Astragalus desereticus
Deseret Milk-vetch

5-Year Review:
Summary and Evaluation

Photo by Bekee Hotze (USFWS).

U.S. Fish and Wildlife Service
Utah Field Office – Ecological Services
West Valley City, Utah 84119

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5-YEAR REVIEW
Astragalus desereticus (Deseret Milk-vetch)

1. GENERAL INFORMATION

1.1 Purpose of 5-Year Reviews

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

1.2 Reviewers

Lead Regional Office: Mountain-Prairie Region (Region 6)
Mike Thabault, Assistant Regional Director-Ecological Services, 303-236–4210
Bridget Fahey, Chief of Endangered Species, 303-236–4258
Seth Willey, Regional Recovery Coordinator, 303-236–4257

Lead Field Office: Utah Ecological Services Field Office
Larry Crist, Field Supervisor, 801-975–3330
Bekee Hotze, Endangered Species Branch Chief, 801-975–3330

1.3 Methodology Used to Complete the Review

On April 18, 2007, we published a Notice of Review in the Federal Register (FR) (72 FR 19549) soliciting any new information on the *Astragalus desereticus* that may have a bearing on its classification as endangered or threatened. We received one comment letter in response to the Notice of Review. The commenter expressed concern that monitoring was not sufficient to determine the species' status and trends; we considered their comments in this 5-year review.

This 5-year review was written by biologists in the Utah Field Office. It summarizes and evaluates information provided in the conservation agreement, current scientific research, and surveys related to the species. All pertinent literature and documents on file at the Utah Field Office were used for this review (See References section below for cited documents).

1.4 Background

1.4.1 FR Notice Citation Announcing Initiation of This Review

72 FR 19549, April 18, 2007

1.4.2 Listing History

Original Listing
FR notice: 64 FR 56590, October 20, 1999
Entity listed: Species
Classification: Threatened range-wide

1.4.3 Associated Rulemakings

Advanced Notice of Proposed Rulemaking and Notice of Critical Habitat Prudency Determination: Anticipated Delisting of *Astragalus desereticus* (Deseret milk-vetch) From the List of Endangered and Threatened Plants; 72 FR 3379, January 25, 2007; Entity listed: Species.

1.4.4 Review History

Since the Federal listing of *Astragalus desereticus* in 1999, we have not conducted a status review or 5-year review.

1.4.5 Species' Recovery Priority Number at Start of 5-year Review

At the start of the 5-year review, the Recovery Priority Number for the *Astragalus desereticus* was 14. This number indicated: 1) the plant was listed as a full species; 2) populations face a low degree of threat; and 3) recovery potential is high (see TABLE 1).

TABLE 1. The ranking system for determining Recovery Priority Numbers was established in 1983 (48 FR 43098, September 21, 1983, as corrected in 48 FR 51985, November 15, 1983).

Degree of Threat	Recovery Potential	Taxonomy	Priority	Conflict
High	High	Monotypic Genus	1	1C
		Species	2	2C
		Subspecies/DPS	3	3C
	Low	Monotypic Genus	4	4C
		Species	5	5C
		Subspecies/DPS	6	6C
Moderate	High	Monotypic Genus	7	7C
		Species	8	8C
		Subspecies/DPS	9	9C
	Low	Monotypic Genus	10	10C
		Species	11	11C
		Subspecies/DPS	12	12C
Low	**High**	Monotypic Genus	13	13C
		Species	**14**	14C
		Subspecies/DPS	15	15C
	Low	Monotypic Genus	16	16C
		Species	17	17C
		Subspecies/DPS	18	18C

1.4.6 Recovery Plan

We did not develop a recovery plan for this species. In 2005, we invited knowledgeable individuals and key stake holders to serve on a recovery team for *Astragalus desereticus*. Instead of developing a recovery plan, we worked with the Utah Division of Wildlife Resources (UDWR), Utah Department of Transportation (UDOT), and Utah School Institutional Trust Lands Administration to develop an interagency conservation agreement—Conservation Agreement for Deseret Milk-vetch (*Astragalus desereticus*) (hereafter referred to as the "Conservation Agreement"). We, along with the State partners, signed this Conservation Agreement on October 10, 2006. We believed the Conservation Agreement served the purpose of the recovery plan and worked toward alleviating the threats for which the species was originally listed. Therefore, we moved forward with an Advanced Notice of Proposed Rulemaking to delist the species (72 FR 3379, January 25, 2007). We received four comment letters in response to our notice. All four letters stated that we did little to show the status and threats to the species changed since we originally listed the species. Furthermore, they recommended we initiate monitoring to collect baseline data to better assess the threats that the species faces.

The Conservation Agreement was signed by us and three State partners. There are no State laws or regulations that give the authority to manage for plants. As we were finalizing this 5-year status review, UDWR eliminated their last remaining full-time botany position within the Utah Natural Heritage Program (UNHP). Therefore, we are uncertain of the State's commitment to managing *Astragalus desereticus* and adhere to the conditions set forth in the Conservation Agreement. As of this review, no replacement entity for the functions formerly served by UNHP botany staff has been identified. Until this issue is resolved, the existing Conservation Agreement is in a state of flux and we are no longer relying upon it to function as a recovery plan.

2. REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment Policy

This section of the 5-year review is not applicable to this species because the ESA precludes listing Distinct Population Segments (DPS) for plants. For more information, see our 1996 DPS policy (61 FR 4722, February 7, 1996).

2.2 Recovery Planning and Implementation

2.2.1 Does the species have a final, approved recovery plan?

☒ No

2.3 Updated Information and Current Species Status

2.3.1 Background on the Species

2.3.1.1 Biology and Life History

Astragalus desereticus is a perennial, herbaceous, almost stemless member in the bean family (Barneby 1989). Individual plants are 2–6 inches (in.) (5–15 centimeters (cm)) in height and arise from the base of an herbaceous stem. Stems are about 2 in. (5 cm) tall. The pinnately compound leaves (feather-like arrangement with leaflets on both sides of a central stalk) are 2–4 in. (5–10 cm) long with 11–17 leaflets. Leaflets are elliptical to ovate in shape, with a dense, silvery gray pubescence (short hairs) on both sides. Seed pods are 0.4–0.8 in. (1–2 cm) long and densely covered with lustrous hairs (see FIGURE 1). The flower petals may be either completely white or whitish with pinkish wings and a lilac keel-tip (see FIGURE 2). This species resembles *A. piutensis* (Sevier milk-vetch) in habit, but is more loosely pubescent with mixed straightish and sinuous hairs with gray-silvery foliage (Barneby 1989).

