U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Astragalus anserinus

Common Name:

Goose Creek milkvetch

Lead region:

Region 6 (Mountain-Prairie Region)

Information current as of:

03/29/2013

Status/Action

___ Funding provided for a proposed rule. Assessment not updated.

___ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

___ New Candidate

_X_ Continuing Candidate

___ Candidate Removal

> ___ Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status
>
> ___ Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species
>
> ___ Range is no longer a U.S. territory
>
> ___ Insufficient information exists on biological vulnerability and threats to support listing
>
> ___ Taxon mistakenly included in past notice of review
>
> ___ Taxon does not meet the definition of "species"
>
> ___ Taxon believed to be extinct
>
> ___ Conservation efforts have removed or reduced threats

___ More abundant than believed, diminished threats, or threats eliminated.

Petition Information

___ Non-Petitioned

_X_ Petitioned - Date petition received: 02/03/2004

90-Day Positive:08/16/2007

12 Month Positive:09/10/2009

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing? **Yes**

Explanation of why precluded:

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The Progress on Revising the Lists section of the current CNOR (http://endangered.fws.gov/) provides information on listing actions taken during the last 12 months.

Historical States/Territories/Countries of Occurrence:

- **States/US Territories**: Idaho, Nevada, Utah
- **US Counties**:County information not available
- **Countries**: United States

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories**: Idaho, Nevada, Utah
- **US Counties**: Cassia, ID, Elko, NV, Box Elder, UT
- **Countries**: United States

Land Ownership:

Over 80 percent of Goose Creek milkvetch (*Astragalus anserinus*) sites in Idaho, Utah, and Nevada occur on Federal lands managed by the Bureau of Land Management (BLM) (U.S. Fish and Wildlife Service (USFWS) 2008a, 17 pp.). The rest of the sites occur as small populations on private and state lands in Utah and Idaho and on private land in Nevada (Baird and Tuhy 1991, p. 14; Morefield 1992, appendix maps; Smith 2007, appendix maps).

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Biological Information

Species Description:

Goose Creek milkvetch is a low-growing, matted, perennial forb (flowering herb) in the legume (pea) family (Fabaceae). Gray hairs cover the leaves giving the plant a gray-green appearance. Goose Creek milkvetch has pink-purple flowers and brownish-red curved seed pods (Mancuso and Moseley 1991, p. 4). This species is distinguished from Torreys milkvetch (*A. calycosus*), woollypod milkvetch (*A. purshii*), and Newberrys milkvetch (*A. newberryi*), the three other mat-forming Astragalus species found in the Goose Creek drainage, primarily by its smaller leaflets and flowers, and the color and shape of the seed pods (Baird and Tuhy 1991, p. 1; Mancuso and Moseley 1991, pp. 45).

Taxonomy:

Goose Creek milkvetch was first collected in 1982 by Duane Atwood from a location in Box Elder County, Utah, and subsequently described in 1984 (Atwood et al. 1984, p. 263).

Habitat/Life History:

Goose Creek milkvetch occurs in a variety of habitats, but is typically associated with dry, volcanic-ash (tuffaceous) soils from the Salt Lake Formation (Mancuso and Moseley 1991, p. 12). The soil series where Goose Creek milkvetch is located include Bluehill fine sandy loam, Codquin gravelly sandy loam, Cottonthomas fine sandy loam, and Tomsherry fine sandy loam (Hardy 2005, p. 4; Mancuso and Moseley 1991, p. 12). The species grows on steep or flat sites, with soil textures ranging from silty to sandy to somewhat gravelly. These habitats can vary from stable areas with little erosion to washes or steep slopes where erosion is common.

Goose Creek milkvetch is generally not found on north-facing slopes, but is found on most other aspects within sparsely vegetated areas in sagebrush and juniper habitats. The estimated total plant cover (of all species) at sites where Goose Creek milkvetch occurs is between 1035 percent (Hardy 2005, p. 4; Smith 2007, p. 2). The dominant native species within the general surrounding plant community include: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), Utah juniper (*Juniperus osteosperma*), green or yellow rabbitbrush (*Chrysothamnus viscidiflorus*), Sandbergs bluegrass (*Poa secunda*), and needle and thread grass (*Hesperostipa comata*). Goose Creek milkvetch is frequently associated with a suite of native species that reside on the tuffaceous sand (Baird and Tuhy 1991, pp. 23) including: Indian ricegrass (*Achnatherum hymenoides*), Douglas dustymaiden (*Chaenactis douglasii*), roundspike cryptantha (*Cryptantha humilis*), slender buckwheat (*Eriogonum microthecum*), cushion buckwheat (*Eriogonum ovalifolium*), ballhead gilia (*Ipomopsis congesta = Gilia congesta*), whitestem blazingstar (*Mentzelia albicaulis*), and silverleaf phacelia (*Phacelia hastata*). Another Goose Creek drainage endemic, Idaho penstemon (*Penstemon idahoensis*), is found near Goose Creek milkvetch, but these species are seldom found immediately adjacent to one another. Other sensitive species in the area include falcate rockcress (*Arabis falcatoria = Boechera falcatoria*), and Cottams cinquefoil (*Potentilla cottamii*) (Franklin 2005, pp. 910, 159160). Several nonnative species also co-occur with Goose Creek milkvetch (see Invasive Nonnative Species, below).

Goose Creek milkvetch typically flowers from late May to early June. At least two different bumblebee species (*Bombus* spp.) pollinate Goose Creek milkvetch (Shohet and Wolf 2011, p. 12), but other specific

pollinators are unknown. Fruit set begins in early June, and fruits remain on the plants for several months. Mechanisms of seed dispersal are unknown, but may include wind dispersion of seed pods and insect or bird agents (Baird and Tuhy 1991, p. 3). Because Goose Creek milkvetch often grows on slopes and because the seed pods are found close to the ground below the vegetative portions of the plant, water or gravity also may be dispersal mechanisms. Clusters of seedlings are occasionally observed on abandoned ant hills, suggesting that ants may also assist with dispersal (USFWS 2006a, pp. 16). Little scientific research specific to Goose Creek milkvetch has been conducted beyond a basic species description and limited survey efforts.

Historical Range/Distribution:

The species is historically and currently known from the Goose Creek drainage in Cassia County, Idaho; Elko County, Nevada; and Box Elder County, Utah (Baird and Tuhy 1991, pp. 516; Mancuso and Moseley 1991, pp. 114; Smith 2007, pp. 15). The Goose Creek drainage occurs within the Northern Basin and Range ecosystem (Bailey *et al*. 1994, map).

Current Range Distribution:

The current range and distribution of Goose Creek milkvetch has not changed significantly from the historic range. Goose Creek milkvetch occurs at elevations ranging between 4,9005,885 feet (ft) (1,4941,790 meters (m)) (Idaho Conservation Data Center (ICDC) 2007b, p. 2; Smith 2007, Table 1; Shohet and Wolf 2011, Figure 2). Most known locations are within an area that is approximately 35 miles (mi) (56 kilometers (km)) long by 6 mi (10 km) wide, oriented in a northeast to southwesterly direction along Goose Creek and extending to Rock Spring Creek.

Figure 1. Goose Creek milkvetch sites and range.

Population Estimates/Status:

The discussion that follows describes the distribution and abundance of Goose Creek milkvetch in terms of Element Occurrences (EOs), a mapping unit used throughout the conservation community and specifically by state Natural Heritage Programs (NHPs) and NatureServe. These EOs encompass a number of specific locations, or sites, where a species is or was known to be present, but do not necessarily represent discrete

populations of the species, due to lack of knowledge about pollinator and seed-dispersal distances and levels of genetic differentiation among locations for this species.

As previously described, Goose Creek milkvetch is endemic to the Goose Creek drainage in Idaho, Nevada, and Utah. Goose Creek milkvetch is known from 19 EOs (5 in Idaho, 10 in Nevada, and 4 in Utah) (ICDC 2007b, p. 4; Smith 2007, p. 1; Utah Conservation Data Center (UCDC) 2007, map; USFWS 2008b, entire).

In 20042005, the USFWS conducted a multiagency survey effort with BLM, the U.S. Forest Service (USFS), and state natural resource agencies from Idaho, Nevada, and Utah. During this survey effort, 40,858 plants were counted at 119 sites distributed among 12 EOs. Combined with the estimated population at the remaining unsurveyed sites, we estimated a total population of nearly 60,000 plants during that time period (USFWS 2008b, Table 1). Of that estimate, approximately 10 percent occurred in Idaho (5,500 plants within five EOs), 25 percent occurred in Nevada (15,500 plants within 10 EOs), and 65 percent occurred in Utah (39,000 plants within four EOs). More than 60 percent of all known individuals (> 37,000 plants) were estimated to occur in a single EO in Utah (EO 001).

