. *E. piscaticus* receives these protective measures in the Tonto National Forest.

Summary of Factor D

We examined the existing regulatory mechanisms that protect *Erigeron piscaticus.* We have determined that the BLM and Forest Service sensitive species designation adequately protects *E. piscaticus* and its habitat and, thus, there is no evidence of impacts to *E. piscaticus* from inadequate existing regulatory mechanisms. We conclude that the best available information indicates that *E. piscaticus* is not threatened by inadequate existing regulatory mechanisms.

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

Small Population Size

Small populations can be especially vulnerable to environmental disturbances such as habitat loss, nonnative species, grazing, and climate change (Barrett and Kohn 1991, p. 7; Oostermeijer 2003, p. 21; O'Grady 2004, pp. 513–514). However, plants that are historically rare may have certain adaptations to rarity (*e.g.,* early blooming, extended flowering, or mixed-mating systems) that enable them to persist (Brigham 2003, p. 61). For more information on species rarity and its effects on the conservation status of a species, see the discussion under Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence in the Five-Factor Evaluation for *Amoreuxia gonzalezii.*

There is no indication that *Erigeron piscaticus* was ever present on the landscape over a more extensive range than it is today. Existing sites are monitored, and surveys have located no new occurrences. There is no information indicating that random demographic or environmental events are a threat to the continued existence of the species because of its small population size.

Genetic Diversity

Small population size can decrease genetic diversity due to genetic drift (the random change in genetic variation each generation), and inbreeding (mating of related individuals) (Antonovics 1976, p. 238; Ellstrand and Elam 1993, pp. 218–219). Genetic drift can decrease genetic variation within a population by favoring certain characteristics and, thereby, increasing differences between populations (Ellstrand and Elam 1993, pp. 218–219). Self-fertilization and low dispersal rates can cause low genetic diversity due to inbreeding (Antonovics 1976, p. 238; Barrett and Kohn 1991, p. 21). This decreased genetic diversity diminishes a species' ability to adapt to the selective pressures of a changing environment (Newman and Pilson 1997, p. 360; Ellstrand 1992, p. 77).

Limited information is available regarding the genetic diversity of the *Erigeron* genus. No information is available regarding the genetic diversity exhibited by *E. piscaticus.* Therefore, we have determined that a lack of genetic diversity is not a threat to the continued existence of the species.

Summary of Factor E

Erigeron piscaticus is a rare species known from two locations, Fish Creek Canyon and the Aravaipa Canyon Preserve. Currently, there are two known populations in Oak Creek Canyon, within the Aravaipa Canyon Preserve. The other populations of *E. piscaticus* in Fish Creek Canyon and Turkey Creek Canyon, in the Aravaipa Canyon Preserve, have not been seen in quite some time. There is no evidence that this species was at one time more widespread than its current distribution. There is no information that *E. piscaticus* populations are subject to threats resulting from small population size. The same conclusion is drawn for the lack of genetic diversity that may affect small populations. Therefore, based on the best available information, we have determined that small population size and lack of genetic diversity are not threats to the continued existence of *E. piscaticus,* nor are they likely to become so.

Finding for *Erigeron piscaticus*

As required by the Act, we considered the five factors in assessing whether *Erigeron piscaticus* is endangered or threatened throughout all or a significant portion of its range. We examined the best scientific and commercial information available regarding the past, present, and future threats faced by *E. piscaticus.* We reviewed the petition, information available in our files, other available published and unpublished information, and we consulted with recognized plant experts and land managers.

Erigeron piscaticus populations do not seem to face any obvious threats. The species is an annual, which means that there is less certainty about the size, location, and permanence of any given site. In addition, the species tolerates,

and may possibly require, disturbance in order to complete its life cycle. The only available information is monitoring data from one location, and two of the other locations have not been seen in quite some time, although attempts to find these populations again have not occurred. As such, there is an incomplete set of information about this species, which makes it difficult to assess threats and make valid predictions on how potential threats may affect *E. piscaticus.* For instance, climate change will affect temperature and precipitation in the Southwest, but it is not known what that means for changes in flooding, and how that will affect *E. piscaticus.*

Other factors potentially affecting *Erigeron piscaticus*—including recreation and watershed degradation—are either limited in scope, or lacking evidence indicating that they adversely impact the species. There is no evidence that overutilization, disease, or predation are affecting this species. Although the existing populations are small, there is no evidence that the populations are subject to a lack of genetic diversity or are more vulnerable to stochastic events. In addition, we conclude that the inadequacy of existing regulatory mechanisms is not a threat to the species.