FIGURE 1. Plant with flowers and seed pods (photo by Ben Franklin with permission).

FIGURE 2. Close-up of flower showing the purple keel tip in the center of the flower (photo by Bekee Hotze (USFWS)).

Astragalus desereticus is a short-lived perennial that occurs on steep, highly erosive soils (Stone 1992). Seedling mortality was high at one site (Humphrey 1993). Although we do not know how long *Astragalus desereticus* may live for, the half-life of established plants within the genus *Astragalus* is 2.7 years (Stone 1992). That is to say, after 2.7 years, half of all individuals are dead.

Plants begin the active growing season shortly after snow melt in about mid-April (Stone 1992). Toward the end of summer when it is hot and dry, the leaves closest to the ground die back. As the current season's vegetative growth die back, new buds, at the soil level, form (Stone 1992). These buds generally survive the winter because they are protected from severe cold by snow cover (Stone 1992).

Astragalus desereticus likely reproduces sexually (Stone 1992). Flowering and seed set occur in May and June (Barneby 1989). We believe that small bees pollinate this plant based on the characteristics of the flower (Humphrey 1993). Fruiting occurs after successful pollination from June to July (USFWS 1991) and mature plants, defined as those greater than 4 in. (11 cm) in diameter, produced the most fruits with 6.4-38.7 fruits per mature plant (Humphrey 1993). Once the seed pods are mature, they fall off the plant and crack open at the tip to release the seeds. Seeds can remain dormant for a considerable time for many *Astragalus spp.* (Stone 1992; Humphrey 1993). This adaptation serves two functions: one is to optimize seedling survival, and the second is to spread

germination over time so that a catastrophic event (such as drought or fire) does not kill all the seedlings. Germination trials indicate seed dormancy is broken by simple physical scarification (Dodge 2008). Another *Astragalus* species (*A. barrii*) occurs in erosive soils in which the moving rocks and soils scarify the seeds thereby breaking dormancy (Dingman 2005). This same process also could help break seed dormancy in *A. desereticus.*

Astragalus desereticus occurs in a sagebrush-juniper community (Welsh and Chatterley 1985). Species that are associated with *A. desereticus* are *Pinus edulis* (twoneedle pinyon), *Juniperus osteosperma* (Utah juniper), *Quercus gambelii* (Gambel oak), *Artemisia tridentata* (big sagebrush), *Purshia tridentata* (antelope bitterbrush), *Opuntia polyacantha* (plains pricklypear), *Pseudoroegneria spicata* (bluebunch wheatgrass), *Achnatherum hymenoides* (Indian ricegrass), *Hesperostipa comata* (needle and thread), and *Eriogonum brevicaule* (shortstem buckwheat) (Franklin 1990; Stone 1992; Humphrey 1993; UDWR et al. 2006). *Bromus tectorum* (cheatgrass) also was one of the main associated species in portions of the *A. desereticus* population (Humphrey 1993).

Astragalus species are typically suited to moderately moist environments; their proliferation into drier climates and otherwise unfavorable microhabitats is a more recent phenomenon that has produced many geographically restricted genotypes, such as *A. desereticus* (Barneby 1989). In fact, *Astragalus'* ability to colonize new unstable habitats in progressively dry climates has hastened the evolution of the genus (Barneby 1989).

2.3.1.2 Distribution, Abundance, and Trends

Astragalus desereticus is a narrow endemic occurring only on the sandy-gravelly hillsides of the Moroni Formation near Birdseye, Utah, in Utah County. The species occurs at elevations between 5,400 and 5,600 feet (ft) (1,646-1,707 meters (m)) (Franklin 1990; Stone 1992; Humphrey 1993; Fitts and Fitts 2010; see FIGURE 3).

Astragalus desereticus was first collected "below Indianola" in 1893 and then again in 1909 on the "slopes near Indianola" (Barneby 1964). Repeated searches in the Indianola area over the next several decades failed to relocate the species (Stone 1992). Then in 1981, the species was rediscovered near the town of Birdseye, approximately 10 miles north along Highway 89 and downstream along Thistle Creek from Indianola (Franklin 1990). We now believe that the first two recordings of the species location were actually made near Birdseye (Franklin 1990; Stone 1992; Humphrey 1993).
The first range-wide survey for *Astragalus desereticus* was completed in 1990 (Franklin 1990). The survey delineated 125 acres (50 hectares) of habitat on UDWR and private lands within 5 colonies, or areas of potential habitat searched and delineated that contain plants (Franklin 1990). Although quantitative population counts were not done, Franklin (1990)

estimated that there were fewer than 5,000 plants and that plant densities were higher in the north than in the south (Franklin 1990).

In 1992, the 1990 mapped habitat was resurveyed (Stone 1992). Once again, quantitative population counts were not done. However, the population numbers appeared to be similar in the northern portion of its range as it had in 1990 while in the southern portion the number of seedlings and young plants increased (Stone 1992). Therefore, the population estimate was increased to more than 10,000 individuals (Stone 1992).

In 1993, six long-term monitoring transects were established (Humphrey 1993). All life stages (seedling, juvenile, and mature) were found throughout the range of the species with the seedling life stage comprising about 70% of the individuals counted (Humphrey 1993). No population estimates were made during this survey. Unfortunately, data was not collected again at these long-term monitoring transects until 2009 (Fitts and Fitts 2010; see below).