Estimating the total Goose Creek milkvetch population size and population trends is complicated due to fluctuations in available abundance data, a lack of knowledge about the primary factors responsible for such variations, and the different survey methods that have been used. Below we discuss five survey and monitoring efforts for Goose Creek milkvetch that occurred since the initial surveys in 20042005:

1. The first effort involved monitoring plant abundance at a number of sites in Idaho (Feldhausen 2007, entire; Theodozio pers. comm. 2013);
2. The second effort targeted 11 monitoring sites in Nevada and Utah to assess the impacts of wildfire and rehabilitation efforts (Mancuso 2010, entire);
3. The third effort was a compilation of 6 monitoring efforts conducted by BLMs Salt Lake Field Office in Utah (Hardy 2010, entire; Hardy 2012, entire);
4. The fourth effort targeted Utah sites (Shohet and Wolf 2011, entire); and
5. The fifth study targeted new sites in Idaho (Kinter et al. 2012, entire; Kinter pers. comm. 2013).

These studies are described in more detail below.

Monitoring Effort 1:

In 2007, the BLM Burley Field Office in Idaho documented considerable fluctuation in plant abundance at Goose Creek milkvetch sites monitored over a nine-year period (Figure 2) (Feldhausen 2007, pp. 89; USFWS 2008a; BLM 2011; BLM 2012). At this point, we do not know what is causing these fluctuations.

Figure 2 - Number of Goose Creek milkvetch plants at select monitoring sites in Idaho by survey year (Feldhausen 2007, pp. 8-9; Theodozio 2013, entire).

Monitoring Effort 2:

In 2007, large wildfires burned significant Goose Creek milkvetch habitat in Nevada and Utah (see Factor A, below). Post-fire reconnaissance surveys documented that approximately 53 percent of the total estimated Goose Creek milkvetch population burned in the wildfires that year. The approximately 31,000 burned individuals occurred within 25 percent of the total occupied habitat delineated in 20042005 (USFWS 2008b, entire). This effort is discussed in detail in the Wildfire section under Factor A, below.

Monitoring Effort 3:

Discussed below are six surveys in Utah which focused on two water pipelines, a range study, and a wildfire burn area (Hardy 2010, entire):

1. The first survey was conducted to determine the effects of a water pipeline bisecting a known Goose Creek milkvetch location on BLM lands in Box Elder County (considered the pipeline site). Two plots were established at this site, one on either side of the pipeline and visited twice once in 2004 and again in 2010 (Hardy 2010, pp. 12). Both plots had more individuals counted in 2010 than in 2004, but the increase was not significant due to the small sample size (p-value = 0.32). Although the population increase between years was insignificant, the 2010 plots displayed evidence of recruitment (Hardy 2010, p. 2). No conclusions regarding population impacts from the pipeline were stated in reports (Hardy pers. comm. 2013). Additionally, in the same study area, four wire cages were placed over Goose Creek milkvetch plants to protect plants from cattle grazing, but no un-caged control plots were established outside of cages (Hardy 2010, pp. 23). The caged plants were visited three times: 2004, 2007, and 2010 (Hardy 2010, pp. 23). Due to low numbers of plants monitored, there were no statically significant differences in the number of plants per cage between years (p-value = 0.60). In order to be statistically rigorous, the sample size for this study should have been at least 26 cages, not 4, for 90 percent certainty of detecting a true difference of 20 percent in the number of plants per plot between the years with a false-change error rate of 0.10. Observational data from this effort indicates that the native grasses within the cages appeared to thrive and potentially compete with Goose Creek milkvetch in the absence of grazing (Hardy 2010, p. 2).

2. The second survey was a belt transect placed on top of a 30-year old range study area that was seeded with crested wheatgrass (*Agropyron cristatum*) in the 1950s (Hardy 2010, p. 4). The data from the 30-year long range study was not included in Hardys report for comparison. Surveyors walked the belt transect twice while

surveying for Goose Creek milkvetch, once in 2006 and again in 2010. In 2006, the surveyors found two mature plants. In 2010, the surveyors found two seedlings and one young plant. However, due to the small sample size, the survey data provided no inferences other than the multi-year presence of plants within an area previously seeded with crested wheatgrass. Although surveyors observed mature plants, seedlings, and a young plant, the age structure between the individuals over the two time periods was statistically insignificant (p-value = 0.81).

3. The third survey effort established one plot called the Large Hillside Plot, north of the pipeline plot described above in this section (Hardy 2010, pp. 45). The plot was visited twice, once in 2007 and again in 2010. In 2007, surveyors counted only the total number of plants and recorded 231 plants (Hardy 2010, pp. 45). In 2010, the surveyors also recorded life stages, documenting 160 total plants with 31 seedlings, 40 young plants, and 89 mature plants (Hardy 2010, pp. 45). Unfortunately, sample sizes were again too small to show a statistical difference in plot population numbers over time. However, unlike the population increase observed at the nearby pipeline plot, the number of plants counted in this plot decreased. This decrease is similar to the findings of Monitoring Effort 1 in Idaho, described above.

4. The BLM designed the fourth survey effort in Utah to monitor the impacts of the 2007 wildfires on Goose Creek milkvetch. This area was previously inventoried in 2005 and had dense Goose Creek milkvetch populations before the wildfires; however, no population estimate was provided (Hardy 2010, pp. 56). The Goose Creek milkvetch population at this site was speculated to contain only 5 percent of what it was before the 2007 wildfire (Hardy 2010, p. 5). The BLM established the first monitoring transects in 2010, but only 3 plants were recorded within the survey quadrats (Hardy 2010, pp. 56). This site was revisited in 2012 and there appeared to be half the number of plants observed in 2010; although no plant counts were provided for the site and within the monitoring transects (Hardy 2012, p. 1-site 1). Unfortunately, this study included only one site. Therefore, its results cannot be compared to other sites, as the type and intensity of threats to the species can vary between sites.

5. The BLM surveyed an unburned site near the burned survey area discussed in number 4, above (Hardy 2012, p. 1-site 2). No post-fire treatments were performed and the density of Goose Creek milkvetch plants appeared to be similar to the density observed in 2005. The plants in 2012 were small in size and brown in color and did not appear vigorous.

6. The BLM surveyed an unburned site in 2012 that was last surveyed in 2002 (Hardy 2012, p. 1-site 3). The population size in 2012 was half of what was documented in 2002, although actual plant counts are not provided. Plants observed at this site in 2012 were small in size and brown in color and did not appear vigorous. The BLM revisited an unburned site in 2012 where a tractor and chain destroyed most of the Goose Creek milkvetch plants in May 2008 (Hardy 2012, p.1-site 4) during post-fire rehabilitation efforts (see Wildfire Control and Post-wildfire Rehabilitation Efforts, below). A few juvenile Goose Creek milkvetch plants were observed growing in the rills created by the chain; however, the current population size on the site is smaller than it was before the chaining event (Hardy pers. comm. 2013).

Monitoring Effort 4:

Completed in 2011, the fourth monitoring effort focused on Federal and State lands in Box Elder County, Utah. The objectives of this effort were (1) to resurvey all known Goose Creek milkvetch sites to determine population parameters (site boundaries and population statistics) within Utah, and (2) to survey potential Goose Creek milkvetch habitats to identify any previously unknown sites. The surveyors conducted a literature review and asked experts for information pertaining to known sites to determine previously known locations. New locations were found using the Intuitive Controlled survey method, a standard and commonly accepted survey protocol which requires walking transects that cover a representative cross section of all major topographic (slopes, draws, benches, ridges) and special features (wet areas, rock outcrops, riparian areas) in each survey unit (Shohet and Wolf 2011, pp. 910). The surveyors revisited and found 70 existing sites and 64 new sites (Shohet and Wolf 2011, p. 11). For all existing and new sites, the surveyors found

18,951 individuals on 74.39 acres of occupied habitat (Table 1; Shohet and Wolf 2011, p. 10). As illustrated in Table 1, the surveys did not discuss EOs, but rather presented the data in terms of sites (Shohet and Wolf 2011, pp. 810). Additionally, the surveyors revisited a number of areas previously known to be occupied, but they failed to find plants. Therefore, the surveyors considered these sites to be lost occupied habitat; the sites were potentially lost to wildfires or mapping errors (Shohet and Wolf 2011, p. 12 and Figure 6).