Based on our review of the best available scientific and commercial information pertaining to the five factors, we find that the threats are not of sufficient imminence, intensity, or magnitude to indicate that *Erigeron piscaticus* is in danger of extinction (endangered) or likely to become endangered within the foreseeable future (threatened), throughout all of its range.

Significant Portion of the Range

Having determined that *Erigeron piscaticus* is not in danger of extinction, or likely to become so, throughout all of its range, we must next consider whether there are any significant portions of the range where *E. piscaticus* is in danger of extinction or is likely to become endangered in the foreseeable future. We also considered the historical range of the species, and have determined that the current range is no different from the historical range. Therefore, there has been no loss of the historical range, and no further analysis of the historical range is required.

The Act defines an endangered species as one ''in danger of extinction throughout all or a significant portion of its range,'' and a threatened species as one ''likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' The term ''significant portion of its range'' is not defined by the statute. For the purposes of this finding, a portion of a species' range is ''significant'' if it is part of the current range of the species, and it provides a crucial contribution to the representation, resiliency, or redundancy of the species. For the contribution to be crucial it must be at a level such that, without that portion, the species would be in danger of extinction.

In determining whether *Erigeron piscaticus* is endangered or threatened in a significant portion of its range, we considered status first to determine if any threats or potential threats acting individually or collectively threaten or endanger the species in a portion of its range. We evaluated the current range of *E. piscaticus* to determine if there is any apparent geographic concentration of the primary stressors potentially affecting the species including flooding, recreation, and watershed degradation. We have analyzed the stressors to the degree possible, and determined that they are essentially uniform throughout the species' range. We also found the stressors are not of sufficient imminence, intensity, magnitude, or geographically concentrated such that it warrants evaluating whether a portion of the range is significant under the Act. We do not find that *E. piscaticus* is in danger of extinction now, nor is likely to become endangered within the foreseeable future, throughout all or a significant portion of its range. Therefore, listing *E. piscaticus* as an endangered or threatened species under the Act is not warranted at this time.

Conclusion of 12-Month Finding

We find that *Amoreuxia gonzalezii* (Santa Rita yellowshow), *Astragalus hypoxylus* (Huachuca milk-vetch), and *Erigeron piscaticus* (Fish Creek fleabane) are not in danger of extinction now, nor is any of these three species likely to become endangered within the foreseeable future throughout all or a significant portion of their ranges. Therefore, listing any of these three species as endangered or threatened under the Act is not warranted at this time.

We request that you submit any new information concerning the distribution and status of, or threats to, *Erigeron piscaticus* to our U.S. Fish and Wildlife Service Office (see **ADDRESSES** section) whenever it becomes available. New information will help us monitor *E. piscaticus* and encourage its conservation. If an emergency situation develops for *E. piscaticus* or any other species, we will act to provide immediate protection.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* and upon request from the U.S. Fish and Wildlife Service, Arizona Ecological Services Field Office (see **ADDRESSES** section).

Authors

The primary authors of this finding are the staff members of the Arizona Ecological Services Field Office.

Authority

The authority for this action is section 4 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Dated: September 22, 2011.

Gregory E. Siekaniec,

Acting Director, Fish and Wildlife Service.

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DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

RIN 1018–AY28

[FWS–R9–ES–2011–0075; MO 92210–0–0010 B6]

Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition and Proposed Rule To List the Yellow-Billed Parrot

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; 12-month finding.

SUMMARY: We, the U.S. Fish and Wildlife Service, propose to list as threatened the yellow-billed parrot *(Amazona collaria)* under the Endangered Species Act of 1973, as amended (Act). We are taking this action in response to a petition to list this species as endangered or threatened under the Act. This document, which also serves as the completion of the status review and as the 12-month finding on the petition, announces our finding that listing is warranted for the yellow-billed parrot. If we finalize this rule as proposed, it would extend the Act's protections to this species. We also propose a special rule for the yellow-billed parrot in conjunction with our proposed listing as threatened for this species. We seek information from the public on this proposed rule and status review for this species.