In 2008, UNHP attempted to census the entire population (five colonies) as mapped by Franklin (1990) (Fitts 2008). An additional colony was located north of the known colonies, thereby slightly expanding the range of the species (Fitts 2008). This new colony increased the total number of colonies known for the species to six (Fitts and Fitts 2009). The range expansion did not increase the acres occupied, presumably because plant colonies were delineated using a global positioning system (GPS) and, therefore, were more accurate in Fitts and Fitts (2009) than the original colony boundaries defined by Franklin (1990) and digitized into a geographic information system (GIS) by Fitts and Fitts (2009). The southern-most colony (South Elmer) was completely surveyed and 12,043 plants were counted (Fitts 2008). The northern-most colony (North Oberhansly) was only partially surveyed, approximately 1/5 of the area surveyed, and 5,729 plants were counted (Fitts 2008). Due to plant numbers being higher than anticipated, census counts were determined to be an ineffective method to estimate the population and transects were set up (Fitts 2008). Transects were spaced 1,312 ft (400 m) apart in order to ensure all known colonies had at least one transect (Fitts and Fitts 2009). Transects were oriented southwest to northeast to cover various slopes and aspects of the habitat (Fitts and Fitts 2009).

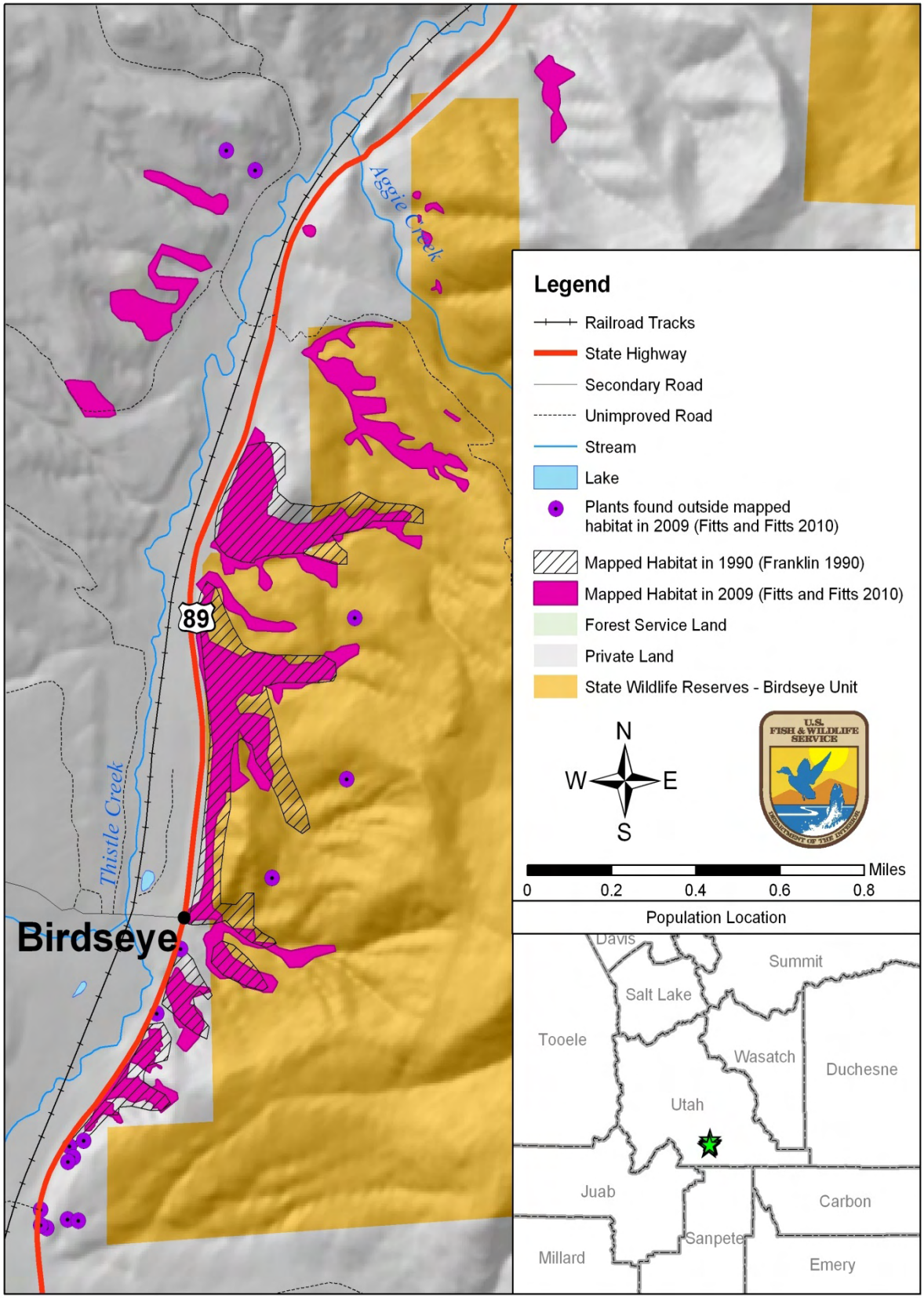

FIGURE 3. ***Astragalus desereticus*** **range map.**

Fitts and Fitts (2009) estimated the population using 2008 data to be 153,533 plants (Fitts and Fitts 2009). With the exception of the southern-most colony where the census count was completed, Fitts and Fitts (2009) estimated populations for the remaining five colonies by multiplying the total number of plants per square meter within the transect within the colony by the habitat area of the colony as defined by Franklin (1990) and digitized by Fitts and Fitts (2009) (see TABLE 2). The estimate likely overestimates the population for a number of reasons: inaccuracy in original hand drawn colony boundaries as defined by Franklin (1990); the small number of transects; and the inclusion of all life stages, including seedlings. As seedlings have a high rate of mortality and established plants are more stable (Humphrey 1993; see section 2.3.1.1), we subsequently calculated density using the adult life stage only. This produced a population estimate between 86,775 and 98,818 plants. This estimate also is likely to be high because the first two contributing factors to overestimating population size cannot be overcome using the data provided. The range in our estimate is due to the census counts in the South Elmer colony. The number provided for that colony did not distinguish the number of individuals per life stage, rather a total count was provided (Fitts and Fitts 2009).

TABLE 2. Population Estimate Per Colony (based on Fitts and Fitts 2009).