The data collected in 2011 by Monitoring Effort 4 cannot be compared directly to previous surveys conducted in Box Elder County because different methods were used to collect the data. However, the data from Monitoring Effort 4 increases our understanding of the species. As documented in Table 1, surveyors not only counted plants, but also recorded age structure (Shohet and Wolf 2011, entire). Only one site in 2011 had more seedlings than any other age class present at that site (Table 1; Shohet and Wolf 2011). The remaining sites had between 4.8 and 16.9 percent of plants within the seedling class (Shohet and Wolf 2011,). With the exception of one site with 53 percent of the population in the seedling class, the overall 16.9 percent is consistent with the age structure previously documented for this species, 1-17 percent as seedlings (Mancuso 2010, p. 21). This suggests that because seedlings were present in similar numbers over a period of time between years 2008, 2009, and 2011, recruitment occurred and was stable.

Table 1. Age Structure of Goose Creek milkvetch by Population Size Class recorded at 133 survey sites in Box Elder County, Utah, during 2011.

Monitoring Effort 5:

Conducted in 2011, the fifth monitoring effort focused on identifying suitable habitat for Goose Creek milkvetch sites in Idaho (Kinter et al. 2012, p. 1). This effort examined National Agriculture Imagery Program (NAIP) imagery to determine potentially suitable habitats. Based on the analysis, five new, previously unsurveyed sites totaling 46 hectares (ha) (114 acres (ac)) were identified. Qualified botanists referenced local known populations to confirm when flowering of Goose Creek milkvetch was occurring, then surveyed the new sites. However, no new Goose Creek milkvetch populations were discovered within the newly identified habitats (Kinter et al. 2012, p. 2). Surveys of potential habitat continued in 2012 on State

land, but no new populations were found. Permission to survey potential habitat on private land was denied by the landowner (Kinter pers. comm. 2013).

Distinct Population Segment(DPS):

Goose Creek milkvetch is a plant, therefore designation of Distinct Population Segments does not apply to this taxonomic group.

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or range:

Our September 10, 2009, 12-month finding on a petition to list Goose Creek milkvetch (74 FR 46521) evaluated multiple factors affecting the species, including wildfire, wildfire management, invasive, nonnative species, livestock grazing, development, recreation, and mining.

Primary threats to Goose Creek milkvetch include: the 2007 wildfires and associated impacts to the species habitat; competition from invasive nonnative species; and livestock grazing. A localized threat is the existence of a pipeline right-of-way bisecting a site. Accelerated climate change could compound the effects of these threats. Our discussion below is focused on these primary threats affecting the species.

Wildfire

Wildfire was not documented within areas where Goose Creek milkvetch occurs between 1939 and 2000 (Feldhausen 2007, p. 3; Sayer 2012). While low intensity, infrequent fires may have occurred in the past, the historic fire-return interval within sagebrush habitat of the Great Basin ranged from 60 to 110 years (Whisenant 1990; p. 4). Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) plant communities occupy the most arid portions in the range of big sagebrush and neither the sagebrush nor the perennial forbs within this plant community increase following a fire (Bunting *et al*. 1987, p. 7). The slow growth of Wyoming big sagebrush after fire may require fire intervals of up to fifty years in order to regain their dominance in the plant community (Bunting *et al*. 1987, p. 11). This plant community is prone to shifting to an annual grass disclimax community (a relatively stable ecological community often including non-native organisms that displace the climax community because of disturbance (Merriam-Webster 2013)) dominated by cheatgrass (*Bromus tectorum*) after repeated fire disturbance (Bunting *et al*. 1987, p. 4).

Habitats occupied by Goose Creek milkvetch are normally sparsely vegetated (e.g., typically 1030 percent total vegetative cover), making them less prone to wildfires because of the lack of fuels required to sustain fire over large areas. However, wildfires occurred in Goose Creek milkvetch habitat in Idaho in 2000 and in Nevada and Utah in 2007. The occurrence of two wildfires within a seven-year interval suggests that fire frequency could be increasing within the range of Goose Creek milkvetch, and is consistent with numerous assessments that the average fire return interval within the sagebrush-steppe ecosystem has been reduced from between 60 and 110 years to less than 5 years (Billings 1990, pp. 307308; USGS 1999, pp. 19; West and Young 2000, p. 262; Whisenant 1990, p. 4; Wright and Bailey, 1982, p. 158).

The fact that Goose Creek milkvetch occurs in habitats that historically did not encounter frequent fire means that the species likely did not evolve with fire, and may not respond favorably to it. Fire-tolerant, fire-adapted, and even fire-dependent plant species exhibit widely variable rates of adult-plant mortality after fire events. If fire-induced mortality exceeds a given species capacity for recruitment, fire (particularly increasingly frequent and/or severe fire) would be expected to threaten that species longevity. Shortened fire return intervals make it difficult for native plants to reestablish or compete with invasive plants (DAntonio and Vitousek 1992, p. 73).

In Idaho, one site (EO-9) was burned on State lands in 2000. However, the effects of the wildfire upon Goose Creek milkvetch are not clear as this population was discovered after the fire. Prior to 2000, a 1939 fire was the last known fire that occurred in or near Goose Creek milkvetch habitat (Sayer 2012).

The rest of this section will focus on the 2007 wildfires that occurred in Nevada and Utah that impacted approximately 53 percent (ca. 31,500) of the Goose Creek milkvetch individuals and 25 percent (400 acres) of the known occupied habitat (see Population Estimates/Status, Monitoring Effort 2, above; USFWS 2008b, Table 1). In 2008-2009, reconnaissance surveys and monitoring were conducted (USFWS 2008a, data; USFWS 2008b, entire; Mancuso 2010, entire). This monitoring effort was conducted with the intent of comparing back to baseline conditions before the fire event (in 20042005), with recognition of the fact that we lacked sufficient resources to design and implement a robust investigation of cause-and-effect relationships between fire and species-level response (Glenne pers. comm. 2011). Because this dataset represents the best available information regarding the potential effects of wildfire upon Goose Creek milkvetch and its habitat, it is summarized below.

We selected 11 monitoring sites within the burn perimeter in which the abundance and density of Goose Creek milkvetch had been recorded during the 20042005 survey effort. In 2008 and 2009, abundance and density were again recorded in these 11 sites, along with observations relating to several threats (including fire) which were either noted in narrative or categorically ranked (Mancuso 2010, entire). Data collected in 2008 and 2009 revealed striking declines in both abundance and spatial extent relative to the 20042005 baseline, with 81 percent fewer individuals and 79 percent less occupied habitat in 2008, and 90 percent fewer individuals and 70 percent less occupied habitat in 2009 (Mancuso 2010, Tables 2 and 4). Based on monitoring results, we conclude that there was a large post-fire decline in Goose Creek milkvetch and that wildfire and disking/seeding had adverse effects on plant abundance (Mancuso 2010, p. 11). In areas that only partially burned, most Goose Creek milkvetch plants were in the unburned patches that were not disked and seeded, suggesting detrimental effects to plants from the combination of the wildfire and post-fire mechanical treatments (Mancuso 2010, p. 11). Areas that did not burn still sustained declines in population numbers and spatial extent (Mancuso 2010, Tables 2 and 4). This may be due to the confounding factors that influenced sites after the 2007 fires, such as non-native invasive species and increased impacts from livestock within occupied habitats.

We realize that this monitoring effort was limited in its ability to distinguish the effects of fire from the confounding (and possibly synergistic) influences of other factors (e.g., numerous post-fire rehabilitation practices and livestock use, discussed below) (Mancuso 2010, pp. 912; Glenne pers. comm. 2011). Anecdotal observations suggest that burning kills established plants, burned areas exhibit massive mortality (loss of thousands of plants), and plants within partially burned areas occur only in intervening patches of unburned microhabitat (Mancuso 2010, pp. 912; Glenne pers. comm. 2011). For example, in 2008, 68 percent of plants occurred in the six percent of the sites that did not burn, and in 2009, 79 percent of all plants occurred in these same unburned portions of the site (Mancuso 2010, p. 9). These detailed characterizations of fine-scale burn patterns were not collected in most monitoring sites, therefore it is impossible to know whether Goose Creek milkvetch plants located after the fire experienced fire and later re-sprouted from the base or germinated from seed, or were located in small patches of unburned refugial habitat.