COLONY	AREA acres (m^2)	#Adult	#Juvenile	#Seedling	Total #Plants	Total Plants per m^2	Total Population Estimate	Adult Plants per m^2	Adult Only Population Estimate
Dense colony (new)	5.96 (24,124)	333	68	173	574	2.08	50,171	1.21	29,106
North Oberhansly	36.62 (148,210)	78	31	29	138	0.18	27,126	0.10	15,332
Long mid	48.63 (196,790)	200	43	33	276	0.27	52,427	0.19	37,990
NW to SE	9.62 (38,950)	8	7	8	23	0.18	6,891	0.06	2,397
Next to S*	14.3 (57,850)	12	9	9	30	0.08	4,875	0.03	1,950
South Elmer**	9.2 (37,230)						12,043		0-12,043
TOTAL	124.33 (503,154)	631	158	252	1,041		153,533		86,775-98,818

* Fitts and Fitts (2009) report this population as having a density of 0.62. However, the density should be the number of plants found (30) divided by the length of the transect (178 meters) multiplied by the width of the transect (2 meters), which equals 0.08. This slight difference results in a difference in the total population estimate for the species. Fitts and Fitts (2009) reports the population estimate as 152,229.

** The South Elmer colony was censused; therefore, this is an exact count of all individual plants within the colony.

The long-term monitoring transects Humphrey established in 1993 were resurveyed in 2009 (Fitts and Fitts 2010). Comparison between the two surveys after a 16-year period may not be valid. For instance, Humphrey chose his transects to be in areas with higher plant densities (Humphrey 1993). As mentioned previously in section 2.3.1.1, *Astragalus desereticus* occurs on steep, highly erosive soils. Habitat is often dynamic for other *Astragalus* spp. (i.e., *A. barrii and A. holmgrenorium*) and plants may move from one area to another over time (60 FR 15966; Dingham 2005). For these reasons, we would expect over a period of 16 years that individual plant locations have shifted. Therefore, any comparisons between the datasets cannot be used to determine trends. Still, the Fitts and Fitts (2010) report provides valuable information for better understanding the species.

Fitts and Fitts (2010) surveyed suitable habitat in 2009. Based on this survey effort, the range of the species expanded to a length of 2.8 miles (4.5 kilometers) along Thistle Creek (Fitts and Fitts 2010). The occupied habitat increased to 146 acres (59 hectacres) (Fitts and Fitts 2010). Using the same transect data from 2008 and extrapolating across the larger occupied habitat area, the population estimate should be 211,915 plants (Fitts and Fitts 2010). This number is not substantiated with quantitative data and we cannot recreate this calculation. Since UNHP laid off their botanical section, including the authors of these reports, we cannot substantiate the population estimate presented in the 2010 report. Therefore, we are using the modified population count from the 2009 data estimating a total population between 86,775 and 98,818 plants.

The majority of the mapped habitat occurs on UDWR owned lands (82 acres), in the Birdseye Unit of the Northwest Manti Wildlife Management Area (WMA). The remaining land is owned privately (64 acres). Nearby Forest Service land has been searched, but suitable habitat does not occur on Forest Service land (Franklin 1990). Our occupied habitat polygons do not include all known plant locations (see FIGURE **3**3). In addition, potential habitat occurs on private land north of the mapped habitat, but these areas were not surveyed due to access restrictions (Fitts and Fitts 2010). Thus, the range of the species is greater than the mapped habitat. All new sites (mapped and unmapped) are within effective foraging distances of possible insect pollinators, and we consider them part of the single existing population.

In summary, we do not have population trend information for *Astragalus desereticus*. We know that the species occurs in much larger numbers than we knew at the time of listing. We also know that the existing geographic area occupied by *A. desereticus* is larger than we knew at the time of listing.

2.3.1.3 Genetics, Genetic Variation, or Trends in Genetic Variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.)

There is no information concerning the genetics of *Astragalus desereticus*. Genetic variability varies greatly in *Astragalus* species (Morris et al. 2002; Alexander et al. 2004; Breinholt et al. 2009; Bushman et al. 2010) and we do not know the variability and vulnerability of *A. desereticus*. In lieu of genetic research, physical characteristics of the species can be measured over time to determine if the species is suffering from reduced genetic fitness. For instance, plant size, fruit production, and seed set can be measured and used as indicators that a species may have reduced genetic diversity. Also, species that are separated by distances that are greater than pollinators can travel may be more at risk to loss of genetic diversity. We do not have trend data to show that the species is being impacted by loss of genetic diversity. Each plant produced approximately 18 seeds and had high germination rates near 80% (Dodge 2009). In addition, plants appeared vigorous (Hotze et al. 2011). We believe the distances between plant colonies are short enough that pollinators can travel between them effectively to ensure genetic variability does not reduce plant fitness.

2.3.1.4 Taxonomic Classification or Changes in Nomenclature

Astragalus desereticus specimens were collected in 1893 and 1909 near Indianola, Utah, but the species was not described until 1964 (Barneby 1964). The 1964 description and classification of *A. desereticus* is the accepted taxonomic status (Barneby 1989; Welsh et al. 2003; NRCS 2010).

2.3.2 Five Factor Analysis

Astragalus desereticus was listed as endangered based on perceived threats from residential development, highway widening, livestock grazing and trampling, wildlife management, and other impacts to its habitat in combination with small population size and restricted distribution (64 FR 56590, October 20, 1999). In our Advanced Notice of Proposed Rulemaking forecasting the anticipated delisting of this species, we determined that threats to the species were not as significant as earlier believed and were managed such that the species was not likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (72 FR 3379, January 25, 2007). To help determine whether the threats identified in our original listing still existed, if they were effectively managed, as well as if there were new threats to the species, we systematically examined what we know about *Astragalus desereticus's* life history in the context of the same five factors we considered when we listed the species and then published our Advanced Notice of Proposed Rulemaking for a proposed delisting. The threats assessment was completed according to our "Draft Guidance for Conducting Threats Assessment under the ESA" (USFWS 2006).

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range.

When we listed *Astragalus desereticus*, we believed residential development, highway widening, livestock grazing and trampling, and wildlife management were threats to *A. desereticus* populations and habitat (64 FR 56590, October 20, 1999). **TABLE 3** lists these threats as well as any new threats that could or have resulted in the destruction, modification, or curtailment of the habitat or range of *A. desereticus*.

TABLE 3. Factors Affecting the Habitat and Overall Threat Level Ranking.