Monitoring efforts to determine long-term impacts of fire to Goose Creek milkvetch did not continue past 2009. In 2010, the BLMs Salt Lake Field Office established a number of transects to determine long-term trends (Hardy 2010, pp. 56). We will not be able to compare the data from this transect with the data collected in 2008 and 2009 from the 11 sites because of the changes in survey methodologies. Regardless, Hardy (2010, p. 5) speculated that the present population of milkvetch plants on this site is about 5% of what it was before the fire. In 2012, the plant population at this site declined further to, ...only half the plants that were on this site two years ago and less than 5 percent of the plants that were on this site before the wildfires of 2007 (Hardy 2012, p.1). Although not quantitative, this observation suggests that the species struggles to recover following wildfire.

In summary, we remain concerned that wildfire frequency is increasing within Goose Creek milkvetch habitat due to changes in the vegetation community, particularly conditions that favor nonnative species such as cheatgrass (Bromus tectorum) (see Invasive Nonnative Species, below). Goose Creek milkvetch and its habitat did not evolve with frequent fire, and is unlikely to respond favorably to this form of disturbance (particularly frequent or intense fires). The striking (in excess of 70 percent) declines in abundance and extent in Goose Creek milkvetch occurrences that have followed the 2007 wildfires suggest that fire is detrimental, but available data are insufficient to distinguish the effects of fire from other threats. The threats identified in the next several sections were either a direct result of the management associated with the fire (the wildfire control and post-wildfire rehabilitation efforts, changes in livestock management) or a result of the fire itself (increased invasive species). We analyze each of these confounding threats below.

Wildfire Control and Post-wildfire Rehabilitation Efforts

Activities undertaken to preemptively manage wildfire risk, control wildfires once ignited, and rehabilitate burned areas are designed to reduce the spread and extent of fire within the range of Goose Creek milkvetch. While these activities are fundamental to reducing the wildfire threat to the species (see Wildfire, above), the activities themselves impact the landscape and certain types of activities can negatively affect Goose Creek milkvetch and its habitat. Activities of particular concern include: the construction of roads, fire lines, and staging areas; application of retardants; and post-wildfire restoration efforts such as disking and seeding (particularly when seed mixes contain invasive nonnative species). Such activities can uproot and kill established Goose Creek milkvetch plants and render habitat unsuitable for re-colonization by new seedlings (74 FR 46521, September 10, 2009).

Monitoring conducted immediately after the conclusion of efforts to control and extinguish the 2007 wildfires in Nevada and Utah revealed several instances in which new roads and fire lines were constructed in close proximity to Goose Creek milkvetch habitat and one instance of a new road and tire tracks within occupied habitat (74 FR 46521, September 10, 2009). Because monitoring for Goose Creek milkvetch was not conducted immediately prior to wildfire suppression/control efforts, it is unknown whether any individuals of this species were within the immediate footprint of these activities. Therefore, direct impacts from fire suppression activities cannot be quantified.

The BLM conducted post-wildfire rehabilitation efforts within close proximity to, and in some cases immediately within, habitats occupied by Goose Creek milkvetch. However, the approach undertaken during post-fire rehabilitation efforts differed in Nevada and Utah, especially with respect to the potential for adverse impacts to Goose Creek milkvetch. In Nevada, rehabilitation efforts by the BLM consisted of aerial seeding of Wyoming sagebrush (*Artemisia tridentata* var. *wyomingensis*), a species that is native to the Goose Creek drainage and characteristic of the sagebrush-steppe ecosystem (74 FR 46521, September 10, 2009). Although we remain unaware of the specific treatment locations and the success rates observed, the effects of these practices upon Goose Creek milkvetch are likely to have ranged from benign to moderately beneficial, particularly if establishment of Wyoming sagebrush effectively reduced soil erosion and/or establishment by nonnative invasive plant species.

By contrast, in Utah the BLM conducted numerous emergency rehabilitation practices within habitats occupied by Goose Creek milkvetch, including fencing projects (to route livestock out of burned areas) and disk-seeding with a mix that included crested wheatgrass (*Agropyron cristatum*), an invasive, nonnative species (see Invasive Nonnative Species, below) (74 FR 46521, September 10, 2009). The effects of these fencing practices are discussed in the section on Livestock Use, below. Disk-seeding was conducted across multiple areas collectively estimated to contain more than 11,000 Goose Creek milkvetch plants (representing approximately 18 percent of the individuals range-wide) during 20042005 surveys. Disk-seeding created two discrete sources of impact to Goose Creek milkvetch, namely soil disturbance (disking) and competition (seeding with invasive species). Disk-seeding was conducted one week before post-fire surveys for Goose Creek milkvetch in 2008; therefore we were able to observe the effects of these activities soon after they occurred (74 FR 46530, September 10, 2009). Disking involved the use of tractors

pulling rangeland drills that turned over soils in swaths of approximately five inches deep and 20 feet wide (Service 2008c, pp. 45). Goose Creek milkvetch individuals located within the path of this heavy equipment were likely uprooted or buried beneath overturned soils (74 FR 46530, September 10, 2009). In 2008, we observed several Goose Creek milkvetch individuals uprooted but still alive in between disking furrows, but no Goose Creek milkvetch plants within the furrows themselves (Service 2008c, pp. 45). We assume any plants located in furrows were immediately buried by overturned soils. The following year (2009), none of the Goose Creek milkvetch plants observed immediately adjacent to disking furrows the preceding year could be relocated. Because the root systems were exposed to the air, and roots are susceptible to drying out if they are not covered with soil, it is likely that these uprooted plants which survived the disking were subsequently killed by desiccation (drying out). The subsequent effects of seeding with invasive, nonnative species are discussed in the next section (see Invasive Nonnative Species, below).

In summary, wildfire control and post-wildfire rehabilitation practices can pose a significant threat to Goose Creek milkvetch and its habitat, either in the form of excessive soil disturbance (which can uproot and/or bury plants, resulting in mortality) or increased competition from invasive nonnative species used in soil stabilization mixes. Avoiding heavy equipment and soil disturbing activities in known Goose Creek milkvetch habitat and using native species to reduce erosion potential can dramatically reduce adverse effects to Goose Creek milkvetch.

Invasive Nonnative Species

The September 10, 2009, 12-month finding describes the locations of noxious and nonnative weeds relative to existing Goose Creek milkvetch populations (74 FR 46521, September 10, 2009), and the potential effects of these nonnative species upon Goose Creek milkvetch. Invasive nonnative plants occupy and alter diverse native communities, often resulting in dense monocultures that erode plant species diversity and also support little wildlife. Invasive nonnative plants are secondary only to habitat loss as factors responsible for biodiversity declines (Randall 1996, p. 370). Invasive nonnative plants alter ecosystem attributes including geomorphology, fire regime, hydrology, microclimate, nutrient cycling, and productivity (Dukes and Mooney 2004, p. 4). Invasive nonnative plants also can detrimentally affect native plants through competitive exclusion, alteration of pollinator behaviors, niche displacement, hybridization, and changes in insect predation. Examples are widespread and involve numerous taxa, locations and ecosystems (DAntonio and Vitousek 1992, pp. 7475; Mooney and Cleland 2001, pp. 54465451; Olson 1999, pp. 618).

Several nonnative plants are known to occur at or immediately adjacent to Goose Creek milkvetch populations, including: desert madwort (*Alyssum desertorum*), crested wheatgrass (*Agropyron cristatum*), cheatgrass (*Bromus tectorum*), flixweed (*Descurainia sophia*), leafy spurge (*Euphorbia esula*), and halogeton (*Halogeton glomeratus*). In 2008, one black henbane (*Hyoscyamus niger*) individual was located within one Goose Creek milkvetch site. In 2011, black henbane was located at two sites (Shohet and Wolf 2011, p. 15).

The nonnative species of most concern to Goose Creek milkvetch are cheatgrass, because of this species tendency to increase the frequency of wildfires, and leafy spurge and crested wheatgrass, because of the invasive capabilities of these species (DiTomaso 2000, p. 255). In 2011, many sites had cheatgrass and desert madwort in high concentrations (Shohet and Wolf 2011, p. 15). In 2011, at least one of the element occurrences in Idaho had cheatgrass and leafy spurge overlapping Goose Creek milkvetch in different areas (Kinter *et al*. 2002, p. 3).

Cheatgrass is an annual grass with a shallow root system that germinates early in the growing season and uses soil moisture at the expense of most native plant species (Billings 1990, pp. 301302). The species dies back early in the growing season usually before the dry summers common to the Great Basin. Once dry, cheatgrass is highly flammable and often occurs in dense swards that effectively carry wildfire. The net effect of cheatgrass invasion is a positive feedback from the initial colonization in the interstices of shrubs, followed by fire, to dominance by cheatgrass and more frequent fire (DAntonio and Vitousek 1992, pp. 7475).

Prior to the 2007 wildfires (see Wildfire Control and Post-wildfire Rehabilitation Efforts, above), cheatgrass was observed throughout the range of Goose Creek milkvetch, but was generally encountered at low density. During the 20042005 surveys, cheatgrass was generally found at less than five percent cover when it occurred with Goose Creek milkvetch. At sites with either a southern exposure or higher levels of livestock trampling, the percent cover of cheatgrass was generally higher (e.g., between 1020 percent, although as high as 7080 percent in a few cases) (USFWS 2008b, entire).

Cheatgrass is the only invasive nonnative species to have rapidly and dramatically invaded new areas since the 2007 wildfires, with increased abundance and extent on south-facing, burned slopes (Mancuso 2010, p. 12). By 2011, cheatgrass was prevalent and found at high concentrations at many sites (Shohet and Wolf 2011, p. 15). Cheatgrass also creates conditions which favor more frequent and severe wildfires. Therefore, increased coverage by cheatgrass is a threat to Goose Creek milkvetch.

Leafy spurge is a perennial forb with a deep and extensive spreading root system, and seeds that are dispersed up to 15 feet by the explosive opening of the species seed pod upon ripening (Selleck et al. 1962, p. 18). As with nearly all other invasive nonnative plants, leafy spurge reduces native plant species diversity (Butler and Cogan 2004, p. 308; Selleck et al. 1962, p. 21). Leafy spurge already occurs in monocultures within the Goose Creek drainage, making it likely that the species could spread and eventually displace Goose Creek milkvetch in some locations (Belcher and Wilson 1989, p. 174; Feldhausen 2007, pp. 12; Hardy 2005, p. 2). The species was documented within a few of the 11 monitoring sites established to assess the effects of the 2007 wildfires upon Goose Creek milkvetch; several of these existing leafy spurge occurrences were disked in 2008 as a part of post-fire rehabilitation practices (Mancuso 2010, p. 12). Despite studies that demonstrated three-fold increases in leafy spurge after tilling (Selleck et al. 1962, pp. 7 and 14), assessments in conjunction with the post-fire assessment of Goose Creek milkvetch suggest that efforts to actively control the spread of leafy spurge occurrences may have been effective (Mancuso 2010, p. 12; Shohet and Wolf 2011, p. 15). In 2009, leafy spurge was not detected at one site where it had been previously documented; at a second site, only a single stem was found where at least 50 had been recorded the preceding year (Mancuso 2010, p. 10). In 2011, 15 sites (11 percent) containing 30 percent of the Goose Creek milkvetch plants found that year in Utah had leafy spurge (Shohet and Wolf 2011, p. 15). Five of these sites were treated for leafy spurge; however, leafy spurge still persists (Shohet and Wolf 2011, p. 15). Thus, while weed control measures appeared to be somewhat effective in controlling this threat to the species in 2010 (Mancuso 2010, p. 10; Shohet and Wolf 2011, p. 15), data from 2011 show that leafy spurge still persists at a number of sites that were previously treated (Shohet and Wolf 2011, p. 15). Therefore, regular weed control appears necessary to contain and control the threat of leafy spurge within occupied habitat of Goose Creek milkvetch.

Crested wheatgrass (*Agropyron cristatum*) is able to competitively displace slower-developing native species because of its drought tolerance, fibrous root system, and good seedling vigor (Bunting *et al*. 2003, p. 82; Lesica and DeLuca 1998, p. 1; Pellant and Lysne 2005, pp. 8283; Pyke and Archer 1991, p. 4; USDA 2006, p 1). Crested wheatgrass plantings are stable and persistent, and may inhibit or retard the development of a native plant community (Hull and Klomp 1966, p. 7; 1967, p. 227; Marlette and Anderson 1986, p. 173).

Crested wheatgrass was planted in the Goose Creek drainage before 1970 (Hardy 2005, p. 2; Feldhausen. 2007, pp. 12; Howard 2007, p. 3). Prior to the 2007 wildfires, efforts to establish crested wheatgrass by seeding were generally well separated from Goose Creek milkvetch populations, and crested wheatgrass did not appear to be spreading significantly from the areas where it had been intentionally introduced. Therefore, occurrences of crested wheatgrass established prior to the 2007 wildfires were not considered to be a threat to Goose Creek milkvetch. In 2008, as noted above (see Wildfire Control and Post-Wildfire Rehabilitation Practices), the BLM conducted post-wildfire rehabilitation efforts that included the use of crested wheatgrass in seed mixtures. Disking-seeding was conducted in areas that collectively contained approximately 18 percent of the Goose Creek milkvetch individuals documented during 20042005 surveys. Crested wheatgrass was recorded in five of the 11 monitoring sites in 2009, all of which had the species in previous years. Therefore, the species has not spread into new monitoring sites, but continues to pose a threat to Goose Creek milkvetch where these species occur in close proximity.

In summary, invasive, non-native species can pose a significant threat to Goose Creek milkvetch because they are strong competitors for soil moisture and can spread rapidly after disturbance events. Regular monitoring and control of weeds, avoidance of soil disturbing activities in known Goose Creek milkvetch locations, and aerial seeding of native species to reduce erosion potential can dramatically reduce adverse effects to Goose Creek milkvetch.

Livestock Use (Trampling, Water Developments, and Habitat Degradation)

Livestock use occurs at every site occupied by Goose Creek milkvetch, and all Goose Creek milkvetch sites on public land are within permitted active grazing allotments (Feldhausen 2007, pp. 12; Hardy 2005, pp. 14). The primary impact to Goose Creek milkvetch from livestock is trampling (Baird 1991 in Hardy 2005, p. 3; Shohet and Wolf 2011, p. 13). Incompatible livestock grazing can also lead to changes in vegetation structure, including the proliferation of nonnative, invasive species such as cheatgrass (see Invasive, Nonnative Species Section, above). Incompatible livestock use may also cause erosion to fragile soils on the steep hillsides where the plants grow (Shohet and Wolf 2011, p. 14). Goose Creek milkvetch is often observed along the margins of livestock trails, suggesting the species can persist at low levels of disturbance but becomes extirpated by repeated trampling (Feldhausen 2007, pp. 12; Hardy 2005, pp. 14). It appears that the species tolerates, and may proliferate with, some level of disturbance, based on its occurrence on steep slopes where downhill movement of soil is common, within eroded washes, and along road margins and edges of cattle trails. However, individuals do not occur where vehicle or livestock travel is frequent or where water flows through washes on a regular basis (Baird and Tuhy 1991, pp. 25; Hardy 2005, pp 14; Mancuso and Moseley 1991, p. 24; Smith 2007, p. 2).

Livestock use was qualitatively noted during the 20042005 census, during post-fire monitoring in 2008 and 2009, and then in 2011 resurvey and discovery effort (Mancuso 2010, p.1112 and Table 11; Shohet and Wolf 2011, pp. 1314). In 20042005 and 2008, over 80 percent of monitoring sites showed evidence of cattle use; in 2009, the overall percentage of sites impacted by cattle had declined to 36 percent. The reduced incidence of livestock use within burned areas is likely attributable to BLMs post-wildfire rehabilitation activities, in which fences were erected or rerouted to exclude cattle from burned areas. Unfortunately, these actions directed livestock into areas containing Goose Creek milkvetch plants that had escaped the effects of the wildfire and subsequent disking and seeding practices. In 2009, livestock evidence was noted in every unburned monitoring site, possibly explaining why unburned sites exhibited declines only slightly less than (or intermediate to) burned and partially burned sites (Mancuso 2010, p. 12 and Tables 2 and 11).

In 2011, all sites surveyed in Utah showed some evidence of livestock grazing (Shohet and Wolf 2011, p. 13). All sites experienced trampling, while 29 of the 133 sites (22 percent) containing 73 percent of the Goose Creek milkvetch plants in Utah had greater impacts associated with livestock use (Shohet and Wolf 2011, p. 13). Although the authors did not define greater impacts, livestock use was highly impacting a number of sites due to a cattle gate immediately north of one site, a mineral lick placed in the vicinity of four sites, a stock driveway affecting one site, and a fence directing animals through an area with high Goose Creek milkvetch concentrations at one site (Shohet and Wolf 2011, p. 14). Cattle tracks and trails were extensive in the portion of EO4 in Idaho that was visited in 2011 (Kinter et al. 2012, p. 3).

Overall, livestock grazing occurs throughout the range of Goose Creek milkvetch. Incompatible grazing impacts the plants directly through trampling and indirectly through habitat degradation. In addition, land management decisions that perpetuate incompatible livestock grazing, specifically in Utah, have had negative impacts on Goose Creek milkvetch and its habitat.