FACTORS AFFECTING THE SPECIES	OVERALL THREAT LEVEL
Residential Development	*No longer considered a threat*
Highway Widening	*No longer considered a threat*
Livestock Grazing & Trampling / Wildlife Management	*No longer considered a threat*
Climate Change	*Not considered a threat*

Residential Development

In our final rule listing the species, substantial population growth and urban expansion were predicted in the Provo, Spanish Fork, and Weber River drainages east of Wasatch Mountains (QGET 1997; 64 FR 56592, October 20, 1999). In our advanced notice of proposed rulemaking forecasting the anticipated delisting of this species, we determined that little to no habitat was lost since the time of listing (72 FR 3379, January 25, 2007). *Astragalus desereticus* is located near Birdseye, Utah, approximately 20 miles south of the closest large town of Spanish Fork, Utah. According to the U.S. Census bureau, Birdseye is considered a populated place that is not a census designated or incorporated place having an official federally recognized name (accessed on-line at http://utah.hometownlocator.com/ut/utah/birdseye.cfm [July 20, 2011]). As such, population growth and development over time has not been tracked specifically for Birdseye. Analyzing aerial photography from four dates (1993, 2004, 2006, and 2009) only one housing development occurred near habitat between 2004 and 2006 (see FIGURE 4). This development was an addition to an existing house and occurred outside both the 1990 and the 2009 mapped habitat boundaries. Within the habitat, approximately 0.32 acres (less than 0.22% of the total) on private lands have been disturbed by what appears to be local access roads or fences (see FIGURE 5). Using aerial photography, the disturbance occurred between the 1993 photo and the 2004 photo (see FIGURE 5).

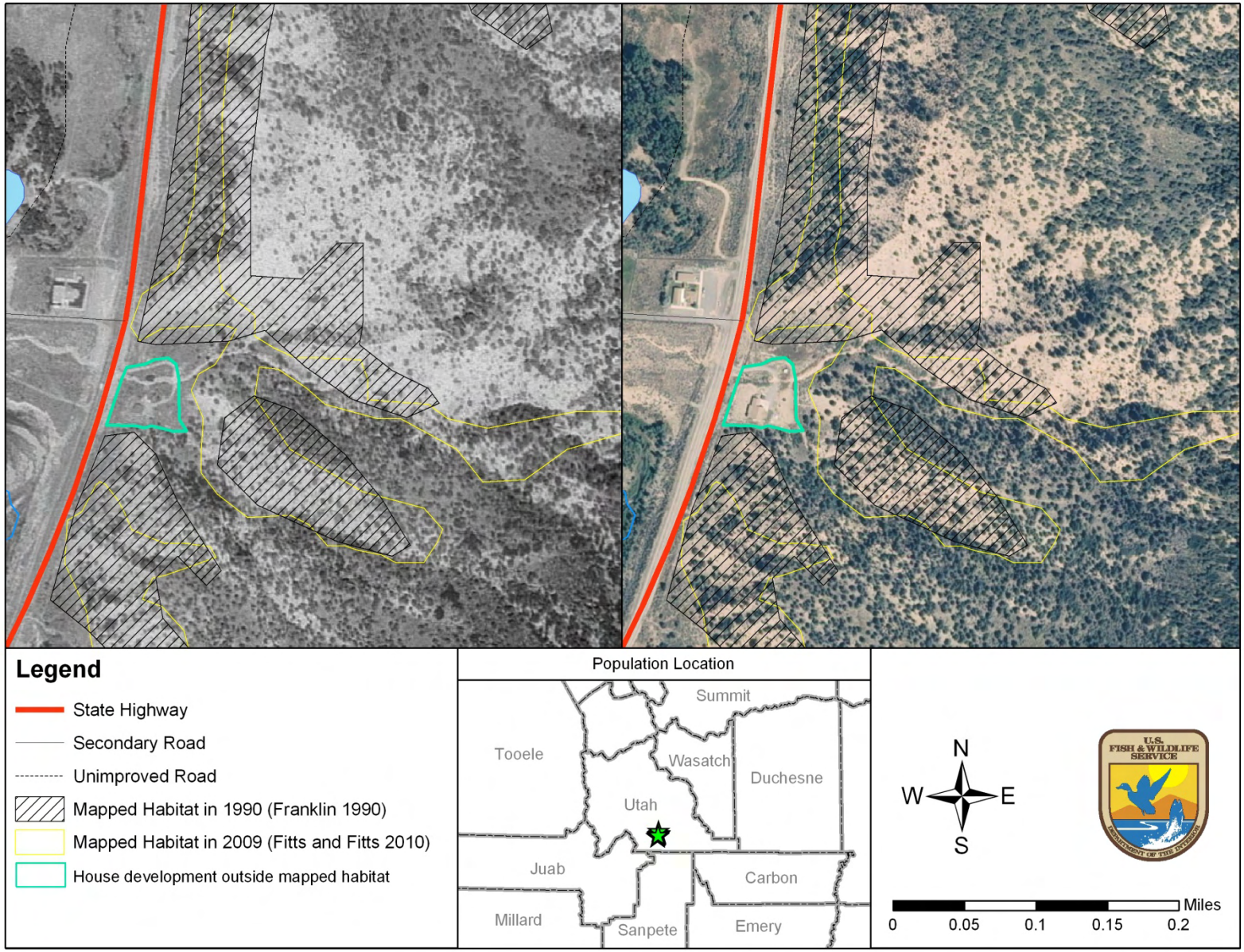

FIGURE 4. The only housing development near habitat – 1993 photo on the left and 2009 photo on the right.

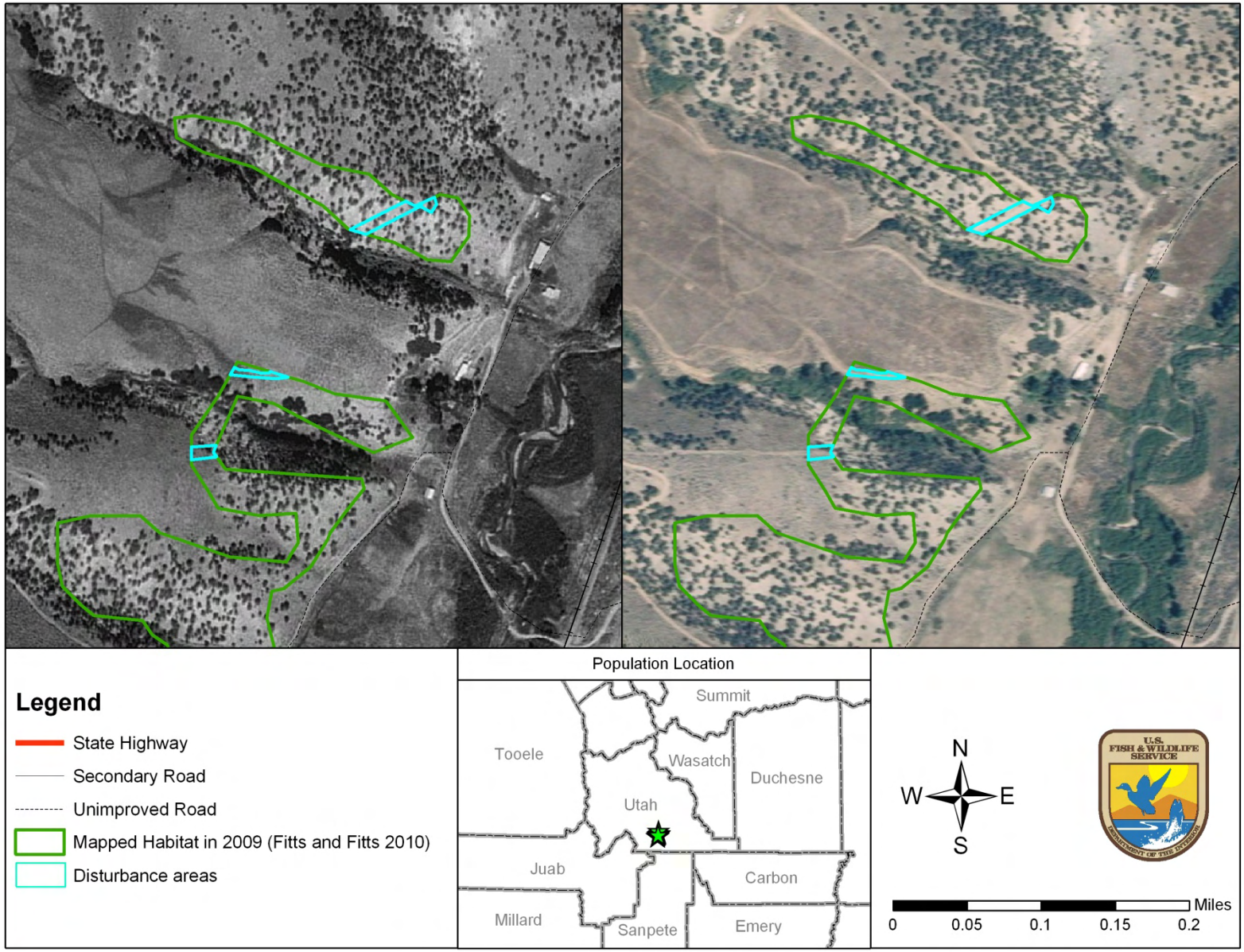

FIGURE 5. Other disturbances to the habitat – 1993 photo on the left and 2009 photo on the right.

Approximately 56% of the species' mapped occupied habitat occurs within the Northwest Manti WMA, and thus will not be impacted by residential development (see FIGURE 3). The majority of the species' habitat, regardless of landowner, occurs on steep, rocky, and highly erosive slopes that are not conducive to development (England pers. comm. 2010). Given the little development and disturbance that has occurred in the area since 1993 coupled with the species habitat requirements, we no longer consider residential development to be a threat to the species in the foreseeable future.

Highway Widening

In our final rule listing the species, we believed widening Highway 89 threatened the species (64 FR 56592, October 20, 1999). Highway widening could affect plants growing within the right-of-way. However, in our advanced notice of proposed rulemaking forecasting the anticipated delisting of this species, we determined that the right-of-way was wide enough to adequately minimize impacts to *Astragalus desereticus* individuals (72 FR 3379, January 25, 2007). In addition, UDOT has not widened this road since the species was listed nor do they have any widening projects planned in this area through 2030 (UDOT 2007). Therefore, we no longer consider highway widening projects to be a threat to the species in the foreseeable future.

Livestock Grazing and Trampling / Wildlife Management

At the time of listing, cattle grazing and trampling and wildlife management were identified as threats because increased soil erosion and animals can trample individual plants or the nests of ground dwelling pollinators. Many species of *Astragalus* are poisonous to livestock (Stone 1992). However, *A. desereticus* tested negative for swainsonine, a compound that is poisonous to cattle (Stone 1992). Therefore, *A. desereticus* is considered to be palatable to cattle and can be impacted by grazing (Stone 1992).

Prior to UDWR acquisition of the Northwest Manti WMA, livestock grazing (primarily sheep) occurred for over 100 years on occupied *Astragalus desereticus* habitat (England pers. comm. 2006). Once acquired, UDWR managed the Northwest Manti WMA primarily for wildlife management, but also for cattle grazing. In order to improve grazing and wildlife habitat, UDWR chained and seeded the tops of the benches upslope of the *Astragalus desereticus* population.

In 1990, the Northwest Manti WMA allowed grazing (Farmer pers. comm. 2010). Impacts of grazing to the habitat, in the form of trails and trampling were more apparent on the southern end of the population (Franklin 1990).

In 1992, there was no evidence of recent cattle grazing and grazing occurred about once every 3 years (Stone 1992). When grazing did occur, cattle were present from mid-May to mid-June (during the flowering period) (Stone 1992; Farmer pers. comm. 2010). Cattle tended to concentrate upslope of the population where the area was chained and seeded for cattle forage (Stone 1992).

In 1993, again there was no evidence of cattle grazing (Humphrey 1993).

The last official cattle grazing on the Northwest Manti WMA occurred in 2002 (Farmer pers. comm. 2010).

In 2010, some private lands adjacent to the species' range contained livestock. However, no impacts from cattle grazing occurred within the species' known occupied habitat on private lands (Fitts pers. comm. 2010).