Pipeline Right-of-Way

A right-of-way associated with a water pipeline bisects Goose Creek milkvetch habitat in Box Elder County, Utah (Hardy 2004, p. 1). Subsequently, the right-of-way is now used as an ATV trail, cattle trail, and a stock driveway (Shohet and Wolf 2011, pp. 1415). These multiple uses along the right-of-way fragment the Goose

Creek milkvetch site, contribute to dust impacts on the plants, and serve as a vector to spread nonnative species (see Invasive Nonnative Species, above). Habitat fragmentation results in smaller populations that are more isolated (Aizen *et al*. 2002, p. 885; Soons 2003, pp. 13; Lienert 2004, p. 53). Dust affects photosynthesis, respiration, transpiration, water use efficiency, leaf conductance, growth rate, plant vigor, gas exchange, and allows the penetration of phytotoxic gaseous pollutants (Farmer 1993, pp. 6372; Hobbs 2001, p. 7; Trombulak and Frissell 2000, pp. 19, 2125). Additionally, small increases in the fine particles from dust may increase populations of nonnative, exotic plant species (Reynolds *et al*. 2001, p. 7126).

The BLM monitored the Goose Creek milkvetch site along the pipeline to determine potential effects to the species and its habitat (Hardy 2010, pp. 12). However, the monitoring effort evaluated only one plot on each side of the pipeline and the plots were visited twice over a six-year period. Although both of the plots along the pipeline right-of-way had more plants in 2010 than they did in 2004, the small sample size rendered the increase statistically insignificant (see Population Estimates/Status, above).

In summary, activities along the pipeline right-of-way likely continue to fragment the habitat of this site, produce harmful dust, and increase the potential spread of non-native species that outcompete Goose Creek milkvetch. However, additional research is needed for a statistically robust analysis at this site.

Summary of Factor A

Goose Creek milkvetch has a number of threat factors affecting its habitat across the range of the species. The 2007 wildfires burned 53 percent of the known Goose Creek milkvetch individuals and 25 percent of the known occupied habitat. The species exhibited striking declines in abundance and spatial extent in 2008 and 2009, in both burned and unburned areas. Relative to baseline conditions established in 20042005, abundance decreased between 71 to 96 percent, and spatial extent decreased from 66 to 83 percent. Goose Creek milkvetch is also negatively affected by post-fire rehabilitation practices (e.g., disking/seeding, fencing projects), incompatible livestock use in unburned areas, and nonnative invasive plant species. Data collected in 2011 suggest that negative impacts from incompatible livestock use have increased since the 2007 wildfires. The BLM erected fencing to exclude cattle from the burn perimeter. However, the fence encouraged cattle to venture deeper into unburned Goose Creek milkvetch habitats and onto steeper slopes they previously avoided, further eroding and disturbing habitats.

The fact that two wildfires have burned within Goose Creek milkvetch habitat in the past seven years suggests that the fires could be increasing in frequency. Fire frequency is increasing within shrub-steppe habitats (Billings 1990, pp. 307308; USGS 1999, pp. 19; West and Young 2000, p. 262; Whisenant 1990, p. 4; Wright and Bailey, 1982, p. 158). Additionally, cheatgrass is a dominant species throughout Goose Creek milkvetchs range and occurs at many of the known sites. Surface disturbances and wildfire can increase the occurrence and densities of cheatgrass. An increase in cheatgrass density will increase the chance for more frequent fires. Competition and subsequent displacement by other nonnative plant species threatens to reduce the abundance and extent of Goose Creek milkvetch populations, further reducing the ability of the species to recover.

Overall, we consider the present or threatened destruction, modification, or curtailment of Goose Creek milkvetchs habitat or range to be high in magnitude due to the large number of plant occurrences that were collectively affected by the wildfires in 2000 (in Idaho) and 2007 (in Nevada and Utah), and by the incompatible wildfire control and post-wildfire rehabilitation practices following the 2007 wildfires in Utah. Impacts from incompatible livestock grazing in the unburned portions of the species habitat have also increased. Invasive nonnative plant species are increasing throughout the range and altering wildfire regime, to which Goose Creek milkvetch appears poorly adapted.

B. Overutilization for commercial, recreational, scientific, or educational purposes:

We are not aware of any threats involving the overutilization or collection of Goose Creek milkvetch for any

commercial, recreational, scientific, or educational purposes.

C. Disease or predation:

We are unaware of any herbivory attributable to livestock, native ungulates, or birds. Some plants show signs of being eaten near the ground, possibly by rabbits (74 FR 46534, September 10, 2009). Fungus and caterpillars also occur on some plants, and may cause some withering, but this is not suspected to be a widespread occurrence (USFWS 2008a, 17 pp.). In addition, several withered plants, particularly after heavy rains in May of 2005 (ICDC 2007a, p.3). However, this factor is not thought to represent a significant threat to the species.

D. The inadequacy of existing regulatory mechanisms:

Eighty percent of Goose Creek milkvetch occurrences are located on lands managed by the BLM. At the time of the 2007 wildfires, Goose Creek milkvetch was designated as a special status species by the BLM, a designation which encourages protection of such species so that they do not trend toward endangerment (BLM 2001, p. 01). According to BLM sensitive species management policy, the "special status" designation is intended to afford protection at least comparable to (if not greater than) the treatment of candidates for Federal listing (BLM 2001, p. 06C1). Therefore, BLM policy should afford some protection to Goose Creek milkvetch so long as it is either retained as a candidate for Federal listing or retained as a special status species by the BLM. However, these policies were not adequate to prevent the impacts that occurred in conjunction with the 2007 wildfires in Nevada and Utah. Numerous threats to Goose Creek milkvetch resulted from wildfire response efforts conducted by the BLM during or after the 2007 wildfires. Particularly in Utah, BLM wildfire control and post-wildfire rehabilitation efforts were undertaken without adequate regard for the presence Goose Creek milkvetch, and we suspect these response activities played a primary role in the declines in this species' numbers and occupied habitat that have since occurred within the burn perimeter (Factor A, above; see also 74 FR 46521, September 10, 2009).

The BLM activities of each state are described below.

Utah

The Box Elder Resource Management Plan (1986) is the regulatory framework for the management of BLM lands where Goose Creek milkvetch occurs (BLM 1986). This plan was amended in 2005 through the Salt Lake Fire Management Plan (FMP) (BLM 2005, entire) to specify the BLMs decisions on wildland fire suppression and use of fire and non-fire vegetation treatments including emergency stabilization and rehabilitation. The FMP provides for the review of appropriate management, conservation, and recovery plans for federally threatened, endangered, and candidate species (BLM 2005, Appendix E-2). The FMP prioritizes the use of native species in vegetation treatments unless natives are not available, not economically feasible, cannot achieve ecological objectives as well as nonnative species, and/or cannot compete with already established native species (BLM 2005, Appendix E-1).

The BLM implements range management measures to control livestock grazing within habitats occupied by Goose Creek milkvetch. These measures specifically include fencing and water lines to direct livestock away from areas inhabited by the species (Hardy 2005, pp. 1-4; Feldhausen 2007, pp. 1-2). However, as noted above in the Livestock Use Section, livestock grazing occurs at every site occupied by Goose Creek milkvetch (Hardy 2005, pp. 14; Feldhausen 2007, pp. 12; Shohet and Wolf 2011, p. 13). The primary threat to Goose Creek milkvetch from livestock is trampling. Livestock grazing management actions, including the construction of a fence designed to keep livestock out of burn areas, concentrated livestock use on some occupied habitats (see Livestock Use, above) (Mancuso 2010, p. 12 and Table 11; Shohet and Wolf 2011, pp. 1314 and Figure 14). The BLM fenced the burn areas to exclude cattle and, as a result, all three of the unburned sites monitored from 2004-2009 showed an increase in cattle presence and disturbance after the fire (Mancuso 2010, Table 11). The BLM also constructed a second fence which led to higher concentrations of

cattle moving through one site during the 2011 survey (Shohet and Wolf 2011, p. 14). These actions have increased the magnitude of the livestock grazing threat. The BLM is planning to develop conservation measures for Goose Creek milkvetch and a proposed Conservation Agreement (CA) with the Service. Although not a regulatory mechanism, the CA would emphasize protection of Goose Creek milkvetch on the BLM lands in Utah. The BLM is also planning to provide a GIS shapefile of known Goose Creek milkvetch occurrences to their resource advisors for fire preparation and strategy purposes as well as post-fire reclamation activities (Hardy 2013).