In 2011, there was evidence of cattle occurring in the area; however, there was no indication of herbivory or grazing on *Astragalus desereticus* (Hotze et al. 2011). Furthermore, the plants appeared vigorous and healthy (Hotze et al. 2011).

The UDWR has no plans to officially graze the Northwest Manti WMA in the near future (Farmer pers. comm. 2010). As mentioned above, fencing is not complete between UDWR and private lands and there is evidence of cattle in the area; although, plants continue to appear healthy and vigorous given the current levels of cattle present (Hotze et al. 2011).

As stated in our advanced notice of proposed rulemaking, we concluded there was no evidence that current grazing levels were negatively impacting the *Astragalus desereticus* populations (72 FR 3379, January 25, 2007). Based on anecdotal observations, it does not appear that grazing is currently occurring at a level where the population is being adversely affected and plants continue to appear healthy and vigorous (Stone 1992; Humphrey 1993; Fitts pers. comm. 2010; Hotze et al. 2011). Therefore, we do not consider livestock grazing and trampling to be threats to the species.

Climate Change

Climate change was not considered a threat at the time of listing or at the time of our anticipated delisting notice. Recent climatic changes, including increased temperatures and changes in precipitation, are important driving forces on ecosystems that affect a wide variety of organisms with diverse geographic distributions (Walther et al. 2002; Parmesan and Yohe 2003). For example, flowering is occurring earlier in the year for many plant species, and some species are moving to higher latitudes or altitudes (Walther et al. 2002). This phenomenon may present

a change in phenology and potential asynchrony for pollinators, depending on the degree of coevolution between this plant and its pollinator type. For most *Astragalus* species, the bumblebee is the most active pollinator (Baskin et al. 1972).

In the southwestern United States, including Utah, average temperatures have increased ~1.5°F (0.8°C) compared to a 1960-1979 baseline (Karl et al. 2009). 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). Utah is expected to see periods between precipitation events increase, while those precipitation events become more intense (Steenburgh et al. 2007). Much of the southwest remains in a 10-year drought, "the most severe western drought of the last 110 years" (Karl et al. 2009).

Climate change may impact *Astragalus desereticus*. Drought conditions led to a noticeable decline in survival, vigor and reproductive output of other rare plants in the southwest during the drought years of 2001-2004 (Anderton 2002; Van Buren and Harper 2002, 2003; Hughes 2005; Clark and Clark 2007; Roth 2008a, 2008b). It is unlikely that this species could adapt to changing rainfall or temperature by shifting altitudinal range due to the limited distribution of its required soil substrate. Extended drought may result in reduced flowering and seed set. However, the weather patterns created by climate change are unpredictable, and effects to rainfall are particularly difficult to predict on a site-specific basis (Smith et al. 2001; Steenburgh et al. 2007). It is thus difficult to predict the long-term effects of climate change on a species such as *A. desereticus* that occurs in a relatively small area.

Drought adapted species may experience lower mortality during severe droughts (Gitlin et al. 2006). As discussed under section 2.3.1.1, *Astragalus desereticus* appears to be drought tolerant with an ability to inhabit microhabitats in progressively dry climates (Barneby 1989; Stone 1992). In fact, *Astragalus's* ability to colonize new unstable habitats in progressively dry climates has hastened the evolution of the genus (Barneby 1989).

In summary, effects related to climate change, such as persistent or prolonged drought conditions, may affect the long-term persistence of *Astragalus desereticus*, but without further research or information, it is difficult to predict the magnitude of effects. Because of these uncertainties, we cannot reliably assess the threat of climate change to the species at this time. However, the species is considered to be drought tolerant. In addition, as described above, there are no threats to the species that would result in significant loss or fragmentation of available habitat, and thus there are no cumulative effects to exacerbate the potential threat of climate change. At this time, the best available information does not indicate that climate change threatens the species.

Summary

Habitat loss, fragmentation, and modification are not threats to the species. Most of the species' habitat occurs on the State-managed Northwest Manti WMA. No development will occur on the WMA, and we do not anticipate development on adjacent private lands in the foreseeable future. Similarly, only very limited livestock grazing occurs across the species' range; therefore, trampling and soil erosion is not a threat. The potential remains for climate change to impact the species, but the available information indicates that the species is drought tolerant, not threatened by other habitat loss or fragmentation variables, and thus this impact does not rise to the level of threatening the species in the foreseeable future.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes.

Overutilization was not considered a threat at the time of listing and was not addressed in the anticipated delisting notice. The only collection of *Astragalus desereticus* is for scientific documentation and cultivation. Approximately 850 seeds were collected from 45 individual plants in 2008 for germination trials and for long-term seed storage at Red Butte Gardens and Arboretum in Salt Lake City, Utah, and the National Center for Genetic Resources Preservation in Fort Collins, Colorado (Dodge 2008). This amount of collection from 45 individuals is insignificant given the current population estimates for the species (see section 2.3.1.2). In addition, this collection will help ensure the genetic preservation for the species should some stochastic event reduce the redundancy and resiliency of the species. There are no commercial or recreational uses for this species. Therefore, we do not consider overutilization for commercial, recreational, scientific, or educational purposes a threat to *A. desereticus*.

2.3.2.3 Disease or predation.

Other than cattle grazing and wildlife management, which we discuss in section 2.3.2.1 above, disease and insect predation were not considered threats at the time of listing. We have no information to suggest the species is vulnerable to any disease or insect predations. Although deer were abundant in the population and some plants were eaten, only a few individuals were affected and there is no evidence that this is occurring to the point that the species as a whole is negatively impacted (Humphrey 1993). Therefore, we do not consider disease and predation to be threats to *Astragalus desereticus*.

2.3.2.4 Inadequacy of existing regulatory mechanisms.

There were no Federal, State, or local laws or regulations that protected *Astragalus desereticus* at the time of listing. The only law or regulation currently protecting this species is the ESA. *A. desereticus* does not occur on Federal lands; therefore, the ESA provides protection only against the removal or transport of the species. Collection is not considered a threat to this species (see section 2.3.2.2). It is unlikely collection would become a threat in the absence of ESA protection.

At the time of listing, we considered habitat loss, cattle grazing, and stochastic events to threaten the species. There are no laws or regulations designed to manage for these factors. However, we no longer consider these factors threats to the species (see sections 2.3.2.1 and 2.3.2.5 for further discussion).

In addition to a lack of threats to the species, the majority (56%) of the known population occurs on the Northwest Manti WMA. Habitat on the Northwest Manti WMA is protected from residential and commercial development. Even on private land, the species occurs on steep, rocky, and highly erosive slopes that are not conducive to development (England pers. comm. 2010).

In summary, in the absence of the ESA's protection, there would be no regulations or laws at any level of jurisdiction to protect *Astragalus desereticus*. Threats to the species from residential development, highway widening, and livestock grazing and trailing, and wildlife management have failed to materialize since listing, or are of very limited impact. Although there are no existing regulatory mechanisms protecting the species, we are not aware of any threats that would require regulatory mechanisms to conserve the species. Therefore, we do not consider inadequacy of regulatory mechanisms to threaten the species.

2.3.2.5 Other natural or manmade factors affecting its continued existence.

At the time of the species' listing, stochastic events, including the threat of flood, fire, or extreme weather, were considered a threat due to the extremely restricted range of the species. The restricted range increases the possibility that inadvertent disturbance, either natural or human caused, could impact a significant portion of the species' population and habitat. Sources of such impacts may include wildfire, and pest insects. We previously determined fire was unlikely in the species' open sparse woodland overstory habitat (72 FR 3379, January 25, 2007). We have no information regarding pest insects that may impact *Astragalus desereticus.*

Since listing, survey data shows the species' range is larger and population numbers are higher than previously thought (see section 2.3.1.2). The species is more likely to be secure from stochastic events and be able to persist into the foreseeable future. We now have much larger populations than previously recorded, and the plants have successfully survived prolonged drought conditions. Therefore, we believe that stochastic events are unlikely to threaten the species.

2.4 Synthesis

At the time of listing, we concluded that *Astragalus desereticus* was threatened due to potential habitat loss, livestock trampling and grazing, inadequacy of existing regulatory mechanisms and stochastic events impacting the small population. At the time of our advanced notice of proposed rulemaking, we determined many of these threats were not as significant as we had anticipated or had failed to develop.

Because of *Astragalus desereticus'* specific habitat needs, the species is a narrow endemic. However, in the absence of information identifying threats to the species and linking those threats to the rarity of the species, we do not consider rarity alone to be a threat. A species that has always been rare, yet continues to survive, could be well equipped to continue to exist into the future. This may be particularly true for *A. deserticus*, which is adapted to dry conditions and has survived during periods of drought. 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.

We do not anticipate threats to the species in the foreseeable future. Little habitat has been lost on private lands from development and we are unaware of development plans within the species' habitat. Current levels of grazing, which are most likely livestock from neighboring private lands, do not appear to be affecting the plants or the habitat. The species' known range and population size is greater than previously thought, providing resistance to stochastic events.

Public comments on our anticipated delisting notice included a concern regarding limited monitoring to determine long-term population trends. Since 2007 when our anticipated delisting notice was published, additional studies have been completed increasing the amount of occupied habitat, increasing the population estimate, and indicating there are no threats to the species (Fitts 2008; Fitts and Fitts 2009, 2010). We conclude that *Astragalus desereticus* should be proposed for delisting due to the absence of threats to the species and its habitat and because the species' known range and population size is greater than previously thought.

3. RESULTS

3.1 Recommended Classification

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

3.2 New Recovery Priority Number

We do not recommend changing the recovery priority number.

Brief Rationale

Using our system for determining Recovery Priority Numbers (48 FR 43098 and 48 FR 51985), we determined that the recovery priority number for *Astragalus desereticus* should stay at 14. This number indicates: 1) the plant's taxonomic standing as a full species; 2) a perceived low degree of threat from activities such as urbanization, road construction, and grazing as described above in the 5-factor analysis; and 3) a high potential for full recovery, as we have concluded the species is recovered and no longer meets the definition of a threatened or endangered species.

3.3 Listing and Reclassification Priority Number

☐ Reclassification (from Threatened to Endangered) Priority Number
☐ Reclassification (from Endangered to Threatened) Priority Number
☒ **Delisting (Removal from list) Priority Number**

TABLE 4. Listing and Reclassification Priority Number.

MANAGEMENT IMPACT	PETITION STATUS	PRIORITY
High……..	Petitioned action……...	1
	Unpetitioned action……..	2
Moderate……...	Petitioned action……...	3
	Unpetitioned action……..	4
Low……...	Petitioned action……...	5
	**Unpetitioned action……..	**6**

Brief Rationale

Delisting the species is unlikely to change the management impact. As determined through the threats assessment process used in this 5-year review, threats to the species are not as significant as we thought when we listed the species or they have not materialized. We have not received a petition to delist this species.

4. RECOMMENDATIONS FOR FUTURE ACTIONS

4.1 Surveys and Monitoring

- Habitat and soil monitoring should be considered to determine the full extent of potential habitat for the species and facilitate post-delisting monitoring.

- The post-delisting monitoring plan should include annual monitoring geared toward assessing the impacts of livestock grazing on the plants and the habitat. Should unauthorized livestock begin to degrade the habitat, fencing should be installed between the UDWR and private lands (see Threats Abatement below).

4.2 Threats Abatement

- Should monitoring show that unauthorized livestock are beginning to degrade the habitat (See Surveys and Monitoring above), fencing should be installed between the UDWR and private lands.

4.3 Administrative Actions

- The species should be proposed for removal from the list of endangered and threatened species.

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U.S. FISH AND WILDLIFE SERVICE
5-Year Review of *Astragalus desereticus* (Deseret Milk-vetch)

Current Classification: Threatened rangewide

Recommendation resulting from the 5-Year Review:
☐ Downlist to Threatened
☐ Uplist to Endangered
☒ Delist
☐ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: 6

Review Conducted By: Bekee Hotze, Utah Ecological Services Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date 8/11/16
Field Supervisor, Utah Ecological Services Field Office

REGIONAL OFFICE APPROVAL:

Lead Assistant Regional Director, Fish and Wildlife Service

Approve _____ Date 8/16/16
Assistant Regional Director - Ecological Services, Region 6