Idaho

The Cassia Resource Management Plan (1985) is the regulatory framework for the management of public lands where Goose Creek milkvetch occurs (BLM 1985a). This plan was amended in 2008 through the Fire, Fuels and Related Vegetation Management Direction Plan Amendment (FMDA). The FMDA amended the plan to specify the BLMs decisions on wildland fire suppression and use of fire and non-fire vegetation treatments including emergency stabilization and rehabilitation. The FMDA provides direction to prioritize use of native species in vegetation treatments in native species habitats. The FMDA also provides restrictions for the protections and conservation measures for federally threatened, endangered, and candidate species and the BLM sensitive species. Although the FMDA did not specify conservation measures for Goose Creek milkvetch, the Record of Decision stated Threatened, endangered, and candidate species with recovery plans, conservation agreements, and conservation strategies will be protected as specified in their respective plans/agreements/strategies. The BLM in Idaho has developed conservation measures for Goose Creek milkvetch which are being implemented and included in a proposed Candidate Conservation Agreement (CCA) with the Services Idaho Fish and Wildlife Office. Although not a regulatory mechanism, the CCA would emphasize protection of Goose Creek milkvetch on BLM lands in Idaho. The BLM is also coordinating with their resource advisors to discuss appropriate wildfire suppression and post-wildfire reclamation activities within Goose Creek milkvetch habitat.

The BLM, in cooperation with Cassia County, Idaho Weed Control, is actively controlling leafy spurge in the entire Goose Creek drainage including in and around known Goose Creek milkvetch habitat. Leafy spurge control is being conducted in Idaho specifically for the purpose of maintaining habitat for Goose Creek milkvetch, as well as to maintain healthy rangelands for a variety of benefits and uses, unlike in Utah, where leafy spurge is being treated solely due to its detrimental effects on livestock, and not specifically for the purpose of Goose Creek milkvetch conservation (74 FR 46531, September 10, 2009).

Nevada

The Wells Resource Management Plan (1985) is the regulatory framework for the management of public lands where Goose Creek milkvetch occurs (BLM 1985b). This plan was amended in 2003 through the Elko/Wells Fire Management Amendment (FMA) (BLM 2003, entire) to specify the BLMs decisions on wildland fire suppression and use of fire and non-fire vegetation treatments including emergency stabilization and rehabilitation. The FMA developed Standard Operating Procedures for listed and candidate species to guide wildfire response activities in areas where these species occur. The FMA identifies Goose Creek milkvetch as a species of concern but does not identify specific conservation measures for the species. The BLM is planning to provide a GIS shapefile of known Goose Creek milkvetch occurrences to every one of their resource advisors for wildfire preparation and strategy purposes as well as post-wildfire reclamation activities (Collins 2013).

The BLM is actively controlling the spread of invasive, nonnative black henbane (*Hyoscyamus niger*) through herbicide application to control the spread of this weed along roadsides. Although this effort is not specifically aimed to maintain habitat for Goose Creek milkvetch (Collins 2013), it will reduce the spread of this invasive, non-native species from roadsides into adjacent habitat.

In summary, the existing regulatory mechanisms are not adequate to protect Goose Creek milkvetch from

becoming threatened or endangered throughout its range. Specific management actions or operating procedures for the species that would minimize threats from weeds, wildfire, and post-fire reclamation activities have not been finalized as amendments in current BLM management plans. While these management actions and operating procedures are in various stages of development and implementation throughout the species range, the species is at risk from these threats until such actions and procedures are finalized and implemented. Without modifications or amendments, ongoing management actions specifically within the state of Utah continue to put the species at risk, including management responses to wildfire events and subsequent rehabilitation efforts (including the use of non-native revegetation species) in the species occupied habitat, the continued threats posed by invasive, non-native species, and the negative impacts of incompatible livestock grazing management actions.

E. Other natural or manmade factors affecting its continued existence:

We have no information concerning genetic diversity or germination that is specific to Goose Creek milkvetch. As such, we are unable to determine whether these factors could potentially affect the ability of this species to survive into the foreseeable future. The declines revealed by the 2008 and 2009 data collection efforts lack clear correlation to the occurrence of wildfire or post-wildfire disking or seeding activities, suggesting either limitations in data collection protocols, interactions among multiple threats, and/or the existence of additional, unidentified factors (Mancuso 2010, 28 pp.). Monitoring data for two other desert milk-vetches, Holmgren's milkvetch (*A. holmgrenorium)* and Shivwit's milkvetch (*A. ampullarioides*), suggests that wide fluctuations in abundance and area are strongly correlated with precipitation (USFWS 2006b, p. 14). This relationship has not been examined in Goose Creek milkvetch, but suggests that local or regional drought, or changes in precipitation regimes associated with accelerated climate change, may pose additional threats to the species.

Our analyses under the Endangered Species Act include consideration of ongoing and projected changes in climate. The terms climate and climate change are defined by the Intergovernmental Panel on Climate Change (IPCC). Climate refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term climate change thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 814, 1819). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

With regard to climate change, cheatgrassand other C3 grasses (C3 refers to one of three alternative photosynthetic pathways) are likely to thrive as atmospheric carbon dioxide increases, likely influencing wildfire frequency (Mayeux *et al*. 1994, p. 98; Winslow *et al*. 2003, pp. 168170). Furthermore, as the climate changes, the abundance and distribution of native flora and fauna will also likely change. While the extent to which climate change may affect Goose Creek milkvetchhabitat is not fully understood, those effects could result in physiological stress or the loss or alteration of habitat. In addition, an increased occurrence of extreme events, such as fire and drought, could also impact the remaining populations. Endemic species with limited ranges, particularly those with limited dispersal capabilities, would be expected to be more severely impacted by climate change than species with wide ecological tolerances (Midgley *et al.* 2002, p. 448; Ryan 2004, p. 182). Because the specific effects of accelerated climate change are unknown for the specific habitats and geographic areas occupied by Goose Creek milkvetch, we are not able to confidently predict the foreseeable consequences of this threat.

Since most EOs are comprised of many sites that are within 0.6 mi (1 km) of each other, genetic exchange should still be possible given appropriate pollination vectors, provided the number of Goose Creek milkvetch

individuals is not so low as to discourage or limit the efficacy of pollinator visits. However, 43 percent of the sites visited in 2011 in Utah had less than 10 individual plants (Figure 3). Small populations and species with limited distributions are vulnerable to relatively minor environmental disturbances (Given 1994, pp. 6667). Small populations are also at an increased risk of extinction due to the potential for inbreeding depression, loss of genetic diversity, and lower sexual reproduction rates (Ellstrand and Elam 1993, entire; Wilcock and Neiland 2002, p. 275). Lower genetic diversity may in effect lead to even smaller populations by decreasing the species ability to adapt, thereby increasing the probability of population extinction (Barrett and Kohn 1991, pp. 4, 28; Newman and Pilson 1997, p. 360). As stated previously, we do not have genetic information and are therefore unable to determine whether these factors could potentially affect the ability of this species to survive into the foreseeable future. However, the small populations sizes of Goose Creek milkvetch may make the species more vulnerable to minor, stochastic events.

Figure 3. Percent of sites with Goose Creek milkvetch per population size class within Utah in 2011.

Conservation Measures Planned or Implemented :

Data collected in 2008 and 2009 (see Monitoring Effort 2, and Wildfire section under Factor A, above) contributed to our knowledge of Goose Creek milkvetch population numbers and trends. The information provided by the 2011 surveys (see Monitoring Effort 4, above) provided additional population locations and numbers. The 2011 study in Utah also provided an assessment of how various threats on the landscape, such as wildfire, incompatible livestock grazing and invasive nonnative plant species have increased and are affecting the species. Additionally, we have a better understanding of the effectiveness of various control measures for these threats. For example, better planning is needed to respond appropriately to rehabilitation of habitats following disturbances such as wildfireto ensure the proper use of equipment and seed mixes in Goose Creek milkvetch habitats. In addition, the BLMs efforts in Utah to control leafy spurge are only partially effective, as this invasive species still persists at a number of sites. Furthermore, evidence of livestock grazing was observed at all Goose Creek milkvetch sites in 2011 within Utah. Nearly a quarter of the sites, which contained the majority of plants found in 2011, were directly affected by livestock grazing in Utah. In Idaho, although livestock grazing occurs throughout the range of Goose Creek milkvetch, data

analyzed by the Burley BLM Field Office show that threats from livestock grazing have not increased (Sayer 2012). The BLM in Idaho is working with the Services Idaho Fish and Wildlife Office to develop and implement a CCA and many of the draft conservation measures are currently being implemented by BLM within Idaho. However, Nevada and Utah still need to develop and implement adequate conservation measures to ensure that fencing and other livestock facilities are sited in a manner that avoids or minimizes impacts to Goose Creek milkvetch.

Summary of Threats :

High magnitude and imminent threats to Goose Creek milkvetch and its habitat in Utah and Nevada include: the 2007 wildfires and subsequent changes to the ecosystem (especially its vegetation) that may increase the risk of future wildfires; legacy effects from wildfire control efforts (construction of fire breaks and staging areas) and post-wildfire rehabilitation practices (disking and seeding); competition from invasive nonnative species introduced via soil stabilization mixtures, as livestock forage, or through other means; trailing, trampling, and erosion to fragile soils occurring along the steep hillsides from livestock use; additional declines in abundance, density and spatial extent which have been documented in unburned areas since the 2007 wildfires, which show no clear relationship to the presence of fire and suggest an interaction with other (unidentified) factors; and the pipeline right-of-way. Additionally, existing regulatory mechanisms in all portions of the species range are not adequate to alleviate the known threats. Finally, accelerated climate change could compound these and other threats, but we are unable to predict the specific impacts of this change to Goose Creek milkvetch at this time.

The species capacity to replace the number of individuals lost to the 2007 wildfires in Utah and Nevada will depend on recruitment. Increased fire frequencies, especially if coupled with similar forms of wildfire response activities (whether during control or rehabilitation efforts) are likely to further reduce recruitment by killing more adult plants and possibly rendering habitat unsuitable for recruitment. There is an apparent trend toward wildfires becoming larger and more uniform across the range, leaving fewer unburned areas, which affects the post-fire recovery capacity of native sagebrush-steppe vegetation (Brooks *et al*. 2004, pp. 682683; Knick and Rotenberry 1997, pp. 287, 297; Whisenant 1990, p. 4). These cascading effects would increase the potential for Goose Creek milkvetch to become endangered within the foreseeable future throughout all or a significant portion of its range.

The establishment of cheatgrass, leafy spurge, and crested wheatgrass, throughout the Goose Creek drainage represents a high magnitude and imminent threat to Goose Creek milkvetch. Cheatgrass represents a threat because of its ability to alter and shorten wildfire return intervals in addition to its strong invasive capabilities. Cheatgrass occurs throughout the sites surveyed in 2011. The impact that cheatgrass will have on Goose Creek milkvetch occupied sites is not currently well understood. However, two wildfire events in the last seven years strongly suggest that wildfire frequency is increasing as is the magnitude of the threat to Goose Creek milkvetch. Leafy spurge and the remaining invasive, nonnative plant species represent a threat primarily because of their invasive capabilities and their ability to displace native plants. Leafy spurge control efforts have occurred, however it still persists at a number of sites that were treated. Crested wheatgrass was directly seeded by the BLM in areas occupied by Goose Creek milkvetch in Utah from 20042005. Crested wheatgrass is known to be an effective competitor with other aggressive introduced plants (USDA 2006, p. 1). It seems unlikely that a species such as Goose Creek milkvetch, with its seemingly limited capacities for dispersal and recruitment, would be any more resilient to competitive displacement from crested wheatgrass than these aggressive nonnative plant species.

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

The data collected in 2011 cannot be compared to data from previous surveys for this species. We recommend BLM use the 2011 data collected in Utah to develop a geographic information systems (GIS) based research project to spatially model the potential habitat of Goose Creek milkvetch. Once a map of potential habitat is developed, the BLM and Service should work together to finalize a monitoring plan to collect long-term demographic data and analyze threats.

Limitations in available monitoring data led to recommendations that the protocols used in 2008 and 2009 should be modified to provide greater statistical power. With larger sample sizes and intensive survey designs, future data may be able to distinguish between the multiple threat factors, such as burning, wildfire rehabilitation practices, encroachment from other plant species, or livestock grazing, (Mancuso 2010, p. 12; Mancuso pers. comm. 2011; Glenne pers. comm. 2011). Additionally, the relatively short, two-year interval represented by this dataset makes it difficult to know whether this species can sustain this magnitude of population fluctuations after a wildfire event because we lack basic demographic and seed viability data for Goose Creek milkvetch. Although neither Mancuso (pers. comm. 2011) nor Glenne (pers. comm. 2011) has specified a recommended duration for this monitoring, the Services Recovery Plan for two other desert milk-vetches (Holmgren milkvetch and Shivwits milkvetch) recommends a minimum of 20 years for establishing baseline population trends on those species (USFWS 2006b, p. 18).

The sites established in 2008 to determine effects of the wildfire and post-wildfire treatments on Goose Creek milkvetch should be revisited following the modified protocols just described above to determine if the conclusions reached in 2010 are valid (Mancuso 2010, entire) and to monitor the species abundance and habitat condition over time. The data collected using completely different protocols in 2011 cannot be compared with the data collected in 2008 and 2009, but many of the conclusions of the 2011 report were contrary to the conclusions discussed in the 2010 report.

The BLM and the Service should work together to develop and implement candidate conservation agreements across the range of Goose Creek milkvetch.

As additional conservation measures, the BLM should continue efforts to control the spread of leafy spurge and black henbane. The BLM should avoid and minimize effects of livestock grazing within the range of Goose Creek milkvetch and should refrain from using nonnative invasive species in soil stabilization mixes. Research needs to be done to determine if small population sizes negatively affect the species.

Priority Table

Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2**
		Subspecies/Population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/Population	6
Moderate to Low	Imminent	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

Since the fire in 2007 and our last review, the magnitude of threats to the species have increased in intensity, leaving the species and its small populations more vulnerable to stochastic events. Surveys searching for additional populations have not significantly increased the range or extent of the species. We now consider threats associated with livestock grazing, invasive species, and a water pipeline right-of-way imminent, as they are currently occurring.

Magnitude:

High. Available monitoring data indicate declines in excess of 70 percent within the perimeter of the 2007 wildfires that affected nearly 50 percent of the known occurrences in Nevada and Utah. Therefore, the cumulative magnitude of existing threats is high, due primarily to the fact that threats are currently occurring within at least 50 percent of the species current range. There is also evidence to suggest that wildfires are becoming more frequent across the species range, which further increases the potential for these threats to continue or increase in magnitude. Livestock use impacts were observed at all sites visited in Utah in 2011 with 25 percent of the sites (containing 73 percent of the individuals) being directly affected. Management activities since the wildfires in Utah have seemingly increased the exposure of Goose Creek milkvetch to trampling by livestock. Invasive species are common within the range of the species and occur in high concentrations at many sites. Cheatgrass, in particular, is prevalent and could exacerbate the threat of wildfire.

Imminence :

Imminent. The threat to the species is imminent because it is a narrow endemic and is vulnerable to stochastic extinction events such as wildfires and drought, which are occurring throughout much of its range in Utah and Nevada and increasing in frequency. The species is capable of recovering from short-term fluctuations in plant numbers at unburned sites across its range. We do not have long-term data monitoring the effects of the wildfire as this effort ended in 2009. Available data show that populations have not recovered from the 2007 wildfires in Nevada and Utah while observational evidence shows little, if any, reestablishment is occurring within some burn areas. Although the 2007 wildfires burned in a mosaic that left patches of suitable habitat for Goose Creek milkvetch, management decisions have led other threats in these areas to increase in intensity (see Summary of Threats section above). In addition, non-native invasive

species, especially cheatgrass, have increased dramatically since the 2007 wildfires and occur in high concentrations at many Goose Creek milkvetch sites. Additional survey efforts after the 2007 wildfires have not substantially increased the range or extent of the known populations to ensure the species has the redundancy necessary to achieve long-term sustainability.

__Yes__ Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

Emergency Listing Review

__No__ Is Emergency Listing Warranted?

No, we are scheduled to develop a proposed listing rule in FY14.

Description of Monitoring:

Idaho plans to continue their monitoring efforts on BLM land in 2013. Utah plans to revisit previously surveyed occupied habitat in 2013. Nevada plans to survey additional sites on BLM land in 2014.

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

Idaho,Nevada,Utah

Indicate which State(s) did not provide any information or comment:

none

State Coordination:

The Idaho, Nevada, and Utah Natural Heritage programs maintain active databases on the distribution and abundance of Goose Creek milkvetch. Information from Idaho, Nevada, and Utah were incorporated into this report.

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Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  05/30/2013
Date

Concur:  10/28/2013
Date

Did not concur: _____ _____
Date

Director's Remarks: